EXPLORING AND IMPROVING HOSPITAL CARE QUALITY FOR NEW ZEALAND RURAL COMMUNITIES

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A thesis submitted for the degree of Doctor of Philosophy
At the University of Otago, Dunedin, New Zealand

October 2019
Abstract

Providing sustainable high quality hospital care to people in small towns and rural areas in New Zealand (NZ) is challenging. Little NZ research has explored hospital health care quality in rural communities. Little hospital patient safety literature has investigated patient location rather than hospital location. This thesis aimed to understand what influences the quality of health care received by people from rural communities requiring hospital level care, and identify ways to improve the quality of rurally focused health care services, particularly hospital-level care.

A mixed methods approach was taken. The Interview Study (IS) collected views of 109 participants through eight community and Māori focus groups and 34 health provider interviews from four diverse NZ rural communities, which were thematically analysed. Although focused on hospital care, participants contributed views on the wider health system. The Hospital Harms Study (HHS) investigated hospital harm through secondary analysis of a retrospective general practice records review study of 9076 patients, where all harms had been identified. Patients’ rurality was defined by general practice address in Stats NZ defined rural centres or independent urban areas. Hospital admissions and harm from admissions were identified. Admission and hospital harm risk differences by urban-rural location were investigated using multivariable analyses, with five alternative rurality definitions tested. The component study results were combined to develop overall findings.

The IS participants questioned the fairness of rural communities’ experience of higher costs to access health services. Eight themes were developed. The Rural Triple Aim’ described the principles of high quality rurally focused health services, including hospital services. The remaining seven themes described the key characteristics that influence the quality of health care that rural communities experience, and relevant focus areas for improvement. These themes were access, ‘one service, many sites’ health service networks, capable workforce, Māori focused service design, greater community participation, rural-appropriate quality measures, and whole system planning and resourcing.
The HHS study group was evenly distributed across rural and urban general practices, and small, medium and large practices and by sex. Of the 9076 patients, 1561 patients (17.2%) had at least one hospital admission identified during the three-year study period, and 172 patients with admissions (11.0%) experienced hospital harm. There was no association evident between rurality and hospital admission risk (adjusted risk ratio 0.98 [0.83-1.17] \( p=0.844 \)), hospital harm risk (aRR 1.01 [0.97-1.05] \( p=0.587 \)) or rates of hospital harm per admission (adjusted incidence rate ratio 1.09 [0.83-1.43] \( p=0.524 \)). One alternative rurality definition, of greater distance to the nearest hospital, showed an increased risk of hospital harm per admission for those living far away (\( p<0.001 \)). Only rural patients required inter-hospital transfer. Significant association between inter-hospital transfer and risk of hospital harm was found (rural, age adjusted RR 2.33 [1.37-3.98] \( p=0.003 \)). Unmeasured differences in patient health status may confound findings.

Combining component study findings, a framework for improving health care quality for rural communities is proposed. This framework, including the Rural Triple Aim and improvement areas incorporating the themes identified above, is relevant to NZ rural communities and likely transferable to other countries.
Acknowledgements

There are many people to thank in producing this thesis. The research was made possible through the participants in the Interview Study contributing their time and thoughts. The original SHARP study research team made their data available to use, and Sue Dovey and Sharon Leitch helped unlock its meaning. Thank you all.

The Health Research Council of New Zealand funded me through a Foxley Fellowship for much of the content of this PhD, followed by support from the Dunedin School of Medicine through a Clinical Research Scholarship. I am very grateful to both organisations for their trust in me to fund this research.

I am honoured to have had such a learned team of supervisors and rural research advisors on this journey: Professor Sue Dovey, who led me through the first year of this thesis, thank you for taking me on as your last project; Professor Robin Gauld, who stayed the distance, thank you for your ongoing guidance and encouragement; Professor Tim Stokes, who stepped in to the breech and led me to completion, thank you for your critical thinking and support; Dr Andrew Gray, who joined for the last half, thank you for drawing me further into the world of Stata than I ever expected to go; and advisors Dr Garry Nixon and Dr Kyle Eggleton, thank you for your availability and advice when I called on you.

My colleagues in the Department of General Practice and Rural Health have hosted me and been wonderfully supportive through this journey. Dr Fiona Doolan-Noble started this whole ball rolling, thanks Fe, and the daily quiz and morning teas kept me going through the depths of data analysis, thanks team.

And lastly, I want to acknowledge the unstinting love, support and encouragement from my parents Bob and Edith, my husband Glen, and my children Brighid and Owain, through this journey. Much has happened over the last three and a half years, and come what may, you have all been there supporting me. Thank you, with my love. Diolch yn fawr, dwy’n dy garu di.
# Table of Contents

Abstract.................................................................................................................................................. ii
Acknowledgements................................................................................................................................. iv
Table of Contents .................................................................................................................................. v
List of Tables .......................................................................................................................................... xv
List of Figures ........................................................................................................................................... xviii
Glossary.................................................................................................................................................... xx
1 Introduction ......................................................................................................................................... 1
  1.1 Why this research? .......................................................................................................................... 1
  1.2 The existing literature on the topic ............................................................................................... 2
  1.3 Thesis aims and research design ................................................................................................... 3
  1.4 Contribution of this thesis to new knowledge .............................................................................. 4
  1.5 Terminology ................................................................................................................................... 4
  1.6 Structure of the thesis .................................................................................................................... 5
2 Literature Review ............................................................................................................................... 7
  2.1 Rurality and Health ....................................................................................................................... 7
    2.1.1 Definitions of rurality ............................................................................................................... 7
    2.1.2 Health outcomes for urban and rural communities ................................................................. 13
    2.1.3 Understanding rural health .................................................................................................... 16
    2.1.4 Hospitals in the rural context ................................................................................................. 21
  2.2 Health Care Quality ....................................................................................................................... 27
    2.2.1 Health care quality concepts and frameworks ....................................................................... 28
    2.2.2 Rural quality frameworks ...................................................................................................... 31
    2.2.3 Access for rural communities ................................................................................................. 32
    2.2.4 Patient safety, harms and urban-rural location ...................................................................... 35
2.2.5 Te Tiriti o Waitangi and health care quality for Māori ............... 38
2.2.6 Measuring health care quality in hospital settings ..................... 40
2.3 Enablers to improving health care quality for rural communities ..... 42
  2.3.1 International findings .................................................. 42
  2.3.2 New Zealand findings ................................................... 45
2.4 Summary .............................................................................. 47
3 Research Methodology ................................................................ 48
  3.1 The rationale for this research ................................................ 48
  3.2 Methodological considerations .............................................. 49
    3.2.1 Theoretical perspectives ................................................ 50
  3.3 Methodological perspectives as applied in my research ............. 55
    3.3.1 Choosing pragmatism .................................................... 55
    3.3.2 Justification for using the mixed methods approach .............. 56
    3.3.3 Purpose, priority and sequence of methods ...................... 56
    3.3.4 The component studies ................................................ 57
    3.3.5 Integrating the data, limitations and insights ................... 65
  3.4 Summary .............................................................................. 66
4 Interview Study Methods ............................................................... 67
  4.1 Introduction .......................................................................... 67
  4.2 Defining the study sample .................................................... 67
    4.2.1 Selecting sites .............................................................. 67
    4.2.2 Selecting interview participants ...................................... 69
  4.3 Developing the interview schedule ......................................... 71
    4.3.1 Semi-structured interviews and focus groups .................... 71
    4.3.2 Developing the topic guide ............................................ 72
  4.4 Conducting the interviews .................................................... 73
    4.4.1 Site visits ..................................................................... 73
4.4.2 Comments on the site visit process ................................................................. 74

4.5 Analysing and interpreting the study findings .................................................... 76
4.5.1 Interview Coding ............................................................................................ 77
4.5.2 Developing themes ......................................................................................... 79

4.6 Summary ........................................................................................................... 82

5 The Interview Study findings: Participants and the Rural Triple Aim ................. 83
5.1 The four communities ....................................................................................... 83
5.2 The study participants ....................................................................................... 87
5.3 The Rural Triple Aim ......................................................................................... 89
  5.3.1 Improving quality, safety and experience of care ........................................... 90
  5.3.2 Improved health and equity for all populations ............................................. 92
  5.3.3 Best value for public health system resources .............................................. 93
5.4 Summary ........................................................................................................... 95

6 The Interview Study findings: Health care quality for rural communities - planning and community themes ................................................................. 96
6.1 Theme 1: Whole of network planning and resourcing ....................................... 97
  6.1.1 An equitable distribution of resources across the whole system ............... 98
  6.1.2 An equitable distribution of costs across communities ............................... 100
  6.1.3 An agreed rurality definition for health purposes ....................................... 101
  6.1.4 Solutions – planning and funding health service networks ....................... 102
6.2 Theme 2: Māori focused service design ............................................................ 103
  6.2.1 Making mainstream services welcoming for Māori .................................. 104
  6.2.2 Including Māori providers in the network ................................................ 106
  6.2.3 Focusing on the impact of service design on Māori outcomes ................... 107
6.3 Theme 3: Community participation ................................................................. 108
  6.3.1 Greater responsiveness to community input ................................................. 108
  6.3.2 Value of greater community participation ................................................ 109
6.4 Theme 4: Access ................................................................................................................. 110

6.4.1 Being rural ......................................................................................................................... 111

6.4.2 Access to information ......................................................................................................... 113

6.4.3 Access to local health services .......................................................................................... 113

6.4.4 Access to urban health services ......................................................................................... 115

6.4.5 Access to whānau support ................................................................................................. 118

6.5 Summary ................................................................................................................................ 119

7 The Interview Study findings: Providing and improving health care quality for rural communities, delivering and measuring high quality services................. 120

7.1 Theme 5: 'One service, many sites’ health service networks ................................................. 120

7.1.1 The current state .................................................................................................................. 122

7.1.2 Developing the culture of ‘one service, many sites’ ......................................................... 123

7.1.3 Developing the network structure to support a ‘one service, many sites’ approach .................................................................................................................................................................................. 125

7.1.4 Information technology’s ability to support the network ............................................. 130

7.1.5 Clear consistent processes between different parts of the network ............................. 133

7.2 Theme 6: Capable workforce ................................................................................................. 135

7.2.1 Communication and relationships .................................................................................... 136

7.2.2 Cultural capability .............................................................................................................. 137

7.2.3 Rural generalists ................................................................................................................ 138

7.2.4 Supportive urban hospital clinicians ............................................................................... 140

7.2.5 Supporting the current and future workforces ............................................................. 141

7.3 Theme 7: Quality measures appropriate for rurally focused health services .................. 144

7.3.1 Quality as experienced across rural and urban settings .............................................. 144

7.3.2 Common quality measures across rural and urban settings ...................................... 146

7.3.3 Rurally focused quality measures ................................................................................. 147
7.3.4  Contextualising quality measures to local circumstances.................... 149
7.3.5  Quality improvement approaches.......................................................... 149
7.4  Summary........................................................................................................ 151
8  The Interview Study discussion ..................................................................... 152
8.1  Summary of findings........................................................................................ 152
8.2  The Interview Study findings in the context of other research..................... 155
  8.2.1  The Rural Triple Aim...................................................................................... 155
  8.2.2  Quality elements for rurally focused health services................................. 156
  8.2.3  Key areas for improvement for rural health services.................................... 159
  8.2.4  Whole of system planning and resourcing................................................... 160
  8.2.5  Māori focused service design...................................................................... 162
  8.2.6  Community participation.............................................................................. 162
  8.2.7  Access........................................................................................................... 163
  8.2.8  Developing a ‘one service, many sites’ network.............................................. 163
  8.2.9  Capable workforce........................................................................................ 165
  8.2.10 Using quality to drive improvement............................................................. 166
8.3  Strengths and limitations of the Interview Study............................................. 167
  8.3.1  Strengths....................................................................................................... 167
  8.3.2  Limitations..................................................................................................... 168
8.4  Summary............................................................................................................ 170
9  Methods for the Hospital Harms Study.............................................................. 171
  9.1  Introduction ...................................................................................................... 171
  9.2  Overview of the approach used....................................................................... 171
  9.3  Preparing the data for analysis....................................................................... 173
    9.3.1  Identifying patients with hospital admissions.............................................. 173
    9.3.2  Identifying patient harms.......................................................................... 177
10.4 Patients with complete length of hospital stay data .............................................240

10.4.1 Characteristics of patients with complete length of stay data compared to all patients with admissions .................................................................241

10.4.2 Information on hospital admissions and lengths of stay .....................................243

10.4.3 Associations between hospital harm and hospital occupancy ..............................244

10.5 Exploratory Analysis – alternative rural definitions .................................................249

10.5.1 Alternative rural definitions ..................................................................................249

10.5.2 The effect of different definitions of rurality on risk of hospital admission, hospital harm, and the rate of hospital events resulting in harm. .................251

10.6 Summary .....................................................................................................................255

11 Hospital Harms Study discussion ..............................................................................256

11.1 Summary of findings .................................................................................................256

11.1.1 The Hospital Harms Study group and rural and urban comparisons 256

11.1.2 Hospital admissions and rurality ..........................................................................257

11.1.3 Hospital harm and rurality .....................................................................................258

11.1.4 Association of general practice size with findings ...............................................259

11.1.5 Association of sex with findings ............................................................................259

11.1.6 Association of age with findings ............................................................................259

11.1.7 Association of ethnicity with findings ....................................................................260

11.1.8 Association of socioeconomic status with findings ............................................260

11.1.9 Hospital bed-day use and hospital harm ..............................................................261

11.2 The Hospital Harms Study findings in context of other research ............................263

11.2.1 Hospital admissions ...............................................................................................263

11.2.2 Hospital harm .........................................................................................................263

11.2.3 Inter-hospital transfer ............................................................................................264
11.2.4 Harm preventability and severity ................................................................. 265
11.2.5 Rurality and hospital harm ............................................................................ 266
11.2.6 Practice size .................................................................................................. 267
11.2.7 Age .................................................................................................................. 268
11.2.8 Ethnicity ......................................................................................................... 268
11.2.9 Resource use .................................................................................................. 269
11.3 Strengths and limitations of the Hospital Harms Study ................................. 269
11.3.1 Retrospective patient record review study .................................................... 269
11.3.2 Bias .................................................................................................................. 271
11.3.3 Chance (random error) .................................................................................. 274
11.3.4 Generalisability ............................................................................................. 276
11.3.5 Secondary analysis study design ................................................................... 277
11.4 Summary ............................................................................................................ 279
12 Discussion ............................................................................................................ 280
12.1 The component studies – study design and main findings ............................... 280
12.1.1 The Interview Study ...................................................................................... 280
12.1.2 The Hospital Harms Study .......................................................................... 282
12.2 Combining the two component studies ............................................................. 284
12.2.1 Common findings and themes ...................................................................... 284
12.2.2 Strengths and limitations of the mixed methods approach ......................... 289
12.3 This thesis's contribution to the literature ......................................................... 290
12.4 Implications for policy and future research ...................................................... 295
12.5 Conclusions ...................................................................................................... 300
References ................................................................................................................ 304
Appendix 1 Approach to background literature review ........................................... 321
Appendix 2 Rural Ranking Scale ............................................................................. 324
Appendix 3 Non-Māori health outcomes, age-standardised to the NZ Māori population in 2001. Adapted from Mātātuhi Tuawhenua: Health of Rural Māori 2012..................................................................................................................................................326

Appendix 4 Rural hospitals in New Zealand ..................................................................................329

Appendix 5 Te Tiriti o Waitangi, Treaty of Waitangi principles ........................................331

Appendix 6 Summary of research findings sent to participants ..............................................332
  Summary sent to health provider participants ........................................................................332
  Summary sent to community participants .............................................................................338

Appendix 7 Ethics Approval and Ngai Tahu consultation documents..............................341

Appendix 8 Comparisons to aid Interview study site selection .........................................346

Appendix 9 Interview schedules ..............................................................................................348
  Initial draft before discussion with supervisors, rural advisors and Māori consultation liaison, and pretesting.................................................................348
  Final version after input and pretesting, for provider interviews ........................................350
  Final version after input and pretesting, for community focus groups ..........................353

Appendix 10 Coding Frameworks ............................................................................................356
  Initial coding framework .........................................................................................................356
  Coding framework after one quarter of transcripts coded, and change to NVivo made ...............................................................................................................................358
  Final coding framework ..........................................................................................................361

Appendix 11 Initial code book ..................................................................................................364

Appendix 12 Mindmaps .............................................................................................................388

Appendix 13 Interview Study research methods checklist ..................................................393

Appendix 14 ISBAR Communication Tool .............................................................................397

Appendix 15 Quality measures suggested by participants ......................................................398
  Table of quality measures suggested by participants .......................................................398

Appendix 16 Excerpt from original grant application, ‘Patient harms in New Zealand general practices: Records review study’ .................................................................401
Appendix 17 Inter-rater reliability of hospital harms identified by SHARP reviewers .......................................................... 405
Appendix 18 Outline of tables to present .......................................................... 407
Appendix 19 Data definitions for Stata do-file ................................................... 431
Appendix 20 Do-file for Stata analysis .............................................................. 436
List of Tables

Table 2.1 Stats NZ urban-rural classification by population size ........................................10
Table 2.2 New Zealand’s Urban/Rural population estimates using different urban/rural classifications, 2015 census projections (total estimated NZ population 4,595,700 people) .............................................................. 12
Table 2.3 Life expectancy at birth and age 65 for rural and urban populations by sex, all people and Māori, 2005-2007, using NHC rural/urban definitions (adapted from ‘Mātātuhi Tuawhenua: Health of Rural Māori 2012’ report 21) ............................................................ 15
Table 2.4 Role delineation models of Queensland, 78 Scotland, 7 and NZ 77, 81 including NZ Rural hospital definitions .......................................................... 22
Table 2.5 Secondary and rural hospitals in towns of less than 30,000 population in New Zealand, 1998-2016 ................................................................................. 26
Table 2.6 Assessing the credibility of study findings, adapted from Murphy, Bailey, and Mays ........................................................................................................ 53
Table 4.1 Outline of purposive sampling frame for interview and focus group selection ........................................................................................................ 70
Table 5.1 Comparison of sociodemographic data and hospital information by the four study sites ........................................................................................................ 85
Table 5.3 Description of health provider participants interviewed at each site..... 88
Table 7.1 Rurally focussed quality measures ........................................................................ 148
Table 8.1 Dimensions of health care quality – comparisons of international frameworks ........................................................................................................ 157
Table 9.1 All hospital harms by hospital admission identification status............. 180
Table 9.2 Demographics of patients with hospital harm, comparing those where hospital admissions were identified in patient record to those where no hospital admission was identified ...................................................................................... 181
Table 9.3 Harm preventability coding used in SHARP Study ........................................ 184
Table 9.4 Kappa statistics for variables .................................................................................. 185
Table 9.5 Alternative measures of rurality applied to 44 participating general practices................................................................................................................ 188
Table 10.1 Characteristics of NZ general practices participating in the SHARP Study (adapted from Leitch et al).................................................................................................................. 202
Table 10.2 Comparison of ethnic composition of Harms study compared to NZ population.......................................................................................................................................... 203
Table 10.3 SHARP Study patient characteristics for whole population, those with hospital admissions and those with hospital harm related admissions ............... 205
Table 10.4 Characteristics of patients in study group, with identified hospital admissions, and hospital harm, comparing rural and urban locations ................. 210
Table 10.5 Hospital admissions and admissions resulting in harm................................. 214
Table 10.6 Comparison of patients who did and did not have a hospital admission .................................................................................................................................................. 219
Table 10.7 Patients with hospital admissions resulting in harm, compared to patients with hospital admissions that did not result in harm, by age, sex, ethnicity, NZDep13 quintile and practice size ........................................................................................................... 227
Table 10.8 Unadjusted and adjusted rate ratios of hospital harm per admission for location, age, sex, ethnicity, and NZDep13 quintile and practice size. ................. 234
Table 10.9 Patient transfer and hospital harm, rural patients ........................................ 235
Table 10.10 Patients with any preventable compared to no preventable hospital harm, by location, practice type, age, sex, ethnicity and socioeconomic status... 237
Table 10.11 Maximum harm severity by location................................................................. 240
Table 10.12 The demographics of all patients with hospital admissions, those with full data on hospital admission length of stay, and those with complete length of stay data by rural and urban location. .................................................................................................................. 242
Table 10.13 Comparison between rural and urban location and inpatient hospital usage over three year period, where complete LOS data available......................... 245
Table 10.14 Association between those with and without hospital harm in patients with complete hospital occupancy data ................................................................. 246
Table 10.15 The associations between both hospital harm and demographic variables and total occupied bed days (OBD) for 753 patients with complete LOS data .............................................................................................................................................. 248
Table 10.16 Different rurality definitions and size of categories for the study group, and patients with hospital admissions and hospital harm......................... 250
Table 10.17 Effect of alternative rurality definitions on estimated risk of hospital admission, hospital related harm and rate of hospital harm per admission ..........254
List of Figures

Figure 2.1 OECD regional typology for selected countries. (From Directorate for Public Governance and Territorial Development OECD, 2010) .............................................. 9
Figure 2.2 Weinhold and Gurtner’s shortages of sufficient health care model .... 17
Figure 2.3 Humphreys et al.’s model of viable rural practice (reproduced from Humphreys et al.) .................................................................................................................. 18
Figure 2.4 Bourke et al.’s conceptual framework for understanding rural health. 19
Figure 2.5 The IHI Triple Aim .................................................................................. 29
Figure 2.6 The New Zealand Triple Aim for Quality Improvement12 .................. 30
Figure 2.7 Key aspects of access for rural communities, adapted from Levesque, J.-F., et al. ......................................................................................................................... 35
Figure 2.8 Definitions of patient safety, harm and adverse events. ...................... 36
Figure 3.1 Schema for mixed methods research approach used, adapted from Zhang and Cresswell ................................................................................................. 57
Figure 4.1 Thematic analysis process ....................................................................... 77
Figure 4.2 Coding abbreviations used to identify quotes ......................................... 82
Figure 5.1 The four study sites. .................................................................................. 83
Figure 5.2 Principles of rural health care quality, adapted from the NZ Triple Aim Framework .................................................................................................................. 90
Figure 6.1 Themes regarding providing and improving health care quality for rural communities ............................................................................................................. 97
Figure 6.2 Components of a whole of health service network approach to planning and resourcing health services ................................................................. 98
Figure 6.3 Components of Māori focused service design ...................................... 104
Figure 6.4 Components of Community participation element for high quality rurally focused health services ..................................................................................... 109
Figure 6.5 Components of access for high quality rurally focused health services ......................................................................................................................... 111
Figure 7.1 Components of the ‘One Service, Many Sites’ health service network 121
Figure 7.2 The components required for a capable workforce in a high quality rurally focused health service network .............................................................................. 136
Figure 7.3 Quality measures for high quality rurally focused health services ...... 145
Figure 10.1 Age distribution for the whole SHARP Study group by 5 year age bands
..................................................................................................................................................207
Figure 10.2 Age distribution for patients with hospital admissions, by 5 year age bands
..................................................................................................................................................207
Figure 10.3 Age distribution for patients with hospital harm, by 5 year age bands
..................................................................................................................................................207
Figure 10.4 Summary of the study group, and by rural and urban location........208
Figure 10.5 Number of hospital admissions by frequency .................................................214
Figure 10.6 Practice size and adjusted risk (with 95% CIs) of hospital admission
..................................................................................................................................................216
Figure 10.7 Age and risk of hospital admission (with 95% CIs), from a Poisson model including linear, quadratic and cubic age variables. ..............................217
Figure 10.8 Impact of age and sex on risk (with 95% CIs) of hospital admission 218
Figure 10.9 The association between age and risk of harm (with 95% CIs) ..............224
Figure 10.10 Associations between age and risk of hospital harm (with 95% CIs) by location..................................................................................................................225
Figure 10.11 Associations between age and risk of hospital harm (with 95% CIs) by sex..................................................................................................................226
Figure 10.12 Interaction between location and socioeconomic status and rate ratios of hospital admissions resulting in harm (with 95% CIs) where NZDep13 data recorded..................................................................................................................233
Figure 10.13 Impact of socioeconomic status on rate ratio of hospital admissions causing harm (with 95% CIs), by distance from nearest hospital and rural/urban location..................................................................................................................252
Figure 11.1 Schema of findings of Hospital Harms Study..........................................262
Figure 11.2 Pattern of hospital harm and rurality.. Error! Bookmark not defined.
Figure 12.1 Framework for improving health care quality for rural communities
..................................................................................................................................................294
## Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>§</td>
<td>Section</td>
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<tr>
<td>aIRR</td>
<td>Adjusted incidence rate ratio</td>
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<tr>
<td>aRR</td>
<td>Adjusted risk ratio</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
</tr>
<tr>
<td>DHB</td>
<td>District Health Board</td>
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<tr>
<td>FTE</td>
<td>full-time-equivalent</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>HRC</td>
<td>Health Research Council</td>
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<tr>
<td>IHI</td>
<td>Institute of Healthcare Improvement</td>
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<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
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<tr>
<td>IUA</td>
<td>Independent urban area</td>
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<tr>
<td>MOH</td>
<td>Ministry of Health</td>
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<td>NHC</td>
<td>National Health Committee</td>
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<td>NTA</td>
<td>National travel assistance</td>
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<td>NZ</td>
<td>New Zealand</td>
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<td>NZer</td>
<td>New Zealander</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>PMS</td>
<td>patient management system</td>
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<tr>
<td>PMS</td>
<td>Practice management system</td>
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<tr>
<td>RDM</td>
<td>Role delineation model</td>
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<tr>
<td>RGH</td>
<td>Rural general hospital (Scottish term)</td>
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<td>RHM</td>
<td>Rural hospital medicine (NZ term)</td>
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<tr>
<td>RRS</td>
<td>Rural Ranking Scale</td>
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<tr>
<td>SHARP</td>
<td>Safety, Harms and Risk Reduction Project</td>
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<td>SNZ</td>
<td>Statistics NZ</td>
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<tr>
<td>uIRR</td>
<td>Unadjusted incidence rate ratio</td>
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<td>Unadjusted risk ratio</td>
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<tr>
<td>Aotearoa</td>
<td>New Zealand</td>
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<td>aroha</td>
<td>love, warmth</td>
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<tr>
<td>kai</td>
<td>food</td>
</tr>
<tr>
<td>kanohi ki te kanohi</td>
<td>face to face</td>
</tr>
<tr>
<td>karakia</td>
<td>prayer in Te Reo Māori, the Māori language</td>
</tr>
<tr>
<td>kaumatua</td>
<td>older man/men</td>
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<tr>
<td>kaupapa Māori</td>
<td>based on Māori principles and practices</td>
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<tr>
<td>Kia ora</td>
<td>Hi</td>
</tr>
<tr>
<td>koha</td>
<td>gift or present</td>
</tr>
<tr>
<td>kuia</td>
<td>older woman/women</td>
</tr>
<tr>
<td>māta waka</td>
<td>Māori from other tribal regions</td>
</tr>
<tr>
<td>Pākehā</td>
<td>New Zealander of European descent</td>
</tr>
<tr>
<td>pepeha</td>
<td>introduction in Te Reo Māori</td>
</tr>
<tr>
<td>pounamu</td>
<td>NZ jade</td>
</tr>
<tr>
<td>tangata whenua</td>
<td>Māori from the local area</td>
</tr>
<tr>
<td>Te Ao Māori</td>
<td>The Māori world/world view</td>
</tr>
<tr>
<td>te Kaihautu</td>
<td>general manager</td>
</tr>
<tr>
<td>te Reo Māori</td>
<td>the Māori language</td>
</tr>
<tr>
<td>Te Tiriti o Waitangi</td>
<td>The Treaty of Waitangi, NZ's founding document</td>
</tr>
<tr>
<td>Te Whare Tapa Whā</td>
<td>The four sided house (a health model)</td>
</tr>
<tr>
<td>Te Wheke</td>
<td>The octopus (a health model)</td>
</tr>
<tr>
<td>tikanga</td>
<td>customs, cultural practices, norms and protocols</td>
</tr>
<tr>
<td>wairora</td>
<td>total wellbeing for the individual and family</td>
</tr>
<tr>
<td>wairua</td>
<td>spirit</td>
</tr>
<tr>
<td>whānau</td>
<td>extended family</td>
</tr>
</tbody>
</table>
1 Introduction

This chapter introduces the thesis being presented. The rationale for the topic chosen is explained, and the topic is positioned within the existing literature. The aims of the thesis and approaches taken to explore these aims are described. The contribution this thesis makes to existing knowledge about health care quality is considered. Finally, the structure of the thesis is summarised.

1.1 Why this research?

I am a New Zealand (NZ) trained general practitioner (GP) who grew up in a rural North Island town. Prior to moving to Dunedin in 2015, I had worked as a GP for many years on the South Island’s rural West Coast of NZ. Since 2005, I had held clinical leadership roles focused on integrated health service redesign (across hospital, primary care and community care) for the region. I visited the health services in rural north of Scotland, and rural Northumberland and South Somerset in England in 2015 to compare and contrast their experiences with those on the West Coast. Challenges and solutions to providing sustainable health services in these different rural contexts were similar. Common themes included tensions between community expectations and resources available to sustainably provide services to increasingly ageing populations; attracting and retaining suitable workforces; and patient access and transport difficulties. This was juxtaposed against a desire from rural communities and policy makers alike for people to experience care closer to home.

The West Coast and the rural Scottish and English sites visited had responded to these drivers in similar ways. They had increased local capacity, for example through expanded nursing roles, greater use of generalist doctors, and streamlining care for elderly across health care settings. They were developing networks with local and distant emergency services, and service linkages with similar sized neighbouring hospitals and larger specialist urban hospitals. Information technologies, particularly telemedicine, were important enablers in maintaining or improving healthcare quality by overcoming challenges of distance.
A shared concern was how to maintain services in smaller rural hospital settings, where many people from rural communities received their health care. Increasing medical sub-specialisation was leading to quality standards being developed with large urban hospitals in mind. There was concern that this could lead to centralisation of services with the loss of local service provision and increased demand on patients and their families to travel for health care. The wider benefit for rural communities of having services available locally may not have been considered, nor the potential broader impact of withdrawing services from rural communities, in making these decisions.

In response to the issues set out above, I undertook this research to explore the influences on the quality of health care that people from rural NZ communities received when they required hospital-level care. I wanted to investigate if there were differences in patient safety experience between rural and urban patients requiring hospital-level care, and to identify ways to improve hospital care quality for rural communities.

1.2 The existing literature on the topic

While there is international academic literature conceptualising health care quality through a rural lens, no NZ-focused studies had been published, to the best of my knowledge, that aimed to understand health care quality in rural communities. The Health and Safety Quality Commission in NZ adapted the Institute of Healthcare Improvement’s Triple Aim into the NZ Triple Aim for Quality Improvement, which has been widely adopted within NZ, but there has been no explicit consideration of its application to rural contexts.

The international literature is mixed on whether there are differences between rural and urban settings in hospital care quality, with some showing better outcomes in larger hospitals, and others showing similar or better outcomes in smaller hospitals. New Zealand’s Ministry of Health (MOH) commissioned a report in 2010 of factors important in improving health outcomes for rural communities, but the role of rural hospitals was not discussed. The international
literature on patient safety in rural hospitals indicates that adverse events in rural hospitals are no worse than urban hospitals.\textsuperscript{22,23} These studies took the perspective of hospitals’ location, rather than patients’ location. Given that NZ research from 2006 showed that 60\% of patients admitted to a group of rural Otago hospitals were transferred,\textsuperscript{24} hospital safety for rural patients needs to be considered at a patient, rather than a hospital, level. The only large study of hospital related adverse events in NZ was undertaken by Davis and colleagues using 1998 data.\textsuperscript{25} Hospitals smaller than 100 beds were excluded from selection and the rurality of patients was not considered in the analysis.

International literature has explored what enables improved health care quality for rural communities.\textsuperscript{9,26-29} While some NZ literature has studied selected elements that would improve health care quality,\textsuperscript{1,30-35} a comprehensive approach to understanding the components of health care quality and mechanisms to improve quality has not been undertaken in NZ, as far as I could tell.

1.3 Thesis aims and research design

This thesis aimed to understand what influences the quality of health care that people from rural communities receive when they require hospital level care, and what measures can be taken by health care planners, providers and communities to improve hospital care quality for rural communities. The main research question asked was how could hospital care quality for NZ rural communities be improved? Answering this would involve looking at four aspects of this question:

1. What did good quality hospital-level care mean for rural communities and health care providers serving rural communities?
2. When considering patient safety, an aspect of health care quality, were there differences in hospital harm experienced by patients who lived in a rural, compared to urban setting, when they required hospital admission, whether that be in a local or distant hospital?
3. How did the pattern of hospital harm seen for rural compared to urban patients compare with, and potentially explain, the perceptions regarding hospital care quality for rural communities?

4. How could the quality of health care that rural communities experienced be improved?

Used a mixed methods research design, a qualitative interview study explored provider and community views about hospital care quality and how service quality could be improved in four rural communities, using thematic analysis. A quantitative secondary analysis of Safety, Harms and Risk Reduction Project (SHARP) study data was undertaken. Three years’ electronic clinical records of 9076 general practice patients, randomly selected with equal numbers attending rural and urban general practices, had already been analysed for patient harm. I identified hospital admissions in these patient records and determined if harm originating from hospital admissions had occurred. The risk and patterns of hospital harm comparing rural to urban patients were calculated taking an exploratory and hypothesis generating approach. The findings of the two study arms were then integrated to develop the overall findings of the research.

1.4 Contribution of this thesis to new knowledge

This thesis provides a comprehensive investigation of health care quality as experienced by rural communities in NZ, with a focus on hospital-level care. Differences in patient safety experienced by rural and urban patients in NZ hospitals are investigated. The Rural Triple Aim, a rural adaptation of NZ’s Triple Aim is proposed. Key areas are identified to improve health care quality for rural communities and a framework for considering health care quality is developed. Areas for further research are identified.

1.5 Terminology

When words from te Reo Māori (the Māori language, the language of indigenous Māori inhabitants of Aotearoa [New Zealand]) are used in this thesis they are...
italicised, and an English translation is provided in parentheses after their first usage. Translations of *te Reo Māori* words used more than once are also provided in the glossary. Some commonly used *te Reo Māori* words, such as *whānau* (extended family), are in common usage in NZ English, and are used throughout this thesis, but the italics convention will be followed for international readers.

The term ‘rural communities’ refers to small towns (independent urban areas as defined in §2.1.3, page 10) and surrounding rural areas and the people living within them. The term ‘rural people’ is also used to refer to people who live in rural communities, noting this includes people living in small towns as well. The term ‘urban people’ refers to people living in large towns of more than 30,000 inhabitants and cities. The terms ‘rural patients’ and ‘urban patients’ refer to patients who live in rural and urban settings. These terms are used throughout this thesis. When the term ‘clinician’ is used in this thesis, it refers to doctors, nurses and/or allied health professionals, depending on context.

### 1.6 Structure of the thesis

After this introductory chapter, Chapter 2 presents a focused narrative review of the academic and grey literature relevant to ideas of rurality, rural health, health care quality, patient safety and measuring health care quality. It describes enablers of improved care for rural communities such as health care networks, information technology and workforce. Chapter 3 outlines the research methodology used in the thesis.

Chapters 4 to 8 cover the Interview Study. Chapter 4 describes the methods used in this qualitative exploration of people’s views in four NZ rural communities regarding health care quality for rural communities when they require hospital-level care, and how to improve the quality of the care received. Chapters 5 to 7 describe the study participants and the study’s findings as themes relating to understanding and improving health care quality for rural communities. Chapter 8
discusses the findings in the context of the existing literature and considers the strengths and limitations of the qualitative study undertaken.

Chapters 9 to 11 relate to the Hospital Harms Study. Chapter 9 describes the quantitative methods used for the secondary analysis of the original SHARP study, and chapter 10 outlines the results of the analysis undertaken. Chapter 11 discusses the results in the light of existing literature and considers the strengths and limitations of the quantitative methods used.

Chapter 12 combines the findings of the two contributing studies and discussed findings in relation to existing literature. The strengths and limitations of the mixed methods approach are considered. Policy and practice implications of the research findings are discussed and future areas for research are outlined. Finally a summary of the conclusions of this thesis complete the chapter.

The next chapter (Chapter 2) provides a focused narrative review of the relevant literature relating to the studies undertaken in this thesis.
2 Literature Review

This chapter presents a narrative review of rurality, rural health and hospital services; quality, patient harm, and measuring quality; and approaches to improving quality for rural communities. The intention of the literature review is to use selected peer reviewed and grey literature to provide context for the original research that follows. The approach used to identify the literature summarised below is outlined in Appendix 1. This chapter is structured as follows: first it focuses on rurality and health, looking at definitions of rurality, and rural health outcomes and hospital services for rural communities; next it discusses the literature on health care quality, including quality definitions and frameworks, measuring quality, patient safety and health care quality for Māori; and last it focuses on the identified enablers to improve health care quality for rural communities.

2.1 Rurality and Health

This section explores literature regarding the intersection of rurality and health. Definitions of rurality used internationally and in NZ are discussed, particularly in the health context. Differences in health outcomes for rural and urban communities are discussed. Theoretically informed approaches to rural health and to Māori health are outlined. Lastly, the role of hospitals within health systems and in rural contexts are considered.

2.1.1 Definitions of rurality

Rurality is a difficult concept to define or measure. There is no internationally agreed rural definition and any definition would potentially change over time and across space. This section describes rural typologies used in different Western countries, compares how ‘rural’ NZ is internationally, and summarises alternative rural definitions used in the NZ health context.
2.1.1.1 International urban-rural typologies

Rural typologies are commonly based on settlement size and one or more other dimensions including population density, remoteness, urban influence (reflected through commuter linkages between where people live and work), distance from services, or land use and economic function.\textsuperscript{40,41} Australia uses settlement size and distance from neighbouring services,\textsuperscript{42,43} Canada\textsuperscript{44} and England\textsuperscript{45} uses settlement size and urban influence. The United States of America (US)\textsuperscript{40} and Wales\textsuperscript{46} use settlement size and population density, and Scotland\textsuperscript{47} uses settlement size and accessibility to service centres to categorise rurality. The maximum population size for a rural town varies from less than 1000 people in Australia\textsuperscript{48} to less than 10,000 people in England and Wales.\textsuperscript{45}

2.1.1.2 How ‘rural’ is NZ?

The Organisation for Economic Co-operation and Development (OECD) developed a urban-rural classification to enable comparisons within its 34 member countries, based on proportion of ‘local units’ (for NZ, Stats NZ area units) within regions in each country classified as rural (with population density of less than 150 people per square kilometre), and the presence of cities within regions. This generated three categories of *predominantly urban*, (less than 15% of local units being rural or 15-50% rural but a city of more than 500,000 people in the region), *intermediate* (15-50% of local units rural or more than 50% rural with a city of more than 200,000 people in the region) and *predominantly rural* (more than 50% of local units being rural and without a city of more than 200,000 people in the region) for regions.\textsuperscript{49}

Comparing NZ to Australia, North America and the countries of Great Britain, Wales had the fewest regions with 12 and Canada the most with 288. Using the OECD definitions and 2000-2001 census data, of the 14 NZ regions 12 were intermediate and two (Auckland and Wellington) were predominantly urban. Placing NZ’s rurality within the context of Australia, North America and Great Britain, NZ ranked in the middle, with the equal lowest proportion of ‘primarily rural’ regions but the third lowest proportion of ‘primarily urban’ regions, as shown in Figure 2.1.\textsuperscript{49}
2.1.1.3  New Zealand urban-rural typology

Stats NZ (SNZ) is the governmental statistics agency that officially defines urban and rural classifications in NZ. The underlying urban/rural classification in NZ is based on settlement size. These classifications have been updated in 2019 and the original and recently updated urban-rural classifications are shown in Table 2.1. Using SNZ population projections, about half of New Zealanders (NZers) (53%) live in large cities of more than 100,000 people. About one third (34%) live in small towns of less than 30,000 people and rural areas, and about one quarter (26%) in very small towns of less than 10,000 people and rural areas. About one in eight of NZers (13%) living outside any settlements of 200 people or more.

In 2004, SNZ developed the Urban/Rural Profile Classification to better describe communities of less than 30,000 people in New Zealand through including the impact of large urban areas on employment and commuting linkages. At the time of writing this thesis, the Urban/Rural Profile Classification had not been updated with the 2019 definitions and the original terms main urban, secondary urban and minor urban are used below. Secondary and minor urban areas were reclassified as either satellite urban communities (where at least 20 percent of the employed
Table 2.1 Stats NZ urban-rural classification by population size

<table>
<thead>
<tr>
<th>Original Urban Rural</th>
<th>Population</th>
<th>Urban Rural 2019</th>
<th>Population</th>
<th>Projected NZ population 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Urban</td>
<td>≥30,000</td>
<td>Major Urban</td>
<td>≥100,000</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large Urban</td>
<td>30,000-99,999</td>
<td>14%</td>
</tr>
<tr>
<td>Secondary Urban</td>
<td>10,000-29,999</td>
<td>Medium Urban</td>
<td>10,000-29,999</td>
<td>8%</td>
</tr>
<tr>
<td>Minor Urban</td>
<td>1,000-9,999</td>
<td>Small Urban</td>
<td>1,000-9,999</td>
<td>10%</td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural Centres</td>
<td>300-999</td>
<td>Rural Settlements</td>
<td>200-999</td>
<td>3%</td>
</tr>
<tr>
<td>Other Rural Land Areas</td>
<td>&lt;299</td>
<td>Other Rural</td>
<td>&lt;199</td>
<td>13%</td>
</tr>
</tbody>
</table>

population commuted to a main urban area for work) or independent urban communities/areas, (where less than 20 percent of the employed population commuted to a main urban area for work). Rural areas were redefined into rural areas with high, moderate or low urban influence, and highly rural/remote areas, based on the proportions of the employed population in the rural area employed in urban areas. This gave seven sub-categories within the urban-rural dichotomy as shown in Table 2.2. Communities categorised as independent urban were generally among the most deprived areas of NZ, particularly in the North Island. Independent urban areas (IUAs) had the lowest median income of any of the seven urban-rural categories and the highest median age, and highest ratio of over-65s to working age adults. Independent urban areas had the highest proportion of Māori across the seven urban-rural sub-categories, at 20% of the population. Otago then Southland had the highest median incomes of all independent urban areas in the country.
2.1.1.4 Other urban-rural typologies

Four health-related urban-rural typologies developed in NZ are presented here. Two binary urban-rural classifications described by the National Health Committee (NHC)\textsuperscript{21} and by Fearnley et al.,\textsuperscript{54} a three stage classification used in MOH reports \textsuperscript{55,56} and a 100 point scale developed by a rural expert advisory group\textsuperscript{57} are described.

In 2010, the NHC developed what they viewed as a better fitting urban-rural classification than SNZ definitions for their 'Rural Health. Challenges of Distance. Opportunities for Innovation' report.\textsuperscript{21} They included IUAs in their rural grouping as they were considered independent of main urban centres. They also included rural areas with high urban influence as urban, as shown in Table 2.2.\textsuperscript{21}

More recently, Fearnley and colleagues have proposed another urban-rural classification that considered people’s access to health services.\textsuperscript{54} They suggested that people in rural areas with high urban influence had access to urban health services (in keeping with the NHC’s view). They argued that IUAs contained communities with urban level access to “District Health Board (DHB) base hospitals” in their town, and communities without access to “base hospitals” (who were therefore accessing rural health services). Taking these factors into account, they calculated that the current SNZ urban-rural profile definition mislabelled over 40% of people who accessed rural health services as urban and conversely mislabelled 20% of people who accessed urban level health care services as rural. They postulated that the differences seen in urban-rural health outcomes internationally, but not shown in NZ, were masked due to inadequacies in the rural definitions used. They proposed a rural definition for health services research similar to the NHC classification but with a further division of independent urban areas into towns with a “base hospital” (being Timaru, Greymouth, Blenheim, Masterton and Whakatane) and towns without, as shown in Table 2.2.\textsuperscript{54} Depending on the urban/rural classification applied, 13.9% (Stats NZ\textsuperscript{53}), 21.2% (NHC\textsuperscript{21}) or 18.9% (Fearnley et al.\textsuperscript{54}) of NZers were classified as rural, as shown in Table 2.2.
Table 2.2 New Zealand’s Urban/Rural population estimates using different urban/rural classifications, 2015 census projections (total estimated NZ population 4,595,700 people)\textsuperscript{51}

<table>
<thead>
<tr>
<th>Category</th>
<th>Stats NZ\textsuperscript{53} (% NZ)</th>
<th>Category</th>
<th>NHC\textsuperscript{21} (% NZ)</th>
<th>Category</th>
<th>Fearnley et al.\textsuperscript{54} (% NZ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main urban area</td>
<td>72.2%</td>
<td>Main urban area</td>
<td>72.2%</td>
<td>Main urban area</td>
<td>72.2%</td>
</tr>
<tr>
<td>Satellite urban community</td>
<td>3.5%</td>
<td>Satellite urban community</td>
<td>3.5%</td>
<td>Satellite urban community</td>
<td>3.5%</td>
</tr>
<tr>
<td>Independent Urban Area</td>
<td>10.4%</td>
<td>Rural area with high urban influence</td>
<td>3.1%</td>
<td>Rural area with high urban influence</td>
<td>3.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IUA with base hospital</td>
<td>2.4%</td>
</tr>
<tr>
<td><strong>Urban Sub-total</strong></td>
<td><strong>86.1%</strong></td>
<td><strong>78.8%</strong></td>
<td><strong>81.2%</strong></td>
<td><strong>Urban Sub-total</strong></td>
<td><strong>81.2%</strong></td>
</tr>
<tr>
<td>Rural area with high urban influence</td>
<td>3.1%</td>
<td>Independent urban area</td>
<td>10.4%</td>
<td>IUA with rural hospital/no hospital</td>
<td>8.1%</td>
</tr>
<tr>
<td>Rural area with moderate urban influence</td>
<td>3.8%</td>
<td>Rural area with moderate urban influence</td>
<td>3.8%</td>
<td>Rural area with moderate urban influence</td>
<td>3.8%</td>
</tr>
<tr>
<td>Rural area with low urban influence</td>
<td>5.5%</td>
<td>Rural area with low urban influence</td>
<td>5.5%</td>
<td>Rural area with low urban influence</td>
<td>5.5%</td>
</tr>
<tr>
<td>Highly rural/remote areas</td>
<td>1.5%</td>
<td>Highly rural/remote areas</td>
<td>1.5%</td>
<td>Highly rural/remote areas</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Rural Sub-total</strong></td>
<td><strong>13.9%</strong></td>
<td><strong>21.2%</strong></td>
<td><strong>18.9%</strong></td>
<td><strong>Rural Sub-total</strong></td>
<td><strong>18.9%</strong></td>
</tr>
</tbody>
</table>

IUA=Independent Urban Area %NZ=percentage of total estimated NZ population

A three-stage urban-rural classification of *urban* (main urban and satellite urban centres), *small towns* (IUAs) and *rural areas* (all four rural categories) was used in reports analysing the associations of ethnicity, rurality and socioeconomic deprivation on health outcomes in general\textsuperscript{55} and cancer outcomes specifically.\textsuperscript{56}

The Rural Ranking Scale (RRS) was developed in 1999 by a rural health sector
expert advisory group to define rural and urban GPs. It used travel times and work commitments to define isolation and accessibility\textsuperscript{57,58} and is shown in Appendix 2. It was used nationally for rural general practice funding allocation until 2014 and is still used by some District Health Boards.\textsuperscript{59}

Given the multiple definitions of rurality presented above, there are currently calls from the rural health sector for a nationally adopted rurality definition for health services research and delivery purposes in NZ to be developed.\textsuperscript{60}

2.1.2 Health outcomes for urban and rural communities

Noting the difficulties in defining rurality as described above, this section focuses on evidence that explores whether people living in urban and rural settings have differences in health outcomes and life expectancy.

2.1.2.1 International data

Health services have been estimated to contribute less than half of the observed population health outcomes, with the larger part being attributed to socioeconomic factors and health behaviours.\textsuperscript{62} Smith and colleagues undertook a comprehensive review of literature regarding differences in urban-rural health outcomes (using measures of life expectancy, mortality and morbidity) across USA, Australia, Canada, New Zealand, the UK, and western Europe.\textsuperscript{63} They found that much of the observed urban-rural differences in health outcomes internationally was explainable by social determinants of health, and that international evidence was inconsistent on whether rurality in and of itself contributed to poorer health status once socioeconomic disadvantage and ethnicity had been accounted for. They summarised:

While rural location plays a major role in determining the nature and level of access to and provision of health services, it does not always translate into health disadvantage. When controlling for major risk determinants, rurality per se does not necessarily lead to rural-urban disparities, but may exacerbate the effects of socioeconomic disadvantage, ethnicity, poorer service availability,
higher levels of personal risk and more hazardous environmental, occupational and transportation conditions.\textsuperscript{6,3}

They argued against policy development and service provision purely around locality based explanations of health disadvantage without taking the broader social context into account. Wilkinson and colleagues in Australia demonstrated that the mortality gradient seen for rural people disappeared when indigenous Aboriginal people’s mortality was accounted for.\textsuperscript{26} Other authors have linked socioeconomic and ethnic disparities as confounders to rural differences in health outcomes.\textsuperscript{44,64}

\textbf{2.1.2.2 New Zealand data}

The NHC explored differences in health outcomes and life expectancy in NZ using their urban-rural definitions (see §2.1.1.4). They found that while life expectancy was similar for people living in rural and urban areas, differences existed between Māori and non-Māori in both rural and urban areas, and between rural Māori and urban Māori, as shown in Table 2.3, with the largest differences seen between rural Māori and non-Māori.

A higher proportion of Māori lived in rural areas compared to urban areas, and a higher proportion of Māori living in rural areas were living in the areas of lowest socioeconomic status (NZDep13 quintile 5). The Committee noted concern about “the potentially compounding effects of deprivation and ethnicity on health, particularly where there are geographic barriers to access.”\textsuperscript{21}

The MOH’s ‘\textit{Mātātuhi Tuawhenua: Health of Rural Māori 2012}’ report compared rural and urban Māori and non-Māori health related statistics using three categories of urban (main and satellite urban areas), small towns (IUAs) and rural areas (all four rural categories).\textsuperscript{55} Māori had significantly worse health outcomes across a wide range of indicators than non-Māori, and Māori living in IUAs
Table 2.3 Life expectancy at birth and age 65 for rural and urban populations by sex, all people and Māori, 2005-2007, using NHC rural/urban definitions (adapted from ‘Mātātuhi Tuawhenua: Health of Rural Māori 2012’ report 21)

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
<th>Urban-rural difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>At birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>77.6</td>
<td>82.4</td>
<td>78.4</td>
</tr>
<tr>
<td>Female</td>
<td>21.2</td>
<td></td>
<td>20.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Māori life expectancy (in years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At birth</td>
</tr>
<tr>
<td>Male</td>
<td>69.7</td>
</tr>
<tr>
<td>Female</td>
<td>74.6</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-1.5</td>
</tr>
<tr>
<td></td>
<td>-1.2</td>
</tr>
</tbody>
</table>

generally had worse health outcomes than Māori living in urban areas or rural areas. The data for non-Maōri, age-standardised to the NZ Māori population in 2001, were also included and are shown in Appendix 3. Non-Māori living in rural areas had similar or better health outcomes compared to urban non-Māori. Non-Māori living in IUAs had worse health outcomes than both rural or urban non-Māori. These data were not adjusted for socioeconomic status but non-Māori living in IUAs tended to have poorer results for socioeconomic indicators presented.55

The Unequal Impact II: Māori and Non-Māori Cancer Statistics by Deprivation and Urban-rural Status 2002-2006 Report56 used the above three-part urban-rural definition, and found a “negligible” adjusted increase (of 1%) for cancer incidence and mortality for Māori related to urban-rural status. Cancer incidence and mortality was significantly associated with lower socioeconomic status and there were residual adjusted differences in cancer outcomes for Māori.56 Studies looking at bowel cancer55 and breast cancer56 survival in Māori56 and Pacific55 populations showed that urban-rural status was not associated with poorer outcomes once ethnicity56 and socioeconomic status55 was controlled for.
2.1.3 Understanding rural health

Frameworks to understand rural health and Māori views of health from a NZ European researcher’s perspective are described in this section.

2.1.3.1 Theoretical rural health frameworks

Three theoretical frameworks developed to understand the nature of rural health care, the first from an international perspective and the next two Australian based, are presented here.

Weinhold and Gurtner\(^1\) presented a framework developed from a systematic literature review that investigated the reasons of shortages of “sufficient health care” (individuals receiving the health care they objectively needed) in rural areas in developed countries. Aspects of shortages of hospital, primary care and community care in rural areas included provider shortages, maldistribution of providers, quality deficiencies, access limitations and inefficient utilisation of health care services. Reasons behind the shortages included physical/infrastructural, professional, educational, social-cultural, economic and political causes. The aspects and the identified reasons behind shortages of sufficient health care were combined in a matrix as shown in Figure 2.2.\(^1\)

They found that deficient quality of health care in rural areas related to the scope of services provided by rural health care professionals and the professional level that these services were provided at, with most quality issues arising from deficiencies in how comprehensive and continuous care was provided. Care coordination was difficult, and care was often highly fragmented with delays resulting. Gaps occurred in allied health services, and the elderly with multiple long term conditions were particularly affected. Integrated care management, and care transitions between providers and settings reduced quality, particularly for older people. Over-stretched providers working at the top of their scope across a wide range of areas and dealing with unfamiliar situations, across large distances, could all lead to reduced quality. Workforce shortages and maldistribution were
linked to the physical, professional and social isolation of rural communities which made them less attractive to health providers and their families. 10

Aspects of shortages of sufficient health care for rural areas and underlying reasons

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Provider shortages</th>
<th>Maldistribution</th>
<th>Quality deficiencies</th>
<th>Access Limitations</th>
<th>Inefficient utilisation of services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical/Infrastructural</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Educational</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Social &amp; Cultural</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Economic</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Political</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Weinhold I, Gurtner S. Understanding shortages of sufficient health care in rural areas. Health Policy. 2014;118(2):201-14.

Figure 2.2 Weinhold and Gurtner's shortages of sufficient health care model

Humphreys and colleagues9 developed a model to describe the elements of sustainable rural general practice in rural and remote Australia. Economic, organisational, professional, environmental and social dimensions of rural health service sustainability were linked to access, care quality and cost of service provision. A systems focus on the interrelated nature of these dimensions created sustainability. Their model is shown in Figure 2.3, taken directly from their paper. Although designed with rural general practice in mind, Humphrey’s model has common elements with Weinhold and Gunter’s model. Humphrey’s model takes a positive ‘what is needed’ rather than the ‘what is missing’ approach of Weinhold.
Bourke and colleagues interviewed rural practitioners, policy advisors, academics and advocates in rural Australia to understand how they conceptualised rural health. They developed a theoretical framework to understand complex rural health systems and promote policy to improve rural health outcomes as shown in Figure 2.4. Key elements identified for rural communities were geographic isolation, the individual rural locale, health responses in the rural locale, the broader health systems and social structures in which they sat and the power of individuals and organisations at each level to influence or be influenced by the whole structure. These were linked using the lens of the UK sociologist Giddens’ theory of ‘structuration’ which theorises that individuals’ actions could support, create or alter structures that are in place, and at the same time the structures that exist influence how individuals act. In Bourke’s framework the influence of Aboriginal people was considered within the rural locales, rather than having a level of importance in its own right. The framework indicated the range of levels and stakeholders where influence needed to be exerted to improve rural communities’ health outcomes. In contrast to Weinhold’s and Humphrey’s models...
it looked beyond the rural community to the broader health system which supported it and considered directly the role of power within this dynamic system.

A conceptual framework for understanding rural health

![Diagram of Bourke and colleagues' conceptual framework for understanding rural health](image)

Bourke and colleagues argued that ‘rural health’ had been created as a political concept within the Australian health care system to advocate for funding for health services in rural areas. In their view, the main discourse around rural health was from a ‘deficit’ standpoint, which focused on the deficiencies and challenges in rural health care and the need for more resources. They suggested that shifting to a positive discourse focused on the strengths of rural health, including the greater sense of community, continuity of care, greater variety and scope for practice would assist with workforce recruitment for rural communities.

2.1.3.2 Māori views of health

This thesis does not take a Kaupapa Māori (based on Māori principles and practices) approach, in that it is not centred in a Māori world view, with Māori values, experiences and beliefs central to the research process and interpreted
through that lens. With this caveat made clear, a brief discussion on Māori views of health follows, from a Pākehā (NZer of European descent) researcher’s viewpoint. Given that a greater proportion of Māori in Aotearoa live in rural areas, an understanding of the Māori view of health is important for this thesis.

Two Māori health models, Te Whare Tapa Whā (the four-sided house) and Te Wheke (the octopus), are increasingly widely applied within the NZ health system. Professor Mason Durie’s Te Whare Tapa Whā model describes a holistic view of health and wellbeing, based around the four cornerstones of health, being the realms of taha tinana (physical), taha hinengaro (emotion and mind), taha whānau (family and social) and taha wairua (spiritual). All four elements need to be in balance for wellness.

Dr Rose Pere described the concept of Te Wheke, the octopus, as a depiction of family health. The head of the octopus represents te whānau (the extended family) the eyes of the octopus as waiora (total wellbeing for the individual and family) and each of the eight tentacles represent dimensions of health. Each tentacle needs to be intact, fully functional and interacting with the other tentacles for total wellbeing to be achieved. Four of the eight tentacles are similar to the four cornerstones of Te Whare Tapa Whā, being Wairuatanga (spirituality), Hinengaro (the mind), Taha tinana (physical wellbeing), and Whānaungatanga (kinship, social bonds of extended family). The additional four tentacles are Mauri (the life force or elemental energy in people, creatures, objects and land), Mana ake (the unique identity, prestige and power of individuals and family), Whatumanawa (the open and healthy expression of the range of emotions) and Hā a koro ma a kuia ma (the breath of life from forbearers – the connection with one’s heritage). Total wellbeing or waiora is about connection with whānau past, present and future, collectivity, spirituality and sustenance through balance of all aspects of health.

These models indicate that the Māori view of health with its emphasis on wholeness, whānau and connectedness with the land is distinct from the majority Pākehā view. Rochford notes that Māori believe that the traditional biomedical
model of Western views of health takes a reductionist world view, and only focuses on the measurable – thus elements beyond the physical are often not addressed. Measures of Māori health agreed at a hui (meeting) of over 1000 Māori health and community leaders in 1994 included what might be considered markers of social determinants of health, including the number of Māori in influential positions, the value of Māori owned resources, reduced crime rates, te Reo Māori use, lower crime rates, higher educational and business achievement, as well as the more traditional health related measure of increased life expectancy.

2.1.4 Hospitals in the rural context

This section outlines how hospitals are conceived within countries including NZ, the history of rural hospitals internationally, and the current framing of rural hospitals in the NZ setting.

2.1.4.1 Typologies of hospitals and networks

As with rurality, there is no universal standard typology that describes hospitals or the inter-relationship between smaller and larger hospitals to provide services to different sized communities. Some approaches taken in different countries, including NZ, are described here.

Role delineation models emerged in the early 2000s in Australia to define what services should be provided at particular facilities to meet local population needs. Rural Queensland’s ‘Clinical Services Capability Framework’ describes six levels of clinical service capability and the corresponding facilities, from a nurse or paramedic led community clinic, to a large metropolitan tertiary hospital, to provide these services as shown in Table 2.4. It sets expectations of medical and other clinical staffing, level of acute and elective health services and facilities to be provided for populations of different sizes. The document described ‘health service networks’ as groups of health services of different levels of capability, with locally agreed linkages that “provide essential service links to ensure continuity of
<table>
<thead>
<tr>
<th>Level</th>
<th>Descriptor</th>
<th>Facility</th>
<th>Medical Staff</th>
<th>Level</th>
<th>Descriptor</th>
<th>Facility</th>
<th>Medical Staff</th>
<th>Level</th>
<th>Descriptor</th>
<th>Facility</th>
<th>Medical Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low complex ambulatory services</td>
<td>Community Clinic</td>
<td>Nurse or paramedic led</td>
<td>1</td>
<td>General Practice and community provided services</td>
<td>General practice &amp; extended primary care GPs</td>
<td>Primary services</td>
<td>Primary care facilities</td>
<td>GPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Emergency services, low complex acute medical inpatient &amp; ambulatory services</td>
<td>Community Hospital, Serves population &lt;2000</td>
<td>RGM available 24/7</td>
<td>2</td>
<td>Assessment, diagnosis and treatment for routine conditions but no surgical capacity</td>
<td>Community hospitals</td>
<td>RGM available 24/7</td>
<td>Community and rural hospitals</td>
<td>Level 1 RH: RGM available 24/7; Level 2 RH: RGM on site business hours, available 24/7; Level 3 RH: RGM on site 24/7, limited specialist medical cover may be provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>As per community hospital plus surgical and maternity</td>
<td>Rural hospital, population ≥2000</td>
<td>RGM available 24/7</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Low to moderate complex inpatient and ambulatory services, services as for rural hospital, no ICU</td>
<td>District Hospital, Serves population ≥4000</td>
<td>RGM available 24/7</td>
<td>2+ (new)</td>
<td>Management of all patients initially, some transferred; surgical and medical capacity, no ICU</td>
<td>Rural general hospitals</td>
<td>Specialists and RGM</td>
<td>3</td>
<td>Acute and elective specialist services</td>
<td>Secondary hospitals</td>
<td>Specialists</td>
</tr>
<tr>
<td>4</td>
<td>Moderate complex inpatient and ambulatory services</td>
<td>Regional Hospital</td>
<td>24/7 on site specialist medical staff, ICU</td>
<td>3</td>
<td>Core admitting services for general surgery general medicine, orthopaedics with anaesthetic and radiology support as minimum</td>
<td>District general hospitals</td>
<td>Specialists</td>
<td>4</td>
<td>Large services with some subspecialisation</td>
<td>Secondary hospitals</td>
<td>Specialists</td>
</tr>
<tr>
<td>5</td>
<td>Moderate to high complex inpatient and ambulatory services</td>
<td>Regional Hospital</td>
<td>Specialists</td>
<td>5</td>
<td>Large services with multiple subspecialties</td>
<td>Tertiary hospitals</td>
<td>Specialists</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>High complex inpatient and ambulatory services</td>
<td>Large metropolitan hospital</td>
<td>Specialists and sub-specialists</td>
<td>4</td>
<td>National high complexity specialised services</td>
<td>Tertiary metropolitan hospitals</td>
<td>Specialists and sub-specialists</td>
<td>6</td>
<td>Most complex service of any subspecialty.</td>
<td>Tertiary hospitals</td>
<td>Specialists and sub-specialists</td>
</tr>
</tbody>
</table>

RGM = Rural Generalist Medical staff, including GPs with special interest in hospital medicine (Scotland) and Rural Hospital Medicine doctors (NZ); RH = Rural Hospital
care for patients and are necessary for safe and sustainable integrated care.\textsuperscript{78} This working definition of health service networks will be used through this thesis.

NHS Scotland developed a similar framework in the late 2000s to define what services were required for rural communities, and how components of the health service would work together to meet these needs.\textsuperscript{7} Four levels of service were defined, from level 1, community provided services, through to level 4, highly specialised national services, as in Table 2.4. The establishment of ‘obligate networks’ was proposed, where clinical links between rural and urban based hospital services were formalised with obligations on urban services to support decision making and clinical care provision in rural general hospitals (RGHs), and local networks between RGHs and local primary care services. Six ‘level 2+’ RGHs were identified in the North of Scotland catchment, staffed by a mix of specialist and generalist medical staff. Specialists based in larger hospitals within the ‘Obligate Network’ would support staff at RGHs through visiting clinics, rotation through the hospital to provide inpatient care, time for RGH doctors to spend in larger hospitals and distant support through telehealth (the delivery of health care services at a distance using information and communications technology).\textsuperscript{79} Improved transport and retrieval services across networks were planned. Care pathways and standards were to be developed collaboratively within obligate networks.\textsuperscript{7}

Seven years after the Scottish framework was developed, I visited the region to explore how implementation of this model had progressed. Unfortunately, as one interviewee noted, “We had all put so much effort into developing the document on obligate networks that we had run out of energy to implement it”.\textsuperscript{3} Limited traction on implementation was evident, but the underlying need for the services as described was still recognised.

The MOH in NZ developed a role delineation model (RDM) in 2010 based on Australian examples\textsuperscript{77} with six levels, from level 1 primary services through to level 6 high complexity specialist tertiary services as shown in Table 2.4. The document describes clinical partnerships, regional collaboration and integrated services rather than networks. It allows comparisons between hospitals\textsuperscript{80} and has been used for national
planning of services through a “regional hub and spoke approach”, such as vascular surgery.\textsuperscript{81} Although the RDM is applied to component services within facilities, and it was intended that facilities could provide services at different RDM levels, in practice an overall RDM level is derived for hospitals.\textsuperscript{77} While the original RDM in 2010 did not specifically define community or rural hospitals,\textsuperscript{77} a 2017 application of the RDM to a national vascular model of care denoted community hospitals and (ambulatory) integrated family health centres as Level 2.\textsuperscript{81}

The Royal New Zealand College of General Practitioners’ Division of Rural Hospital Medicine has defined rural hospitals in NZ as:

Hospital[s] staffed by suitably trained and experienced generalists, who take full clinical responsibility for a wide range of clinical presentations. While resident specialists may also work in these hospitals, cover is limited in scope or less than full time.\textsuperscript{82}

There are 33 rural hospitals in NZ divided into three levels based on medical support provided, access to laboratory and radiology services and whether specialist doctors provide limited services to the facility\textsuperscript{82} (see Appendix 4 for more detail). Rural hospital medicine (RHM) has developed as a vocational scope in NZ in the last decade,\textsuperscript{33,82} and rural hospitals around NZ are now staffed by a mix of RHM doctors, rural GPs and doctors who are dual trained as both. Rural hospitals are most closely aligned to Level 2 community hospitals in the RDM model (particularly Level 1 and Level 2 rural hospitals), and have been placed within level 2 of the RDM included in Table 2.4.\textsuperscript{82}

The term ‘base hospital’ is widely used in NZ literature and exists in the titles of some around NZ, such as Taranaki Base Hospital, and Grey Base Hospital. Despite its currency as a term, no MOH standards or definitions of the term have been found. Base hospitals and secondary hospital definitions are changing as medical workforce and telehealth capabilities evolve. As an example, Grey Base Hospital is now classed as a secondary hospital within the RDM model and a rural hospital by the Medical Council of NZ.\textsuperscript{82} A mix of RHM doctors and specialist doctors provide health care on site, with some
services being provided on site 24/7 by generalists, supported by specialists in Christchurch 250 km away\(^1,2\)

### 2.1.4.2 Rural hospital services in NZ: past and present

In high income countries, including NZ, the growth in the nineteenth and early twentieth century of rural communities then their decline post World War II in favour of urbanisation was mirrored by the fortunes of local rural hospital services\(^6,21,27,83\). In the 1980s and 1990s in NZ, particularly in the South Island, community trusts were set up with the aim of taking ownership of small rural hospitals under threat of closure\(^21,24,84,85\). Janes asserted in 1999 that “the retention of general practitioners and rural hospitals are the top two concerns of rural communities” in NZ\(^84\). Williamson and colleagues found that about 40% of a group of rural Otago hospitals’ inpatient workload was managed locally by generalists in rural hospitals in 2006 (noting that this was before RHM became a vocational medical specialty in NZ). This allowed people to receive their health care in familiar settings, supported by friends and family in the local health care context into which they would be discharged\(^24\).

Since 1999, four surveys of rural hospitals in New Zealand have been undertaken\(^84,86-88\). Table 2.5 combines these surveys (which sometimes did not count exactly the same hospitals) with the list of secondary and rural hospitals\(^89\) and shows that the number of hospitals located in towns of less than 30,000 has trended downwards over the last 20 years.

Rural hospitals have become hubs for their local health systems, providing diagnostic access and a limited range of acute and emergency services. Rather than struggling to provide the full range of hospital services, access to more specialised hospital services is provided through networks with larger hospitals where more complex patients are transferred\(^3,4,27,90\).
Table 2.5 Secondary and rural hospitals in towns of less than 30,000 population in New Zealand, 1998-2016

<table>
<thead>
<tr>
<th></th>
<th>Number of secondary hospitals</th>
<th>Number of rural Hospitals</th>
<th>Total number of hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janes et al. 1998 84, adapted</td>
<td>11</td>
<td>35</td>
<td>46</td>
</tr>
<tr>
<td>Williamson et al. 2002-3 86 adapted</td>
<td>6</td>
<td>44</td>
<td>50</td>
</tr>
<tr>
<td>Lawrenson et al. 2009 87 adapted</td>
<td>5</td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>Lawrenson et al. 2015 88 adapted</td>
<td>5</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>2016 RHM training handbook 82</td>
<td>5</td>
<td>33*</td>
<td>37*</td>
</tr>
</tbody>
</table>

*Grey Base Hospital counted as both a rural hospital and secondary hospital in 2016 data

As noted by Williamson and colleagues, rural hospitals, and all hospitals, need to be considered in the context of their health system, and the interplay between the various parts of the system for best patient outcomes.24 Despite this, central government has limited focus on rural hospitals. The NHC’s ‘Rural health: challenges of distance, opportunities for innovation’ report in 2010 included visits to a number of rural hospitals, but made no mention of their present or future contribution.21 New Zealand’s role delineation model developed in 2010 did not recognise rural hospitals77,81 and no relevant documents regarding rural hospitals have been produced by central government since then.

Over two-thirds of health care funding in NZ is distributed through a population based funding formula to the country’s 20 DHBs. The formula includes adjustments for rurality, as well as unmet need measured by Māori, Pacific and lower decile population composition.91 Frustration at the lack of transparency in how the formula was constructed and applied has been expressed,91,92 particularly in the South Island.92 Most DHBs with rural hospitals received more than their population share of funding in 2011/12,91 but over a quarter of NZ’s rural hospitals are located in either Southern DHB (in which six out of the country’s 33 rural hospitals sit) and Canterbury DHB (with three rural hospitals) which both have large urban populations and do not receive an extra share of funding over and above their population share.
2.1.4.3 Rural hospitals – more than just a health care facility

The international literature describes the role of hospitals in rural communities as extending beyond the actual services provided.\textsuperscript{26,93} Rural hospitals contribute to the economic, social and human capital of rural communities through employment, local spending, a place for social interaction in a small community, as well as providing reassurance of the viability and vitality of the community.\textsuperscript{93} Local hospitals express “community identity and a sense of place”\textsuperscript{83} The desire of rural communities to care for members within their community is important and drives ongoing community efforts to maintain local services through significant local community involvement in service design and delivery, including volunteering.\textsuperscript{83} Threatened losses of these added-value dimensions to be replaced by new, visiting services often spark a strong community response.\textsuperscript{83,94-96}

Several NZ case studies of rural towns endorse these findings. The existence of local health services were integral to the communities’ view of themselves and threatened hospital closures rallied communities together.\textsuperscript{75,85,97,98}

This section has considered aspects of rurality, health and health care. The next section focuses on health care quality.

2.2 Health Care Quality

The World Health Organisation defines quality as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.”\textsuperscript{99} This section outlines developments in health care quality improvement, describes key frameworks developed to understand health care quality and considers rurally focused health care quality concepts. Access and patient safety, two aspects of quality, are covered in more detail. Literature regarding the quality of health care experienced by NZ Māori is outlined. Measuring quality in the rural context is then discussed.
2.2.1 Health care quality concepts and frameworks

Avedis Donabedian’s work, first published over 50 years ago, laid the foundation for quality improvement thinking. In his influential 1966 paper on evaluating quality in health care, Donabedian defined quality as reflecting the “values and goals current in the medical care system and in the larger society of which it is a part.” He later noted that what might be ‘best’ health care for the individual might not be ‘best’ for the community. Optimally effective health care was when the benefits of health care were optimised for the cost of providing care, taking the incremental benefit for additional cost into account, rather than considering only benefits. He described assessing quality through three key components, being structure (the material and human resources, as well as the organisation structure), process (the way that care was sought and provided), and outcomes of care (including changes in health status and patient satisfaction).

In the late 1990s United Kingdom (UK) and US research demonstrated a wide variation in health care outcomes and there was public outcry at gross medical system failures in UK, such as at the Bristol paediatric cardiac services. Inequalities in access to and outcomes of health care for disadvantaged groups were also being identified. Efficiency became important as health care costs were escalating in the face of increasing technological advances and ageing populations with multiple long-term health conditions. In response to these pressures, pockets of innovation at service and organisational level were appearing, such as the benchmarking collaboratives established by the Institute of Healthcare Improvement (IHI) in the US, and institutions such as the National Institute for Clinical Excellence in the UK.

In 2001, The American Institute of Medicine (IOM) in their seminal work Crossing the Quality Chasm described quality health care as being “safe, effective, patient centred, timely, efficient and equitable”. This definition of quality has now been widely adopted and adapted with expansion of the concept of patient-centred to be person-centred, and timely to include accessible and affordable. Equitable health care was noted above as one of the six IOM attributes of quality, and the World Health Organisation defines equity as
the absence of avoidable or remediable differences among groups of people, whether these groups are defined socially, economically, demographically or geographically.\textsuperscript{109}

Concepts of quality were further developed by the IHI in 2008. The IOM’s focus on improving health care at individual health care sites across the six aspects of quality noted above was expanded by IHI into a quality approach for a defined population with interlinked goals, called the ‘Triple Aim’ for health care quality as shown in figure 2.5.\textsuperscript{11} The Triple Aim focused on improving the individual patient experience of care, improving the health of the defined population, and reducing the per capita health care costs for the population. While the authors noted that equity should be the promise of implementing the triple aim successfully, they commented that decision-making around equity lies in “the realms of ethics and policy, and it is not technically inherent in the Triple Aim”.\textsuperscript{11}

![The IHI Triple Aim](image)

\textit{Figure 2.5 The IHI Triple Aim}

In 2010 the English and Scottish National Health Services (NHS) defined health care quality, for England as being “care that is effective, safe and provides as positive an experience as possible,”\textsuperscript{110} and for Scotland as being based on the three concepts of person-centred, safe and effective health care.\textsuperscript{107} Australia’s health services quality framework, also developed in 2010, focused on three key areas: consumer centred, driven by information and organised for safety.\textsuperscript{111}
Quality Improvement describes the process by which systems seek to improve quality, “designing and redesigning work processes and systems that deliver health care with better outcomes and lower cost, wherever this can be achieved”. In New Zealand in 2011, the newly formed Health Quality and Safety Commission adapted the IHI’s Triple Aim after intensive health sector-wide consultation to describe the quality improvement approach for the New Zealand context, as shown in Figure 2.6. The New Zealand Triple Aim for Quality Improvement has three key strands of improved quality, safety and experience of care for individuals; improved health and equity for all population groups; and best value for public health system resources. This was an evolution of the IHI’s Triple Aim as the population of interest was the whole population of NZ and equity was explicitly included as an aspect of quality in NZ. This was in recognition of the disparities in health indicators for Māori and Pacific people and the need for improving these inequities to be a whole of system priority. It also clarified that the NZ health quality agenda was not aimed at reducing overall health spending, but on maximising benefit from future health funding by removing waste throughout the health care system. Value was defined as “benefit for patients for every dollar spent”.

![Figure 2.6 The New Zealand Triple Aim for Quality Improvement](image-url)
The IHI’s Triple Aim has been adapted in many different settings internationally, and it has been applied to populations and health systems ranging from local communities to global levels. In a review of the Triple Aim’s application, equity and provider experience of care were described as elements missing from the original framework. Americans Bodenheimer and Sinsky proposed that the Triple Aim should be expanded into the Quadruple Aim, adding a fourth aim of the quality of working life for health care providers, to address provider burnout. Southern DHB in Otago and Southland, NZ, adopted ‘The Fourfold Aim’ that includes teaching and learning as a fourth aim, to reflect the DHB’s role in providing health workforce training nationally through its close relationship with the University of Otago and local polytechnics.

In response to calls to expand the Triple Aim, the current IHI Chief Executive noted that equity and engaged contented staff are pre-requisites to achieving population health and quality of patient experience aims within the Triple Aim. While they did not discourage groups from adding a fourth aim if it helped achieve organisational goals, the IHI cautioned against allowing other areas of focus and measurement to distract from pursuing the core patient-centred elements of the Triple Aim.

2.2.2 Rural quality frameworks

In contrast to the widespread use of frameworks of health care quality generally, very few rural quality frameworks have been published. The IOM developed a quality framework for rural US health systems based on their six elements of quality and focused on the rural context of poorer health behaviours, isolation, workforce and financial barriers that impacted on access to core health services. Their five point strategy for rural health care quality improvement focused on:

- addressing health needs at the personal and population level within communities;
- establishing stronger quality improvement support structures, including standardised measures appropriate for rural communities;
• focusing on rural workforce development across professional groups, as well as developing the capacity of communities to engage in improving their own health;
• providing adequate targeted financial resources so that rural health care systems were sustainable to meet rural communities’ need;
• investing in information technology as a vehicle to improve health care for rural communities.

The Queensland government in Australia developed guiding principles for high quality rural health services, which indicated that services should be:

• Person focused;
• Health outcome focused;
• Quality (consistent, innovative, with flexible and skilled staff);
• Safe;
• Sustainable;
• Accessible;
• Culturally appropriate;
• Supported by information technology such as telehealth;
• Supported by formal arrangements with the broader health service network.

The New Zealand Triple Aim for Quality Improvement framework is widely adopted and recognised across the New Zealand health system but there is no formal rural health quality framework in NZ that I am aware of.

2.2.3 Access for rural communities

Access is a key element of quality, and rurality presents particular challenges to access. Levesque and colleagues undertook a synthesis of published literature in 2013 that conceptualised health care access. They defined access as “the opportunity to have health care needs fulfilled”. They theorised that access results from the interplay between health services and health users and that utilisation is “realised access” and developed a framework to conceptualise access. The accessibility of health services
required services to be organised and provided so as to be approachable, acceptable, available, affordable and appropriate. When coupled with people's ability to perceive, seek, reach, pay for and engage with services, access was achieved.\textsuperscript{120}

International studies have shown that people living in rural communities have lower rates of acute hospital admission\textsuperscript{121} and out-of-hours service use\textsuperscript{122} compared to people living in urban communities. Key areas that impact rural people's health care access include geographic distance and transport difficulties,\textsuperscript{10,123,124} workforce availability,\textsuperscript{123,124} economic ability to afford to access services,\textsuperscript{10} and a rural culture that makes seeking health care difficult especially if services are at a distance.\textsuperscript{10,123,124} People living in rural communities are more likely to accept ill health and death as natural and less likely to seek help for non-urgent issues than urban people.\textsuperscript{125} Rural patients who were transferred to urban hospitals after admission to rural hospitals for critical illnesses experience anxiety and confusion about the transfer and discharge planning and the impersonal nature of care at the urban hospital was noted.\textsuperscript{126}

New Zealand's NHC report\textsuperscript{21} found that low socioeconomic status, poor access to transport or telecommunications, service cost and the acceptability of services hinders access to health services in rural NZ. A survey undertaken by Rural Women New Zealand\textsuperscript{127} showed that one in five respondents have access problems due to distance for primary care, one in three for specialist care and mental health services and one in two for accident and emergency care, maternity care, elder support and disability support. Cost (financial and time) of accessing primary care is also noted as a barrier by two thirds of respondents. NZ research looking at Emergency Department (ED) attendance on the advice of the national telephone triage service, Healthline,\textsuperscript{128} indicates a sharp drop off in people following advice to attend ED for people living over 40 minutes away from their nearest ED.

The rural health workforce, in particular rural GPs, has long been an issue in NZ,\textsuperscript{84} and rural workforce training continues to be a major concern for rural communities.\textsuperscript{50} The desire to receive treatment near home was strong, particularly for older rural Māori.\textsuperscript{32} One study of rural NZ patients requiring intensive specialist cancer treatment away
from home\textsuperscript{129} found that rural patients experience added stress and social, emotional and financial burden compared to urban counterparts.

Cost is another barrier to access for rural people. A Central Otago study in 2013 by Fearnley and colleagues\textsuperscript{130} estimated that average personal costs to patients and their support persons of attending publicly funded outpatient clinics at the local rural hospital (Dunstan) to be NZ$172, and at the larger urban hospital 200 km away (Dunedin) to be NZ$732. Using the median annual household income in 2013 of $63,800\textsuperscript{131} this equates to 15\% of the median weekly household NZ income for a rural hospital visit, and 60\% for an urban hospital visit.

Financial assistance for health-related travel in NZ is controlled through the National Travel Assistance scheme (NTA) that is administered by each of NZ’s 20 DHBs. It is currently available for all people who need to travel for distant hospital services (more than 350 kilometres (km) one away from home for adults, or 80 km for children under 18), with lower thresholds for people with limited income. Lower thresholds also apply for people needing multiple visits over a period of time. Unless DHBs seek specific dispensation, GP referrals to hospital specialists do not initiate NTA eligibility, and NTA eligibility is activated by specialist or hospital referral only. The NTA offers financial assistance rather than full reimbursement. People need to become registered before they can claim, funding is retrospective and receipts generally need to be provided for travel and accommodation\textsuperscript{132}.

The NTA policy has recently been reviewed and data indicates that 23\% of NTA recipients are Māori, compared to 15\% of the general population being Māori. Rural and urban people’s usage of the NTA scheme was also reported. The urban-rural definition used was not stated but is assumed to be the SNZ definition. More rural people received NTA assistance than urban people, but rural people received on (mean) average less money per claim than urban people. In addition, rural people living in poorer areas also received less money per person on average than rural people living in wealthier areas.\textsuperscript{133} It was acknowledged that “the NTA Scheme needs to be more patient focused, providing practical but empathetic solutions for its clients”.\textsuperscript{133} The report made a
number of short-term recommendations to improve the process as it currently stands, and longer term recommendations to review eligibility, scope, funding levels and processes to improve population level outcomes and equity of services access. It was noted that investment in improving access would return future savings if it avoided later more costly hospital inpatient costs.\textsuperscript{133}

The aspects of access relevant to rural communities identified above have been applied to Levesque and colleagues’ framework to show accessibility and service user factors that are relevant to improving access for rural communities, and is shown in Figure 2.7.

![Key access issues for rural communities](image)

\textit{Figure 2.7} Key aspects of access for rural communities, adapted from Levesque, J.-F., et al.\textsuperscript{120}

2.2.4 Patient safety, harms and urban-rural location

Safety is one of the IOM’s six aspects of health care quality\textsuperscript{103} and a key element of NZ’s Triple Aim.\textsuperscript{12} Patient harm is an indicator of whether health care is safe. This section discusses literature regarding patient harms and urban-rural location. The World Health Organisation’s International Classification for Patient Safety definitions of patient safety, adverse events and harms\textsuperscript{99} are shown in Figure 2.8 below.
**International Classification for Patient Safety, World Health Organisation**


*Patient Safety*: the reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum.

*Harm*: impairment of structure or function of the body and/or any deleterious effect arising there from. Harm includes disease, injury, suffering, disability and death.

*Adverse event*: an incident that resulted in harm to a patient.

*Healthcare-associated harm*: harm arising from or associated with plans or actions taken during the provision of healthcare, rather than an underlying disease or injury.

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The US Institute of Medicine’s 2010 “To Err is Human” report brought the impact of patient harm widespread international attention. Adverse events are caused by healthcare rather than underlying disease processes. The resulting patient harms are major causes of health loss, due to prolonged hospital stays, ongoing disability and death, and cause additional costs to health systems. De Vries and colleagues undertook a systematic review of hospital related adverse events identified by retrospective hospital patient record reviews, which included NZ as well as US, UK, Australia and Canadian data. They showed that approximately 9% of patients admitted to hospital experienced an adverse event. While there were some differences in the data collection process between countries, pooled analysis showed that 7% were lethal. About 40% were operation related and 15% medication related, and just under half (median 43.5%) were judged as preventable. Classen and colleagues used the IHI’s ‘global trigger tool’ to assess adverse events through retrospective hospital records review and estimated that about one third of hospital admissions indicated adverse events.
Davis and colleagues investigated adverse events in NZ hospitals in 1998\textsuperscript{25} and their research was included in De Vries’ review. Davis’s study included 6579 hospital records drawn from 13 hospitals with over 100 beds (which excluded most small provincial secondary hospitals). Urban-rural location of patients was not recorded. In their sample, they found that 10.3\% of hospital admissions caused harm, with 6.3\% of admissions causing preventable adverse events originating in hospital. Harm originating outside the hospital setting caused 2.6\% of admissions.\textsuperscript{137} Just under 15\% of all adverse events caused permanent disability or death. Adverse events were associated with greater hospital resource use and length of stay. Being older was associated with higher risk of adverse events,\textsuperscript{25} preventable adverse events and experiencing greater impact from adverse events, through prolonged hospital stays and permanent disability or death.\textsuperscript{137} Urban-rural location of patients was not recorded in the study. This was consistent with the findings of Hogan and colleagues, who found that the majority (60\%) of all preventable deaths seen in English NHS hospitals occurred in frail elderly patients with multiple co-morbidities.\textsuperscript{138} Robb and colleagues found that adverse drug events in NZ hospitals were associated with increasing age and over a third of recorded events caused increased length of hospital stay.\textsuperscript{139}

There is little information about patient safety in rural hospitals but available research largely comes from the US. Coburn and colleagues reviewed available literature in 2004 and concluded that while there was not enough published information to be definitive, rates of adverse events in rural hospitals appeared to be no worse than in urban hospitals, nor in smaller (less than 50 beds) rural hospitals compared to larger (over 100 beds) rural hospitals.\textsuperscript{22} In 2010, Vartak and colleagues compared patient safety outcome indicators in rural and urban American hospitals with less than 100 beds. They found that small rural hospitals outperformed small urban hospitals on most measures, but when patient and hospital characteristics were accounted for, all differences disappeared, except for pressure sores, which were more likely in small urban hospitals.\textsuperscript{23}

Literature on patient safety and adverse events related to inter-hospital patient transfer indicates that patient transfer is associated with adverse outcomes, including delay in time to surgery,\textsuperscript{140} longer length of hospital stay,\textsuperscript{141,142} longer time in intensive care
unit\textsuperscript{142} and higher in-patient mortality compared to patients not transferred during admission. When patient characteristics and underlying illnesses were controlled for, differences persist.\textsuperscript{142,143} Rural patients have higher rates of transfer than urban patients.\textsuperscript{141} Patients who were transferred between hospitals are noted to be vulnerable to adverse outcomes due to the complex and unstable medical problems necessitating transfer. In addition, system issues of poor communication and handover between referring, transferring and receiving clinical teams, and limited resources and space during transfers to monitor and address evolving changes in health status are also noted.\textsuperscript{142,144}

\subsection*{2.2.5 Te Tiriti o Waitangi and health care quality for Māori}

The NZ government and Māori (the indigenous people of Aotearoa) have a special relationship established by Te Tiriti o Waitangi (the Treaty of Waitangi), New Zealand’s founding document.\textsuperscript{119} Te Tiriti o Waitangi has three articles, Article One regarding kāwangatanga (governance), which related to Crown obligations to provide good government; Article Two, tino rangatiratanga, (self-determination and autonomy) for Māori; and Article Three, ōritetanga, (equality), where Māori were promised equal rights with other British citizens. In signing Te Tiriti o Waitangi, Māori exchanged sovereignty for British citizenship rights and protections.\textsuperscript{145} This has translated into contemporary NZ Government’s commitment to partnership, participation and protection for Māori,\textsuperscript{146} as shown in Appendix 5. This section considers literature that explores whether NZ health services have met crown obligations under Te Tiriti o Waitangi in terms of Māori health and suggests areas for improvement.

As previously discussed in section 2.1.2.2, Māori in New Zealand have poorer health outcomes than people of European descent in New Zealand.\textsuperscript{55,56,65} Māori often experience “the heaviest burden of illness but the lightest landscape of medical care”.\textsuperscript{75} Several authors discuss the role of the health system, and hospitals within that, in contributing to these disparities.\textsuperscript{147-152}

Health disparities are seen as a failure of protecting health as a right enshrined in Te Tiriti o Waitangi. Treaty obligations have not been translated into improved health
outcomes for Māori in the New Zealand health system. The reduced availability of accessible high quality health care in hospital and primary care settings contributes to these disparities, as do socioeconomic factors, lifestyle choices and discrimination.\textsuperscript{152}

Hospital care contributes to ethnic disparities through differences in quality of health care Māori receive, with poorer treatment than best practice or clinical need would dictate.\textsuperscript{148} Māori experience hospital admissions proportionate to the general population, suggesting reasonable access, but have significantly higher rates of adverse events whilst in hospital, compared to non Māori /non Pacific patients, after adjusting socioeconomic factors and case-mix,\textsuperscript{147} but not adjusted for the complexity of patients’ health conditions.\textsuperscript{148}

Māori with bowel cancer have poorer access to care and poorer quality of care, accounting for about one third of the mortality difference seen. Māori access private hospitals less often, and have adjuvant chemotherapy less often. Smaller and rural hospitals are less likely to provide chemotherapy services, and Māori in the study were four times more likely to live rurally than non Māori.\textsuperscript{149} Jansen and Smith noted that in comparison to care that is highly protocolised, for example care relating to emergency transfer and treatment for injuries, less structured care can allow a lack of social or cultural concordance between the health care provider and patient to lead to less care being provided. They suggested this may account for some of the disparities in care provided to Māori patients usually by European health care providers.\textsuperscript{150}

Proposed solutions included accurate identification of self-reported ethnicity, monitoring health outcomes based on ethnicity, increasing cultural competency in the health workforce, and providing access to health services both by Māori for Māori, as well as ensuring mainstream services were responsive to the needs of Māori.\textsuperscript{151,152} Culturally appropriate communication skills training would help to improve service provision for Māori, in addition to addressing other barriers such as cost, and funding and policy settings.\textsuperscript{150} Finding the right balance required communication between Māori leaders and health providers based on \textit{Te Tiriti o Waitangi} partnership. An outcomes framework that took a Māori world view such as \textit{Te Whare Tapa Whā} model
was suggested as an alternative to the bio-medical focused model of the predominant Euro-centric view.\textsuperscript{151}

2.2.6 Measuring health care quality in hospital settings

This section explores the literature on the association between hospital size and patient outcomes and the concerns expressed in the literature regarding taking a 'one size fits all' approach to measuring quality in rural and urban hospital settings. Suggestions for rurally focused quality measures are outlined.

International evidence is mixed about the linkage between hospital size and patient outcomes. Some studies showed better outcomes with higher volume hospitals where the distinction between low and high volume was set at hospitals with about 50 beds, for surgical\textsuperscript{13} and non-surgical treatments,\textsuperscript{14-16} as well as high volume surgeons.\textsuperscript{13,153} Other studies showed the same or better outcomes for 'low volume' (usually rurally located) hospitals for surgical\textsuperscript{17-19} and non-surgical conditions,\textsuperscript{20} although the cut-off for low and high volume hospitals was at around 200 or 250 beds in these studies.

Mesman and colleagues\textsuperscript{154} sought to understand the connection between hospital size and patient outcomes. They noted the modest quality of the studies reviewed and argued that until it was fully understood what volume was a proxy for, caution should be taken in a greater move to centralisation of services into high volume hospitals.

Mungall supported this view\textsuperscript{6} and suggested that centralisation of services had gone further than necessary to maintain quality services. He proposed that “within finite resources, the product of access and quality is a constant”, and a balance between the two that was acceptable to local communities was required.\textsuperscript{6}

Scottish,\textsuperscript{7} American,\textsuperscript{28} Australian\textsuperscript{155,156} and NZ\textsuperscript{2} researchers and planners have expressed concern over applying national quality standards designed largely in urban settings to rural settings. Underlying assumptions including having ready availability of appropriately skilled workforce, patients and providers living close to hospital, and having social and community structures in place to support health services, including aged care and community support, were often not applicable to rural settings.\textsuperscript{156}
structure and processes of providing rural care could make it difficult to achieve urban-focused national standards for outcomes. Rural hospitals have generally lower patient volumes covering smaller ranges of procedures, often with more limited resources and a generalist health workforce, compared to urban hospitals. Economies of scale were often not able to be achieved in rural settings.

Rural clinical advice was needed when developing hospital quality standards to take rural contexts into account. The Australian College of Remote and Rural Medicine notes that the ‘access risk’ that loss of local service delivery poses to rural patients needs to be considered. These risks to rural patients include treatment delay due to travel time, loss of continuity across distance, loss of local capacity to treat the wider community (not just the service under consideration), and reduced access to distant services through prohibitive financial and time costs for patients. The risks to the community of losing the service in question need to be exceeded by other risks to justify service removal. In Moscovice’s view, rural health services made rural communities possible, and note that:

> If rural systems are held to the highest attainable standards, they might have to jettison services that underpin the existence of the health care system.

Quality measures are a mixture of structure, process and outcome measures, and can be indicators for judgement, or indicators for improvement. Suggested quality measures for rural hospitals include the traditional measures of such things as emergency care, medication management, infection and infection control, disease based measures (e.g., heart failure, pneumonia and acute myocardial infarction), procedural (surgical) measures and advance directive use, pressure ulcers, falls, length of stay and readmission rates. Rurally focused measures relating to processes and outcomes of the triage, stabilisation and timeliness of transfer processes for the rural hospital in the context of its wider hospital network have been proposed. Measures of connectedness of hospital services to rural communities’ culture have been suggested. Given the need for rural hospitals to work within a health service network
to be sustainable, rural hospitals should not be seen as contained units when assessing quality, but rather hospitals should be considered within their network context.\textsuperscript{28}

This section has explored health care quality both generally and with a rural focus, and as it applies to Māori health, looked at access and patient safety, and considered measuring health care quality in rural contexts. Improving health care quality for rural communities is the focus of the final section in this chapter.

### 2.3 Enablers to improving health care quality for rural communities

In this section the elements of health care planning and provision that improve the quality of health care provided to rural communities will be outlined, first in the international context then looking at NZ specifically.

#### 2.3.1 International findings

The international academic and grey literature that has explored enablers of improved health care quality for rural communities is summarised in this section.

Researchers and governmental frameworks from Australia\textsuperscript{9,26,155,156}, US\textsuperscript{27,28}, UK\textsuperscript{6}, NZ\textsuperscript{21} and international comparisons\textsuperscript{29} have identified ten common key areas to improve the quality of health care provided to rural communities. These are:

1. comprehensive primary health care with locally based extended generalist care;\textsuperscript{21,27,28,155}
2. focus on stable, well trained health workforces,\textsuperscript{28} increasing scopes of practice for providers,\textsuperscript{21,156} and skills development appropriate to the tasks required rather than the role title; \textsuperscript{6}
3. integrated local health services through collaborative local partnerships, teamwork and planning;\textsuperscript{9,26,28,29,155,156}
4. leadership, community governance, performance and transparency\textsuperscript{21,156} and community input into service design;\textsuperscript{28}
5. access to health care, including transport to distant specialist care in urban settings;\textsuperscript{6,9,21,29,155,156}

6. information technology to enable clinical care through telehealth capacity and electronic health records\textsuperscript{6,9,21,26,27,29,155,156} and to enable quality improvement through measurement;\textsuperscript{28}

7. regional networks, placing smaller rural hospitals within networks with larger services, with strengthened links through collaborative care between local generalists and distant specialists, with visiting outreach clinics and centralisation of specialist services;\textsuperscript{6,9,26-29,155,156}

8. rural academic networks\textsuperscript{26} and developing rural career pipelines;\textsuperscript{6,27}

9. flexible, efficient and sustainable funding and contracting including business models that supported innovative local arrangements\textsuperscript{9,21} with concerted national policies to maintain equitable access to quality health care for rural communities;\textsuperscript{27}

10. developing a rural set of standards for quality that recognise rural systems don’t provide the same spectrum or volume as urban systems, with measures that assess the impact of the health care system on the whole community’s health.\textsuperscript{28}

Farmer and colleagues\textsuperscript{161} advocated for a holistic approach to service redesign to include the economic and social effects of providing rural communities’ health services in different ways, as well as the health care impacts. This involved a wider societal discussion about the value and contribution of rural communities to society as a whole.\textsuperscript{161} Mungall argued that good quality accessible care for rural communities required disproportionately more funding than for urban communities, which should be recognised and planned for.\textsuperscript{6} McClellan and colleagues\textsuperscript{162} found that to successfully move away from funding services through individual contracting to accountable care models, in which sets of providers were jointly responsible for defined population outcomes with common budgets, broader changes were needed in addition to funding changes. These included system-wide change in how the contributing services worked together, shared information and developed multidisciplinary teams.\textsuperscript{162}

The Alma Ata Declaration over 40 years ago\textsuperscript{163} stated that “the people have the right and duty to participate individually and collectively in the planning and implementation
of their health care.” Taking communities to mean “those who have social ties and/or share common perspectives”\textsuperscript{164} the concept of community engagement spans from national policy level, through regional and local services down to individuals participating in health programs.\textsuperscript{164} Types of community engagement and participation include giving information, consulting and inviting feedback to influence policy and planning, partnership with shared decision making, delegation where control of designated aspects are handed over to communities, and control of the entirety of an issue.\textsuperscript{164} Farmer and colleagues\textsuperscript{165} noted that including communities in service co-design created services that meet local needs and harness the application of local resources. Factors identified that increase the success of community participation include local leadership, trust, good networks, a shared vision, using and recognising the value of communities’ resources, taking some risks and evaluating outcomes, and reflecting on lessons learned.\textsuperscript{164} Capacity building of both community leaders\textsuperscript{164,166} and health providers\textsuperscript{164,165} to working differently, and recognition of the time true partnerships takes to develop\textsuperscript{166} were important.

Wilkinson and colleagues suggested that multiskilled health professionals’ training and generalist approaches should be practiced across the urban-rural continuum, rather than just in rural health settings. Skills developed in rural health settings being transferrable to urban settings make a rural career more attractive for health professionals who might want to spend part, but not all, of their career in rural settings.\textsuperscript{26}

Telehealth services include telephone consultations, videoconference-based consultations, text message-based communication and wearable devices and mobile health apps.\textsuperscript{79} Videoconference-based or virtual consultations have been shown to improve the quality of care provided to rural communities in a variety of clinical and geographical contexts internationally.\textsuperscript{167-172} Six key success factors for implementing sustainable telehealth services in rural Australia included having a clear defined vision for the purpose of the service; clinician and management ownership of and support for the service; the ability to adapt the telehealth service to changing needs to be sustainable; a transparent value proposition for the service, whether that was saving patient or clinician time or money, with comparable clinical outcomes to in-person
services; efficient processes and procedures even though telehealth services do not need to be high volume to be effective; and equipment and infrastructure fit for purpose with technical support available.\textsuperscript{173} Appropriate workforce, including technical support, funding and infrastructure at rural centres is needed for successful telehealth services.\textsuperscript{174,175}

2.3.2 New Zealand findings

In this final section, NZ literature regarding enablers of improved rural health care quality are outlined. Much of the available literature offers descriptions of relevant services rather than vigorous evaluations.

The NHC identified factors to address when designing the delivery of appropriate accessible health services for rural NZ. These were distance and time for people to get to services, and for services to get to people; access to services including appropriate patient transfer systems; community participation in service development; Māori ways of working with \textit{whānau ora}\textsuperscript{1} approaches; partnership and collaboration within the rural community and networks with larger providers; and service sustainability, mindful of the changing nature of the rural environment, physically, demographically and culturally.\textsuperscript{21}

In 2010 the MOH’s National Health Board outlined how it viewed regional clinical networks would develop across NZ.\textsuperscript{77} Regionally and sub-regionally focused clinical networks delivering integrated care were described where tertiary centres supporting secondary and “community” hospitals. More care would be provided in community rather than inpatient settings. When redefining secondary hospitals in the future “lower intensity” hospitals as well as “typical provincial general hospital(s) providing core secondary services” were discussed. Some smaller hospitals were envisaged as operating more like large extended primary care services with visiting specialised clinical teams, more community-based diagnostics and fewer complex procedures.

Hospital clinicians in larger hospitals would likely be spending more time supporting colleagues in smaller hospitals, travelling to provide outpatient clinics and would use electronic communication more. Training the future workforce would be a key part of preparing for these changes. Future growth in specialist services was envisaged as being confined to large provincial centres.\(^7^7\)

Health care for rural communities provided through a network of primary care and rural hospital services well connected to the urban based specialist services has been described.\(^1\) Services provided locally with specialist input, with less travel for patients and similar costs,\(^3^0\) and similar outcomes\(^3^1\) have been described. Technological advances, such as point-of-care laboratory testing\(^3^2\) and telehealth\(^1\) enable patients to be treated appropriately at their local small town hospital. The importance of respect, communication, interprofessional team work and clinical and managerial leadership in successful networks has been highlighted.\(^1\) The development of rural hospital medicine as a vocational scope in NZ\(^3^3\) has enabled rural generalist medicine to become a core element of the health service network caring for rural communities, as in Canada, US, Australia \(^1^7^7\) and Scotland.\(^3\) Developing a ‘rural pipeline’ with undergraduate exposure to rural health and postgraduate opportunities to develop the competencies required to be a rural practitioner, including advanced skills training in areas such as general medicine, obstetrics, surgery, psychiatry, health care of the elderly and palliative care has been advocated,\(^1^7^7\) and NZ has an increasing number of these elements in place.\(^3^3,1^7^8,1^7^9\)

Lloyd and colleagues identified the elements of ideal emergency transfer processes from rural hospitals to larger urban hospitals. Elements include regional transport systems with guidelines agreed across the network, so patients are transferred to hospitals that provide definitive care; rural hospitals with capacity and capability to assess and stabilise patients before transfer; smooth transfer processes with clear referral processes and single senior doctor to senior doctor handover; appropriately skilled transporting personnel capable of managing potential patient deterioration en route; good communication between referring, transporting and receiving staff; and good communication with family.\(^3^4\)
Available publications on the use of telehealth in clinical contexts between hospitals in NZ indicate that while telehealth consultations are potentially an acceptable alternative to face to face interactions for clinicians and patients in the right context, implementation is varied and embedding it in to ‘business as usual’ needs focused attention.\textsuperscript{35,180}

2.4 Summary

This background chapter has outlined the various definitions of rurality used internationally and in the NZ health system. Connections between poorer health outcomes seen in people living in rural communities and socio-economic disadvantage and ethnic disparities was outlined. Constructs to help understand rural health were presented, as was a Pākehā NZer’s perspective of Māori views of health. Frameworks to describe different levels of hospital services provided within national and state health systems were outlined along with where rural hospitals sat within the NZ context. The importance of hospitals to rural communities was described.

Different quality frameworks over the last 50 years were presented, including NZ’s Triple Aim for quality improvement. The particular challenges of access for rural communities was outlined. Patient safety in the context of rural hospitals was discussed. The quality of health care that NZ Māori received was outlined, along with potential explanations and suggestions for improvement. The importance of measuring health care quality for rural communities in ways that took local context into account was outlined, and appropriate measures were suggested. Lastly, the enablers that had been identified internationally and described in NZ to improve health care quality for rural communities were presented.

This chapter has summarised the existing literature to allow me to build on the findings of this work as the thesis is developed. The methodological considerations applied in this thesis will be presented in the next chapter.
3 Research Methodology

As outlined in Chapter 1, the aim of this thesis was to explore health care quality in the hospital setting for rural communities, and how the quality of health care for rural communities could be improved, focused around hospital care. The previous chapter has outlined the background literature relevant to this thesis. In this chapter the methodology employed to undertake this research is described. My prior experiences which would influence my interpretation of the data are outlined, as are my reasons for applying a pragmatic approach and mixed methods methodology to this research. The key elements of the qualitative and quantitative components of this research are described before finally explaining the aspects of mixed methods research methodology employed in integrating these components.

3.1 The rationale for this research

In this section I outline my background and the underlying perspective and assumptions that I brought to this research. I am a Pākehā and I spent many years living and working in rural communities in the Eastern Bay of Plenty of New Zealand’s North Island (where I am from), and the South Island’s West Coast. When I was a young doctor, the specialties of rural hospital medicine and accident and medical practice (now termed urgent care) did not exist, and the only option for me to work as a generalist doctor in rural communities was general practice. I became a vocationally registered general practitioner (GP) and worked in rural New Zealand and rural Wales (UK). I also worked as a generalist doctor in the Emergency Department at Whakatane Hospital (Bay of Plenty) for several years just as accident and medical practice was becoming a speciality and several years before rural hospital medicine came in to existence.

In addition to my clinical work, I have held various roles in health services management and clinical leadership over the last 15 years. During five years as Chief Medical Officer for West Coast District Health Board I led the redesign of health services on the West Coast. This included developing the ‘Transalpine health service’, where specialist and generalist clinicians from Christchurch and the West Coast worked together to provide
hospital-level services for the West Coast communities. I visited other rural health services in Scotland and England, and observed how they were also grappling with providing sustainable rural health services for their communities.

I had formed the following views as a result of these experiences:

- A rural perspective on what contributes to good quality health care may be different from an urban view, as greater importance may be placed on the impact of health services on the wider community, as well as on the individual patients being treated.
- Members of rural communities may place different emphasis on what is important when they need hospital services compared to the views of rural health care providers. Their views might also differ from the views of people responsible at a strategic level for planning and overseeing rural health care services, based centrally within DHBs’ senior management structures.
- The overall quality of hospital care that rural communities receive probably does not differ greatly from their urban neighbours, but the balance between different aspects of quality (such as patient centredness and access) may differ. Quality issues may in particular arise related to the transfer of care between hospitals.
- The impacts on families when people need hospital care are likely be greater for rural people due to the more frequent need to travel to access services.
- Maximising health care quality and sustainability for rural New Zealand communities will likely require the right balance of local and regional health care provision across a network of health services, with the right balance of generalist and specialist workforce enabled by technology, to provide high quality patient-centred care.

3.2 Methodological considerations

The last section outlined my previous relevant experience and the rationale behind this research. This section discusses the various methodological approaches that are relevant to this thesis.
3.2.1 Theoretical perspectives

A range of methodological perspectives underpins researchers’ choices of research methods. Underlying beliefs about the nature of truth and reality and how knowledge is created influence how researchers conceive, design and interpret their data. These beliefs guide choices of research method such as interviewing and analysing the interview content, or collecting numerical data to analyse using statistical models. I outline the main paradigms underpinning quantitative and qualitative research below.

3.2.1.1 Research paradigms

A research paradigm is the set of beliefs, values, assumptions, practices and standards that underpin the research framework being used. Traditionally, each paradigm has its own ontology, or view of the nature of reality, including what ‘things’ exist and how these ‘things’ are related, and epistemology, or view of how knowledge is gained, what knowledge can be so gained, and how it can be justified. These underpin the theoretical perspective used, or approach taken to understand a topic. This in turn directs the researcher towards one or more methodologies they could use to explore the topic in question, which then points to possible methods, or techniques, that could be applied to answer the research question.

Quantitative research uses quantities as the basic unit of data and applies reproducible statistical techniques to identify and describe relationships within a sample of data that has been collected from a population, that can be generalised, to some extent, to this larger population. It is traditionally underpinned by a paradigm described broadly as ‘positivism’. Positivism takes the ontological position that there is an objective truth or reality that can be a posteriori known through sensory experience and appropriately applied research techniques. Underlying objective truth can never be fully known, but can be elucidated through careful observation and measurement, as ideas are reduced to a small set of theories to test. This happens through the careful objective collection of evidence, where bias is identified and controlled for as much as possible. Positivism emphasises theory-driven deduction, researcher objectivity and generalisability of findings. This is the basis of the ‘scientific method’. 
Qualitative research in contrast is concerned with the collection, analysis and interpretation of data that are not quantity based, but relate to the social world and people’s behaviours, and explore meaning through in-depth analysis to generate theories and concepts and sits within the paradigm broadly termed ‘constructivism’. Constructivism takes the ontological view that there is no single reality or truth, but that reality is constructed by people’s interpretation of the world. Knowledge is gained through the open-ended exploration of people’s experiences and contexts. There is no objective reality, and theories are developed from the ground up through understanding of people’s individual and communal contexts. Researchers are always viewing information through their own experiential lens and construct meaning through social interactions and social, cultural and historical context. Constructivism emphasises data-driven induction, the subjectivity of the researcher in the research, and the context-specific nature of the research findings.181-183

Traditionally, these two approaches to research have been seen as incompatible due to the underlying different ontological and epistemological standpoints underpinning quantitative and qualitative research. Guidance was lacking on if and when it was possible to combine methodological approaches and compare results from projects conceived in different paradigms.181,182 This dichotomy between qualitative and quantitative research has been challenged in recent years by proponents of ‘pragmatism’, who advocate for a greater focus on methodology as the connecting point between abstract epistemological considerations and the practical aspects of the methods employed rather than the ‘top-down’ ontologically driven application of paradigms.182

Pragmatism takes a ‘what works’ approach, where the problem being explored takes precedence over the theoretical paradigm being used. Elements from different theoretical frameworks and accompanying research methods can be drawn together. Research is acknowledged as happening within social and other contexts. Pragmatism focuses on ‘abductive’ reasoning, where existing theory is used as a basis from which to form new hypotheses informed by immersion in the study data.184 This process has elements of both inductive and deductive approaches, with an ‘intersubjective’ approach to the role of the researcher which acknowledges that in reality the
researcher is neither fully objective nor fully immersed within the research. A middle ground approach to inference from data is taken, by looking at the ‘transferability’ of findings from one context to another, rather than a blanket view that all findings are either generalizable or context-specific. Pragmatism is the theoretical position that most commonly underpins mixed methods research.

3.2.1.2 Mixed methods methodology

Mixed methods methodology has been increasingly adopted in health services research in the last quarter of a century. It is allows for more in-depth exploration of complex health issues than either quantitative or qualitative studies alone can address. Mixed methods research has been defined in terms of focusing on real-life and multi-level perspectives, using a mix of quantitative and qualitative methods and intentionally combining or integrating these approaches to make the most of the strengths of each, framed within a theoretical position. The quality of mixed methods research rests in the quality of the component studies and the manner of integrating or mixing the data.

Quantitative and qualitative studies have the same commitment to producing credible findings through attention to validity (how trustworthy are the findings?) and relevance (how applicable are the findings to the research area?). How validity and relevance are achieved will differ depending on the methods used, as shown in Table 3.1. Quantitative studies address validity through addressing confounders (variables associated with both the outcome and exposure that distort the relationship), bias (errors that systematically cause deviation in association between exposures and outcomes) and chance (the possibility that results are due chance, not a real association) in the results. Relevance is addressed through external validity or generalisability of results to the general population. Qualitative studies address validity through clear, transparent description of data collection and analysis processes; attention to contradictory data in analysis; fair dealing through incorporating a wide range of perspectives; and researcher reflexivity (being sensitive to how the researcher shaped the data collection and analysis). Analysis validation by the participants; and triangulation (where results are compared from different methods of data collection or different participant groups to corroborate findings) are also discussed as contributing
to validity, although they may also be seen as contributing to the comprehensiveness of the study design rather than its validity.\textsuperscript{188,190} Relevance in qualitative studies is addressed through considering the contribution the findings make to the topic area; and the transferability of the findings to other settings aided by detailed description of the subjects and settings of the study.\textsuperscript{188,190}

Table 3.1 Assessing the credibility of study findings, adapted from Murphy\textsuperscript{188}, Bailey\textsuperscript{189} and Mays\textsuperscript{190}

<table>
<thead>
<tr>
<th></th>
<th>Quantitative Studies</th>
<th>Qualitative Studies</th>
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<tbody>
<tr>
<td><strong>Validity</strong></td>
<td>Confounders</td>
<td>Description of data collection and analysis</td>
</tr>
<tr>
<td></td>
<td>Bias</td>
<td>Attention to contradictory data</td>
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<td></td>
<td>Chance</td>
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<td>Reflexivity</td>
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<td>Participant validation</td>
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<td><strong>Relevance</strong></td>
<td>Generalisability</td>
<td>Contribution to topic</td>
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<td>Transferability</td>
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Different ways of classifying mixed methods research purposes have been proposed.\textsuperscript{185} Classifications have been based on ‘why’ (the reasons for using the mixed methods approach)\textsuperscript{185} or ‘how’ (the priority given to the qualitative and quantitative data, either equal priority, or one being more important than the other), and sequence (sequential or concurrent) of data collection.\textsuperscript{191}

Taking the ‘why’ approach, the various purposes for using mixed methods research include confirmation (where different methods are used to confirm findings in a convergent way); complementarity (to explore different elements of the same research question); expansion (where different questions are addressed within the research) and development (where one or more methods within the research are used to develop others).\textsuperscript{186}

Morgan described the ‘Priority-Sequence’ model as a ‘how’ approach to classifying mixed methods research.\textsuperscript{192} A decision would be made about whether the quantitative
or qualitative method was the leading method, or that they were of equal weight, and a
decision about whether the qualitative or quantitative method went first or were they
done in parallel – the sequence.\textsuperscript{185} In Morgan’s view, although it was possible to give the
quantitative and qualitative arms of the research equal priority, in reality most
researchers placed greater emphasis on one or the other. Researchers tended to
sequence the lesser priority method to maximise its ability to complement the main
method. Morgan thought that giving equal priority to both methods could become
problematic if both methods produce discordant or contradictory findings, and one had
to decide how to integrate these equally weighted arms. Cresswell was more relaxed
about priority and sequence, noting that data could be collected consecutively or
sequentially regardless of the priority being given, and this would create different data
integration or mixing approaches.\textsuperscript{36}

Data mixing is the process of combining the separate arms of the research to integrate
into a whole to understand and interpret research findings. Approaches to data mixing
include merging, embedding or connecting.\textsuperscript{36} Where data are collected consecutively,
they can be analysed separately using methods appropriate to each technique, then
subsequently combined and further analysed. This technique has been described as
data merging,\textsuperscript{36} integration\textsuperscript{39} or triangulation.\textsuperscript{193} As some researchers use the term
integration to describe the act of mixing data,\textsuperscript{36} the term ‘data merging’ avoids
confusion. Data merging can confirm knowledge through triangulation of different
methods to strengthen the findings\textsuperscript{193} or can complement or expand knowledge through
considering how the findings from different arms of the research contribute to the
wider understanding of the topic.\textsuperscript{186} Deeper consideration of apparently discordant
findings can produce new insights or research questions about the phenomena under
investigation.\textsuperscript{39}

Sequential data collection allows a connecting approach to data mixing.\textsuperscript{36,39} This is also
termed an explanatory design.\textsuperscript{193} In this approach, either the quantitative or qualitative
data are collected and analysed first, which then informs the design of the second arm of
the research. For example, qualitative research (e.g., in-depth interviews) can inform
the design of a quantitative survey questionnaire, or findings from quantitative surveys
can be subsequently investigated in depth through qualitative methods (e.g., focus groups).

Both consecutive and sequential data collection can use *embedding* as a data mixing technique, when one arm of data collection is nested within the other.\(^{39}\) The smaller study sits within a larger piece of research, such as an in-depth interview sub-study within a larger experimental study. The data for the lower priority study arm could be collected before and after, or during, the main study.\(^ {36}\) This allows the nested study to complement or expand on the findings of the main study.

### 3.3 Methodological perspectives as applied in my research

The previous section outlined methodological considerations relevant to this thesis. This section outlines why a pragmatic approach using mixed methods methodology was chosen for this research. O’Cathain and colleagues’ ‘Good Reporting of A Mixed Methods Study’ (GRAMMS) guidelines\(^ {191}\) provides guidance for assessing the rigour of published mixed methods research. Attention to justifying the use of the mixed methods approach, describing the purpose, priority and sequence of methods used in the study design, describing each method used in the component studies, describing where and how data integration occurred, and describing the limitation and insights gained from the mixing process allows other researchers to assess the quality of the research. The GRAMMS framework is followed here to describe aspects of this thesis’s research methodology.

#### 3.3.1 Choosing pragmatism

Pragmatism, with its elements from various theoretical frameworks, fits well with my generalist approach to clinical work as a general practitioner. My training as a doctor is rooted in the scientific method. My experience talking with people in the clinical context of the doctor-patient consultation to help them make sense of their world and experiences has similarities with the constructivist approach that underlies interview-based research. The essence of being a generalist is taking a “what works” approach, and it made sense to me that this research should be underpinned by pragmatism.\(^ {36}\)
3.3.2 Justification for using the mixed methods approach

This research was initially funded through a Health Research Council of NZ (HRC) funded Foxley Fellowship, which encourages applicants to propose research projects linked to an existing HRC funded project. Through the HRC funded ‘Safety, Harms and Risk Reduction Project’ (SHARP) study I had access to a data set focused on patient harm in New Zealand general practice records. I wanted to analyse these data in more detail to investigate potential differences in hospital-related patient harm experienced by people living in rural and urban settings. Patient harm is another way of viewing patient safety. But providing safe care is only one aspect of providing high quality health care, as noted in §2.2.1, page 28. I wanted to use qualitative research methods (semi-structured interviews and focus groups) to explore and understand the views of people who lived and worked in rural communities regarding health care quality in relation to hospital care. These two study arms were well suited to using a mixed methods approach. I thought that exploring the topic by combining information about hospital related patient safety for rural and urban patients, with interview based data about aspects of health care quality would contribute to a greater understanding of this complex phenomenon than either approach alone.

I recognised that my background as a GP and rural health service clinical leader would influence how I gathered and interpreted the study data. The validity and relevance of the study’s findings would be supported by careful attention to transparent, consistent study design during data collection and analysis processes of the quantitative and qualitative data, and in the mixing process.

3.3.3 Purpose, priority and sequence of methods

The purpose for using the mixed method approach was to complement and enhance understanding of different aspects of the research question. My priority was towards the qualitative aspects of the research, where all elements of quality were being explored. This would be supported by the quantitative data which directly compared patient safety outcomes for people who lived in rural and urban settings.
Data collection was done concurrently. The time frames of the Foxley Fellowship research grant and when the quantitative data from the SHARP Study would become available for secondary analysis dictated this approach. A sequential approach with quantitative data collection initially could have allowed any specific patient safety concerns uncovered to be explored in the interview arm of the research. Taking into account that patient harm is only one aspect of quality, that my questions covered patient safety generally, and the timeframes to complete the study, I made a pragmatic decision to undertake the two arms of the study concurrently, then subsequently mix the results. This approach is outlined in Figure 3.1.

3.3.4 The component studies

The main research question asked in this thesis was how could hospital care quality for NZ rural communities be improved? Answering this involved looking at component questions:
1. What did good quality hospital-level care mean for rural communities and health care providers serving rural communities?
2. When considering patient safety, an aspect of health care quality, were there differences in hospital harm experienced by patients who lived in a rural, compared to urban setting, when they required hospital admission, whether that be in a local or distant hospital?
3. How did the pattern of hospital harm seen for rural compared to urban patients compare with, and potentially explain, the perceptions regarding hospital care quality for rural communities?
4. How could the quality of health care that rural communities experienced be improved?

This section outlines the component studies of the research that address each of these four sub-questions and methodological considerations within each study as outlined in Table 3.1 on page 53.

3.3.4.1 Study 1. The Interview Study
The Interview Study aimed to address component questions 1, 3 and 4 above. A qualitative investigation of views of people who lived and worked rurally, together with views of the senior leadership of the health systems that the rural areas were based in, was undertaken to explore health care quality for rural people receiving hospital care. Aspects of validity and relevance of the Interview Study design are considered below.

3.3.4.1.1 Data collection and analysis processes to increase validity
This research project was initiated as an HRC-funded career development award. It was by design conducted as a piece of individual research with support from my supervisors (initially Professor Susan Dovey (SD) and Professor Robin Gauld (RG) and, after 1 year, Professor Tim Stokes (TS) replacing SD as main supervisor, and after 2 years, Dr Andrew Gray (AG) joining to add statistical oversight) and occasional input from my rural research advisors, Dr Garry Nixon (GN) and Dr Kyle Eggleton (KE). As a consequence of the design, the majority of interview and focus group data was single-coded (by myself), with a sample of coded interviews reviewed by my supervisors (SD,
RG and later TS) to validate the codes chosen and the developing coding framework. My supervisors were involved in ongoing discussion of ideas expressed in my analytic memos (SD, RG, TS) and as the categories and themes of the research were developed (RG, TS). The rural research advisors commented on the overall summary of findings.

In keeping with the pragmatic paradigm underpinning my overall research, I undertook thematic analysis of the interviews and focus group data, where the concepts were coded and developed into themes to describe and understand the commonalities and differences in views expressed. As described by Gale et al, thematic analysis

...identifies commonalities and differences in qualitative data, before focusing on relationships between different parts of the data, thereby seeking to draw descriptive and/or explanatory conclusions clustered around themes.\(^{197}\)

This approach was chosen as it fitted with the methodological perspective and research aims, and as a first piece of in-depth research it was an accessible approach to embark upon.\(^{37}\)

Braun and Clarke outlined some explicit decisions to be made when undertaking thematic analysis. These included whether the data description is broad and rich, or narrow and detailed; whether one looks for explicit ‘semantic’ or deeper ‘latent’ themes; and the approach taken when analysing themes (e.g. a deductive or inductive approach).\(^{37}\) Rich descriptions of the data across themes of quality and how to improve quality for people living in rural communities were sought. Some topics canvassed during interviews were not analysed, e.g. relating to learning and teaching, due to the large volume of data gathered, knowing these data could be returned to later. Themes were analysed at the semantic level, which was appropriate for pragmatic health services research. An abductive approach was taken to understanding the data was taken.\(^{182}\) This involved using existing models of health care quality and approaches to improving quality described in the literature as a lens to view the interview data through initially. As concepts emerging from the research data challenged these ideas,
developing themes were modified to accommodate new insights. A wide range of views were represented from the more than 100 participants. Participants’ views that challenged the existing models were consciously sought. Going backwards and forwards between existing models and research data, comparing and developing ideas with discussion and challenge from my supervisors refined the themes.\(^\text{184}\)

Feedback from study participants was obtained at two points in the analysis. A summary of initial findings was sent to all participants requesting feedback (see Appendix 6). All participants were also invited to presentations of the research findings in each of the four study sites, where further feedback was received.

3.3.4.1.2 Reflexivity

‘Reflexivity’ is the process of reflecting on how my subjective views and experiences influenced the gathering and interpreting of research data.\(^\text{181}\) My role as a GP and health services clinical leader and experience of living and working in rural communities for many years would influence how people responded during interviews, as well as the lens through which I interpreted the data. These experiences gave me a degree of ‘insider’ status in all the interviews conducted,\(^\text{198}\) and more so with those participants I knew, particularly those who I interviewed on the West Coast where I had lived for many years, some of whom were friends. As Dwyer and Buckle note, qualitative researchers will be closer to being insiders or outsiders, depending on the individual context, but can never be truly one or the other.\(^\text{198}\) The researcher role, including the background knowledge of literature on the topic being canvassed, stops one being an insider (in my case, I was no longer living and working in a rural community and was clearly in a research role). Most often there are some points of commonality in lived experience with the participants (in my case, having lived in rural areas) so the complete outsider role is not available. Being reflective of the degree of insider status in different interviews and focus groups, and aware of my own preconceptions and biases, would “reduce the potential concerns associated with insider membership”.\(^\text{198}\) Whether participants were known to me or not, I thought that those in clinical and management roles would feel a degree of affinity with me which would make it easier to have detailed and frank conversations. Community members as participants may feel reticent to express their views due to a perceived power differential as I was a doctor,
conversely may feel that by disclosing their experiences I might be able to influence the outcomes or give them advice. I was careful to not give advice, and to try and put participants at ease at the outset of interviews, drawing on my experience of doing this in clinical situations.

My previous life experience of living and working in rural communities would influence my interpretation of what I found; from a positivist perspective it could be viewed as introducing bias to my ability to uncover the objective truth, and to the enrichment of my ability to interpret the findings from a constructivist view. I actively sought out different views to my own when analysing the data and discussed discordant findings with my supervisors.

3.3.4.1.3  Transferability

A purposive sampling frame was used to identify the four rural areas visited, and the people to interview at each site. Individual semi-structured interviews with health care providers, and focus groups with general community and Māori community members were used to explore the research questions, rather than a more structured positivist approach of questionnaire surveys, as I wanted to understand people’s views more deeply than a survey would allow. A purist constructivist view would be that the research findings were only applicable to the four rural health systems visited. I anticipated that by describing the context and process through which the data were gathered and analysed, being reflective on my involvement as researcher and commenting on transferability of the results, readers would be provided with the information needed to make their own assessment of the study findings’ transferability.

3.3.4.2  Study 2. The Hospital Harms Study

The Hospital Harms Study aimed to address research component questions 2 and 3 above in §3.3.4, through investigating evidence of differences in patient harms when people living in rural and urban settings received inpatient hospital services through secondary analysis of an existing quantitative data set. This section outlines the methodological considerations of the approach used.
3.3.4.2.1 Study design

One of my original supervisors (SD) led the HRC funded ‘Safety, Harms and Risk Reduction Project’ (SHARP) study. The SHARP study aimed to address unanswered questions about the influence of location on patient safety, one of the IOM’s six aspects of health care quality. The SHARP study tested the hypothesis that there was no difference between patients registered at rural and urban general practices in the frequency, type, preventability and severity of patient harms detectable from general practice records. This retrospective patient record review study for the complete calendar years 2011, 2012, and 2013, identified patient harms as viewed through the lens of the electronic patient record for 9076 people from randomly selected general practices. Equal numbers of people attending rural and urban general practices were sampled. Clinical record data were downloaded electronically from participating general practices. The GP researchers reviewed each record to establish whether patients experienced harm from their healthcare, defined as “physical or emotional negative consequences to patients directly arising from health care, beyond the usual consequences of care and not attributable to the patient’s health condition (including delays in treatment associated with failure to resolve patient experiences of poor health, inconvenience and additional financial costs to patients).” Errors that were not associated with harm were excluded, and harms as a result of routine, correct care were included in the analysis. The study protocol and Appendix 16 contain more detail.

General practice clinical records provide a window into hospital care as they include summaries of hospital encounters (although they may contain missing, spurious, incorrect or incomplete information). The Hospital Harms Study involved secondary analysis of the SHARP Study data in order to identify hospital admissions within the patient record, and harms experienced as a result of these hospital admissions. This allowed investigation of any association between rural or urban residence on the nature of harms people experienced as a result of hospital admissions (hospital harms), as an indicator of patient safety. The overall proportion of harms arising from hospital admission for people living in rural and urban communities were calculated and compared, and potential differences in the pattern of patient harms for the two sub-groups were explored.
Aspects of validity and relevance of the Hospital Harms Study design are now considered. The robustness of the Hospital Harms Study is underpinned by the validity and relevance of the original research and the techniques used in the secondary analysis.

3.3.4.2.2 Chance

As sample size increases, the role of chance in false negative findings decreases and statistical power increases. One becomes more confident in the findings from statistical analysis as standard errors become smaller, and so confidence intervals become narrower, indicating the greater precision of the estimates. The statistical power available for my hospital harm analysis was dependent on the number of hospital admissions identified in the general practice patient records, the frequency of patient harm detected by the original research team and the similarities between patients within the same practices. Published data on the rates of hospital discharges indicated there were 225.4 publicly funded hospital discharges per 1000 New Zealanders in 2012/3.\footnote{201} Information on the number of people who experience hospital admissions is not readily available. Using data from a general practice population of 3611 people in the early 1990s, 13.3\% of patients had a hospital inpatient event in the study year.\footnote{202} Noting that some people would be admitted more than once during the three year study period, and that admission rates in a single city practice 20 years prior may not reflect contemporary patterns, it would be reasonable to expect that at least 1000 people would have had a hospital admission in the SHARP study group. Harms were identified in about 16\% of patients in the SHARP Study (personal communication, Professor Dovey). Assuming that the likelihood of hospital harms would be similar to harms overall experienced in the study group, I expected that there would be at least 150 people with hospital harms for analysis. Information on the similarity of patients within practices (an intraclass correlation coefficient, which would affect the design effect, the statistical penalty for cluster-based sampling rather than individual patient-based sampling) was not available.

3.3.4.2.3 Biases and confounding

The SHARP study was designed to randomly select an average of 150 patient records from participating practices. Patients in small general practices (average of 1739
patients per practice) had a greater chance of being selected than patients in large practices (average of 12813 patients per practice) and this was accommodated by the use of weights in the analyses. Differences in age, socioeconomic and ethnic structures may be present in rural communities compared with urban communities and if these were also associated with the outcomes, these would be confounders of the associations of interest between rural and urban patients and hospital harm. These variables would need to be controlled for in the analysis if possible.

A limitation of secondary analysis is that key variables may be missing in the original data. The SHARP study reviewers did not identify whether hospital admissions were detected in their in-depth review of patient records. This was suggested part way through their data gathering but was considered overly burdensome on the reviewers. My method of screening patient records to identify hospital admissions was about 88% accurate (as outlined further in Chapter 9, §9.3.3, page 179). If the ways hospitals provided information on hospital admissions to the general practice patient record differed for different hospitals, this could introduce identification bias. Different hospital information technology systems are used across public and private hospitals, and by different public hospitals in different regions. This could lead to a systematic under-identification of hospital admissions in certain parts of the country compared to others if, for example, discharge summaries of hospital admissions to a large city hospital were presented in a format that was difficult to recognise. Whether this would confound the associations of interest would depend on whether both rural and urban general practices in that region had been randomly selected to participate. If data on variables that could be potential confounders were not collected in the SHARP study, these could not be adjusted for in the secondary analysis.

3.3.4.2.4 Generalisability

The external validity of the study depends on how well the results apply to other contexts. These contexts most obviously include all patients attending rural or urban general practices in NZ, but also across time (will the results apply to future patients?) and place (can the results be applied to other countries?).
In secondary analysis, the researchers have no control over the quality of the original data.\textsuperscript{185} This analysis used the harms identified and categorisations applied by the original SHARP researchers. Assessing patient harm through records review is an inexact science.\textsuperscript{203} When multiple reviewers are collecting data, the question of agreement or consistency between the different reviewers is raised. Inter-rater reliability measures “the extent of agreement among data collectors”.\textsuperscript{204} The kappa statistic is a commonly used index to assess the degree of agreement between two raters taking into account agreement as a result of chance.\textsuperscript{205} The inter-rater reliability in the original study was important in the robustness of the data presented.

Because admissions and harms were not rare (i.e. not<10%) Poisson regression was used to estimate risk ratios for the presence or absence of any admission and any hospital harm, as approximating risk ratios through odds ratios using logistic regression would have overestimated the relative risk of hospital harm.\textsuperscript{206}

Secondary analysis of data collected for one purpose raises ethical issues when using data for purposes for which it was not originally collected. The consent process for the original SHARP Study related to using the data to explore harm arising as a result of health care. My secondary analysis of the data explored harm arising from a particular health care setting, so was included within the consent given for the overall study. My research also received ethics approval in its own right (Human Ethics Committee, University of Otago, reference number 16/084, see Appendix 7).

3.3.5 Integrating the data, limitations and insights

The data regarding urban-rural differences in patient harms arising from hospital admissions were merged with the thematic analysis of the semi structured interviews and focus groups after initial analysis of both data sets. The topics and themes that were in common between the two data sets of the study were tabulated as part of the mixing process to aid their identification and consideration of how they related to each other, as suggested by Cresswell et al.\textsuperscript{36}
The concurrent rather than sequential design meant that findings from the Hospital Harms Study were not able to be specifically explored through the Interview Study. This limited the study’s potential to be explanatory. Consequently, the Interview Study did not seek to directly confirm the patient safety findings of the Hospital Harms Study, but rather to explain how different aspects of health care quality for rural people may contribute to safety, as one aspect of quality. This approach allowed me to examine discrepancies in the data gathered from both sources, to help understand the topic more deeply, reduce the risk of spurious findings and suggest future areas of research.39

3.4 Summary

In this chapter I have outlined the rationale for this research, aimed at exploring how hospital care quality for New Zealand rural communities could be maintained and improved. The choice and application of a pragmatic paradigm using mixed methods methodology was explained. The methodological considerations associated with the Interview Study and the Hospital Harms Study, which together addressed the four sub-questions of the research were discussed. Finally, considerations relating to the mixing of the two datasets were outlined.

The following five chapters relate to the Interview Study. In this next chapter the particular methods used in undertaking the Interview Study are outlined.
4 Interview Study Methods

4.1 Introduction

The previous chapter covered methodological considerations relating to the overall mixed methods study undertaken for this thesis. This chapter focuses on the methods used in the Interview Study. It first covers how the sample of people to interview was selected, then describes how the interviewing schedule was designed, followed by the processes of interview and focus group data collection. Finally, it outlines how the data were thematically analysed.

4.2 Defining the study sample

This section outlines how the study participants were identified. As outlined in the previous chapter semi-structured interviews and focus groups were chosen to investigate what was important in health care quality for rural people receiving hospital care, and how to improve quality of health care delivered and received. I planned to interview participants who lived and worked rurally, and senior District Health Board (DHB) leaders of the health system that the rural area was based in. A purposive sampling frame was used to identify participants to interview in similar roles across four study sites to allow for comparisons of views. Robinson described purposive sampling as

“non-random ways of ensuring that particular categories of cases within a sampling universe are represented in the final sample.”

He noted that the rationale was that the researcher had a degree of understanding of the topic being investigated, and that certain people would bring important or different perspectives that meant they should be included. This involved first selecting a sample of sites to visit, and then selecting a sample of participants to interview at each site.

4.2.1 Selecting sites

Here the process of selecting sites to visit is described. Robinson suggested describing the ‘sampling universe’ in purposive sampling to make clear the complete population to
whom the research findings could be transferable.\textsuperscript{207} The sampling universe for my research was all rural communities in NZ with access to rural hospitals. I defined ‘rural’ to mean small town provincial NZ with populations of 10,000 or less and the surrounding rural areas. Rural hospitals were defined as hospitals approved by the Division of Rural Hospital Medicine.\textsuperscript{82} Rurality in the North Island was characterised by more socioeconomically deprived populations over less geographically dispersed areas, whereas rurality in the South Island involved fewer socioeconomic challenges but greater isolation. I aimed to study rural communities that contrasted geographically, with differing ethnic and socioeconomic population demographics, rural hospital size and ownership structures.

Rural areas with high Māori populations include Northland and the eastern region of the upper North Island, from the eastern Bay of Plenty through to northern Hawkes Bay. These areas also have high levels of socioeconomic deprivation. In the South Island, the West Coast is notable for its lower socioeconomic status than much of New Zealand, despite its lower Māori population. West Coast rural hospitals are DHB owned. In contrast to the West Coast, the Central Otago/Lakes area has one of the wealthier populations in New Zealand. Dunstan Hospital in Clyde is owned by a community trust, whereas Queenstown Lakes Hospital is DHB owned.

In consultation with two of my supervisors, (SD, RG), I decided that four communities with a range of these characteristics would provide sufficient diversity of views, while being manageable within the timeframe of the research. This has been termed the ‘representativeness versus saturation trade-off’, taking available resources into consideration, as described by Teddlie and Yu.\textsuperscript{208} My supervisors (SD, RG) and I agreed the regions within NZ that the study sites would come from were Northland, Hawkes Bay, the West Coast and Central Otago/Lakes area.

Taking a pragmatic approach, I approached people I knew in these regions to assist in gaining agreement from key local health leaders that their local health system would participate in the study. Health professionals from Wairoa community with a DHB owned hospital in northern Hawkes Bay agreed to be a study site.
To increase the diversity of hospital ownership in my study sites I included the area around the trust-owned hospital in Central Otago as the study site. One of my rural research advisors (GN) in Central Otago agreed to act as the key contact person in the study site of the area around Alexandra, Clyde and Wanaka.

I had initially hoped to include Rawene and its trust-owned hospital as the Northland study site, but due to the many study projects going on in their community they declined. Dargaville and Kaitaia with DHB owned hospitals were suggested by my other rural research advisor (KE) as suitable alternative sites. In discussion with my supervisors and KE I included Kaitaia as the Northland site, as it was a similar size to Dunstan hospital but with a different population demographic (see Appendix 8). A key contact in Kaitaia was suggested by KE, and they agreed to being involved.

Colleagues from the West Coast agreed to be involved. The options for choosing the study site in the West Coast included Westport with its 12 bed rural hospital and Greymouth with its 80 bed hospital and a mixed generalist – specialist medical workforce (see Appendix 8). Greymouth was both a designated rural hospital and a ‘base’ hospital, with some, but not a full complement, of specialty services available 24/7. This was the first hospital in NZ to actively plan to have a mixed generalist (through rural hospital medicine doctors) and specialist medical workforce on site and I had been involved in establishing this service delivery model. Both sites offered different aspects to contribute to the study. After discussion with my supervisors, we decided to consider the West Coast as a whole. Greymouth would be the main focus but Buller hospital was also included as a counterpoint to Wairoa hospital. My supervisors (SD, RG) always saw ‘The West Coast’ as one study site, whereas in my mind it was two distinct areas, reflecting our levels of familiarity with the locale.

4.2.2 Selecting interview participants

This section describes how study participants were selected. I wanted to explore the range of perspectives held by rural health providers and community members regarding hospital care quality. Based on my understanding of how rural health systems work, I aimed to interview health service managers and lead clinicians at the central
DHB site with overall responsibility for health care provision in the rural area, and at the ‘coal face’ of the rural community. I also wanted the perspective of the local community, including local Māori perspectives. The purposive sampling frame is shown in Table 4.1. I anticipated that by interviewing the people outlined in Table 4.1 over the four study sites I would reach data saturation.

Table 4.1 Outline of purposive sampling frame for interview and focus group selection

<table>
<thead>
<tr>
<th>Interviews/focus groups</th>
<th>Central DHB view</th>
<th>Rural provider view</th>
<th>Rural community view</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Leader interviews</td>
<td>Executive clinical lead (Chief Medical Officer or Director of Nursing)</td>
<td>Medical lead in rural hospital</td>
<td>Community focus group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nursing lead in rural hospital</td>
<td>Māori hui focus group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General Practitioner</td>
<td></td>
</tr>
<tr>
<td>Manager interviews</td>
<td>Senior Manager of Planning and Funding</td>
<td>General Manager, rural hospital</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Te Kaihautu (general manager), Māori health provider</td>
<td></td>
</tr>
<tr>
<td>Focus groups</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In each site, I identified a person to be a key contact who was either someone I knew personally (for three sites) or who had been recommended to me by a colleague (in one site). The key contact at each site assisted in identifying appropriate people to invite to be interviewed based on the roles outlined in Table 4.1. I contacted the people identified by e-mail or phone to invite them to participate in the research. At each site there was an element of snowball sampling (where research participants recruit or propose other participants for the study) as the local contact person or another person I had interviewed had identified one or two other people who would be worthwhile
interviewing, in addition to the seven interviews initially planned. Everyone suggested
to me by the key contact agreed to be interviewed.

Two focus group meetings in each rural community were also planned: a general
community focused group and a Māori focused group. Key contact people identified the
appropriate people in the local communities to approach to assist in inviting people to
participate in the focus groups. I aimed for 6 to 10 people in each group to allow ideas to
be discussed within the group and for each person to have the opportunity to contribute.²¹⁰

4.3 Developing the interview schedule

The previous section described how the study participants were selected. This section
outlines the rationale for the interview format used and how the topic guide was
developed.

4.3.1 Semi-structured interviews and focus groups

Individual semi-structured interviews were undertaken as outlined in Table 4.1 to make
it more convenient for participants to select a time in their work day that suited to be
interviewed. Their perspectives may differ from their colleagues and individual
interviews would allow them to freely express their views. An interview is “a
conversation with a purpose”.²¹¹ The semi-structured interview format of several key
questions to guide the interview, but with the ability to digress as the interview
progressed, allowed for the discovery of views that were important to the participants
that I may not have considered important in advance. The flexibility of this approach
also permitted incorporation of new relevant questions into further interviews.²¹⁰

The focus group format was chosen to understand the collective ‘community’ views of
people living in rural communities rather than just the views of the individuals. The
interplay and discussion that would happen as part of the focus group process would
enable this.²¹⁰ As with the individual interview process, I could adapt the interview
schedule as the focus groups progressed.
4.3.2 Developing the topic guide

The process of developing and testing the topic guide to use during interviews and focus groups is outlined here. The topic guide used the research questions included in the ethics approval application as a basis, informed and modified by the literature review of aspects of rurality, health care quality and enablers of improved health care quality undertaken, as outlined in Chapter 2. For health providers, it would focus on participants’ views of what quality meant in providing care to their rural communities, how best to measure it, and how it might differ from care provided to urban communities. This would include exploring the role of networks between rural and urban providers in providing services to rural communities, and barriers and enablers to effective network provision. It would also discuss the role of information technology could play in improving quality.

For the focus groups, I aimed to understand their different perspectives on the quality of hospital care they received as rural dwellers. This included exploring the impact of travelling for hospital services, and what types of hospital services were more important to have access to as close to home as possible, and what types of hospital services were considered reasonable to have to travel for. I wanted to explore the role of new technologies in improving quality, and what supported and hindered their application.

The initial draft interview schedule was based around six areas, being

- rurality and health;
- hospital care;
- quality;
- quality measurement;
- health networks;
- enablers – what will make things better?

After discussion with my supervisors (SD, RG), my rural research advisors (GN, KE) and the Māori consultation liaison at the University about the interview schedule, I
pretested the semi-structured interview with a colleague and the focus group schedule with a group of colleagues in the university department in which I was based. After this process, the final interview schedules were framed around the topics of:

- rurality and health;
- quality and hospital care;
- enablers – what will make things better?

The initial draft version schedule and the final versions of the interview schedules after pre-testing are included in Appendix 9. I anticipated that each interview would take an hour. For the focus groups I was aiming for about 8 to 10 people in each group, and intended each meeting to take about 2 hours, including time for refreshments.

### 4.4 Conducting the interviews

The previous section described how the interview format and topic guide were developed. This section describes the interview processes at the four sites.

#### 4.4.1 Site visits

I sent the information sheet and consent form to each individual participant and to the person assisting in organising the focus groups in advance when confirming appointment times. I spent a week in each rural region. Most individual interviews took place at people’s place of work or at a venue of their choice if meeting at their place of work was not convenient to them. Alternative sites included their home (two people), a motel (one person), a café (four people) and my office (one person). One interview was undertaken by videoconference. The focus groups were held in a venue that the person organising the focus group had suggested. These included a meeting room within the hospital (four focus groups), at the local Primary Health Organisation (one focus group) and a community organisation meeting room (three focus groups).

When I met with participants, I outlined my background and the purpose of the research and provided the opportunity to ask questions. At one of the focus groups, a
person left after the introduction, as they thought the meeting was for a different purpose (the meeting they intended to attend was the following day) and they were busy that week preparing to travel overseas. All other participants agreed to be interviewed. After they had read the information sheet, agreed to have the interview recorded and signed the consent form, I started recording the interview or focus group with a small digital recorder.

I approached the interviews with an open mind to see what emerged as the interview process progressed. Interview schedules were reasonably consistent throughout the interviews and focus groups although the focus of some questions evolved as the process progressed. An example of this was to change the focus of the questions for Planning and Funding managers towards service planning rather than provision, as that was their area of knowledge and expertise.

At the completion of the interview or focus group, participants were given a *koha* (gift or present) as a recognition of the contribution of time that they had given. The *koha* for individual interviews included *pounamu* (NZ jade) and table coasters, and for participants in focus groups, *pounamu* or supermarket or petrol vouchers, depending on the situation and advice given by the person organising each focus group.

Immediately after each interview I captured my thoughts and reflections of the interview in my research diary to encourage my reflexivity as a researcher. I also wrote my observations and thoughts at the end of each site visit in my research diary. The recorded interviews were downloaded to a drop-box for transcription as soon as an internet connection was available.

### 4.4.2 Comments on the site visit process

Here I outline the deviations from my planned approach and noteworthy observations made during the interview process.

My original plan to hold 7 interviews at each site was modified at all sites. This was due in part to people’s work roles and by local suggestions of people who should be
interviewed for their particular perspective. For example, one DHB had both a primary care and a hospital Chief Medical Officer and they met me together as a joint interview. In smaller sites, the GPs were also the medical staff at the hospital. One Māori health provider provided general practice services and I spoke to their clinical lead GP, whereas the other Māori health providers provided community based health services and I interviewed their *te Kaihautu* (general manager), two of whom had a nursing background and one who was non-clinical. At one site an individual interview with a community person was arranged by the person organising the focus groups. Other suggested people interviewed included roles of quality coordinator, hospital manager, GP and dual trained GP-Rural Hospital Medicine (RHM) doctor.

All four Māori focus groups started with a *karakia* (prayer in *te Reo Māori*, the Māori language) and also a *karakia* before the *kai* (food) was eaten. In one of the Māori focus groups, the meeting started with a formal introduction in *te Reo Māori* during which I gave my *pepeha* (introduction in *te Reo Māori*). The conversation was steered towards matters relating to *Te Ao Māori* (the Māori world and world view) by the local organiser and some of the conversation was in *te Reo Māori*. In contrast, at the other Māori focus groups introductions were in English and thus when it was my turn to introduce myself, I did so in English. The ensuing conversations were all in English apart from occasional *te Reo Māori* words, and the content of the conversations were less immersed in the *Te Ao Māori* world view.

As I had worked on the West Coast prior to undertaking this research, all but one of the interview participants were known to me, and I knew about one third of the focus group participants. In contrast, one quarter of the people individually interviewed at Wairoa were known to me in advance, and none of the focus group members; one of the participants in Kaitaia and no participants in Central Otago were known in advance. This greater insider status could have influenced the interview and focus group conversations that occurred on the West Coast, as discussed in Chapter 3, §3.3.4.1.2, page 60. The familiarity with the setting and the participants could have allowed a more frank conversation to unfold, but also could have inhibited the freedom with which people felt they could talk about negative aspects of local health services, as I had been involved in shaping the services. I could also have made assumptions about what
participants were meaning due to my prior experiences in their locale. I chose to visit the West Coast last and I did not get a different view of hospital quality and how to improve services from the West Coast interviews compared to the other three sites. This also confirmed that I had reached data saturation by the end of the four site visits.

It seemed easy to establish rapport with participants across all sites in the individual interviews and focus groups. Although the interviews and focus groups were focused around hospital care, many participants contributed views on the wider local health system, including primary care and community services. Focus group participants in the main did not approach me as a clinician who might give advice, but some of the individual interviewees sought my advice on their current service delivery challenges, which I tried to discourage and deferred discussing until after the interview had finished.

4.5 Analysing and interpreting the study findings

The previous section described the process of data gathering. This section describes how thematic analysis\textsuperscript{37,196} of the interview data was undertaken. An abductive approach was taken to understand the data.\textsuperscript{182,184} Abduction uses an existing model or lens through which the interview data is initially approached. As concepts described within the research data challenge the initial ideas framework used, or new ideas are represented, the thematic framework is expanded and may be reformed to accommodate new insights. This backwards-and-forwards thinking between theory or framework and data, with discussion and challenge from supervisors, refines the themes.\textsuperscript{182,184}

The abductive approach to analysing the data is shown visually in Figure 4.1 and described in more detail below.
4.5.1 Interview Coding

This section describes the approach to initial coding of the interview and focus group data. Data analysis started on completion of the first site visit and continued throughout data gathering from site visits.

The recorded interviews were transcribed using a professional transcription service. Interviews were transcribed using an ‘Intelligent Verbatim’ setting, which excluded all fillers (including ums and ahs), false starts, laughter, crying, etc, to allow for a more fluid reading of the text. I listened to the recordings and corrected the transcripts.

The interview data were initially coded into headings of a) rurality and health, b) quality and hospital care, and c) enablers that would make things better, taken from the interview schedule, as agreed with my supervisors (SD, RG), as shown in Figure 4.1. Interview data was open-coded by asking myself “what are they talking about?” If existing codes did not capture new concepts being expressed in the interview data, the coding framework was expanded, and subcategories and new main headings to encompass new ideas were developed. Some subheadings were broadened to
encompass an idea rather than create a new category. An example of this was to rename ‘Partner and Family issues’ to ‘Social challenges for professional and family’. After each interview was analysed, the coding framework was refreshed to include any new concepts (see Appendix 10).

After the first three interviews had been coded, the original interview transcripts, the analysed and coded interviews and the developing coding framework were reviewed by my supervisors (SD, RG). They confirmed that the framework was a valid representation of the ideas expressed in the data gathered through the interviews. Following this, all interviews and focus groups coded from the first site visited were shared with my primary supervisor at that time (SD) for comment and to provide feedback about the credibility of the codes developed. A selection of the coded interviews from the second site were reviewed by my supervisors (SD, RG) and the current coding framework was reviewed at monthly supervision meetings.

Initially, the technical approach to coding the interviews had been use tables in Microsoft Word and Excel to develop to coding framework into which the interview data were coded. After one quarter of the interviews were coded, the seventh version of the coding framework (see Appendix 10, version 7) had 92 headings, sub headings and sub groups. Managing this volume of coding categories through a ‘cut and paste’ approach was becoming difficult. In discussion with my supervisors, a decision was made to convert to using the NVivo Pro version 11 software programme, and the existing coding framework and coded text was transferred into NVivo and data were coded directly into NVivo thereafter. As new ideas developed from the interview data, new parent nodes and child nodes were added within NVivo and the coding framework was adjusted accordingly (see Appendix 10). Analytic memos of thoughts and ideas that came to mind as the original recordings were listened to and the transcripts read were recorded in a research diary. This included connections with ideas that others had expressed, both similarities or contradictions. An example of such an entry was “X’s comment re disruption of travel to (major hospital) for knee surgery re Y’s view that it is ok to travel for elective surgery but not for a broken arm.”
After one year working on the research project, when I had analysed three-quarters of the interviews had been analysed, my original primary supervisor (SD) headed overseas and TS became my new primary supervisor. He aimed to create continuity in the supervision process rather than redirect the analysis as he would have if he had been primary supervisor from the outset. At this point, I asked my new main supervisor (TS) and continuing secondary supervisor (RG) to review two interview transcripts and the associated coding (one individual interview and one focus group). Both supervisors (TS, RG) reviewed the coding and were in general agreement with the framework I had developed. The initial coding of all interviews was completed in May 2017. Appendix 10 shows the final coding framework and Appendix 11 contains the codebook describing the codes developed during this process. When all interviews were coded, the coding framework had expanded and codes were grouped under seven main headings of rurality and health, health care quality, concept of health, barriers to change, service delivery models, enablers and equity shown in Figure 4.1.

I initially coded the provider interviews and focus groups (Maori and general community) separately. As it became evident that broadly similar findings were coming through, I combined the provider and community data for ongoing analysis. Had there been significantly different findings from different groups I would have continued to analyse the provider and community data separately, but because views expressed were largely similar, I decided to present combined results and flag up differences in the analysis.

4.5.2 Developing themes

The interview transcripts as coded, the field research diary entries and the analytic memos noted as data was analysed formed the body of data available for further analysis. This section describes the approach to developing themes out of the data.

To be immersed in the original data as the coded data was coalesced into sub-categories and categories to build into themes, all interview transcripts were re-read. A summary of comments in the research diary was compiled to make these ideas easier to access in this next phase of the analysis. The data was approached asking the question, “what are
they meaning, and how do the threads connect between different people and different ideas?”.

On the prompting of my primary supervisor (TS), a one page mindmap of the key themes and categories within themes that were being described in the interview data was developed. These covered three key areas, being discussions around the definitions of rurality; health care quality; and around improving integration across the health system (see Appendix 12, page 388).

To develop my understanding of the themes in the data, all the coded interview excerpts within a main section of the initial coding framework were then read – for example, rurality. All the ideas coming from the data were captured in a document with verbatim quotes inserted that supported these ideas – for example, ‘Rural definitions’, under which sat ‘lack of clarity’, with 10 quotes relating to this idea, followed by ‘more nuanced nomenclature suggested’, with 2 quotes, and ‘this can affect rural funding and delivery approaches’, with 3 quotes. After going through the data relating to rurality, and developing ideas, a mind map was drawn around the topic of rurality, that captured inter-related ideas – see the mind map for rurality in Appendix 12.

This process was repeated to analyse the data on health care quality and improving integration. The inductively coded data on the principles of quality were reviewed with reference to the literature regarding quality frameworks. The NZ Triple Aim was tested and selected to help construct a quality framework that incorporated existing conceptualisations of quality and was sensitive to the rural health perspective (as shown in the mind maps in Appendix 11). Coded data related to teaching and learning was not analysed further to contain the data to manageable volumes focused on the key research questions, with the intention of coming back to these data at a later date. Feedback from study participants was obtained through sending a summary of initial findings to all participants (see Appendix 6).

By February 2018, two years after starting the research project, the open codes had been iteratively constructed into sub-categories and categories that developed into four
themes. As shown in Figure 4.1, the themes were rurality and health, health care quality, measuring quality, and enablers to improving quality, with several categories and sub-categories within each theme. All participants were invited to presentations of the research findings when I visited the four study sites over February to April 2018 where further feedback was received.

The process of thinking about the themes, referring back to the original interview data and reflecting on the literature findings as outlined in Chapter 2 continued. The concept of a ‘Rural Triple Aim’ for NZ was further developed. The literature on enablers of improving health care quality guided the further refinement of the themes, and the inter-relationships between sub-categories and categories within and between the themes were considered. A final set of eight themes, with categories within each theme, was developed as the research findings of the study. The eight themes were 1) Rural Triple Aim; 2) Access; 3) ‘One service, many sites’ health network; 4) Capable workforce; 5) Māori focused service design; 6) Community participation; 7) Rural-appropriate quality measures; and 8) Whole of system planning and resourcing. These final themes are shown in Figure 4.1.

The consolidated criteria for reporting qualitative research (COREQ-32) was developed by Tong, Sainsbury and Craig with the goal of improving the quality of the reporting of qualitative research. It is increasingly being used as a framework to report qualitative studies and systematic reviews of qualitative studies. The methods used in this study are reported in line with the COREQ-32 framework and a ‘checklist’ using this framework is presented in Appendix 13. Quotes are used in the following chapters for illustrative purposes. The abbreviations used to identify the quote sources are outlined in Figure 4.2. Sites were labelled 1 to 4.
This chapter has covered the methods used in the Interview Study. The approach taken to selecting study sites and participants has been outlined. The process of developing the interview schedule and undertaking the individual interviews and focus groups has been described. The process used to undertake thematic analysis of the transcribed interview data was covered. The methods used have been reported against the COREQ-32 framework for reporting qualitative studies. The next chapter is the first of three chapters presenting the results of the Interview Study. The characteristics of the study sites and participants are described, and the theme of the Rural Triple Aim is presented.
5 The Interview Study findings: Participants and the Rural Triple Aim

This chapter is the first of three chapters presenting the results of The Interview Study. This chapter initially describes the four sites that participated in the study and the participants interviewed. Next, the principles of health care quality that were relevant to rural communities are described under the theme of the Rural Triple Aim.

5.1 The four communities

Four rural towns were selected as study sites. The urban hospitals supporting them were also included in each study site. Health care providers were interviewed at the rural towns and their supporting urban hospitals. Members of the community were interviewed at the rural towns. The rural towns (red stars) and associated major urban hospitals (yellow stars) are shown in Figure 5.1.

![Figure 5.1 The four study sites.](image-url)
Information regarding the four selected communities and the rural hospitals serving them are shown in Table 5.1. The North Island communities of Kaitaia\textsuperscript{218} and Wairoa had significant Māori populations,\textsuperscript{219} as well as high levels of socioeconomic deprivation. Half or more of both communities’ population were more living in the most socioeconomically deprived 20% of areas in New Zealand (Quintile 5 areas) as measured by NZDep13 quintiles\textsuperscript{2,221} In contrast, the South Island's West Coast and Central Otago communities had much lower Māori populations,\textsuperscript{219} and lower levels of socioeconomic deprivation, with Central Otago having no residents living in Quintile 5 areas.\textsuperscript{221} The nearest main hospital was 2 hours’ drive for the North Island sites,\textsuperscript{222} and 2.5\textsuperscript{223} to 4.5 hours’ drive\textsuperscript{222} for the South Island sites. Kaitaia had 26 beds\textsuperscript{224} and Dunstan hospital 24 beds\textsuperscript{223} and both were Level 3 rural hospitals with Rural Hospital Medicine (RHM) doctors onsite 24/7.\textsuperscript{82} Westport hospital and Wairoa Hospital both had 12 beds\textsuperscript{225} and both were level 2 Rural Hospitals with general practitioner (GP) and RHM doctors available but not 24/7.\textsuperscript{82} Dunstan hospital was the only hospital visited that had no Emergency Department, nor onsite general practice during working hours.\textsuperscript{223} Grey Base Hospital was also a level 3 Rural Hospital\textsuperscript{82} but differed from the other level 3 rural hospitals in its larger size and mixed generalist (RHM and rural GP doctors) and specialist workforce.\textsuperscript{1}

Dunstan hospital was managed by a community trust\textsuperscript{223} created to preserve hospital services for the community when Healthcare Otago (the provincial health board at the time) exited service provision and proposed to close the hospital in 1999.\textsuperscript{226} The community had undertaken significant fund-raising for the facility and owned the fittings and fixtures in the hospital building, including a CT scanner, while Southern DHB owned the building.

The other 3 sites were DHB owned and operated. The Kaitaia community had fought strongly to keep the Kaitaia hospital open when it was threatened with closure in the

\textsuperscript{2} NZDep13 scores are area-based deprivation scores derived from aggregated census data regarding internet access, income, employment, qualifications, home ownership, living arrangement and access to transport for individuals living in small geographical areas. (220). Atkinson J, Salmond C, Crampton P. NZDep2013 index of deprivation. Wellington: Department of Public Health, University of Otago. 2014.
Table 5.1 Comparison of sociodemographic data and hospital information by the four study sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Towns</th>
<th>Town size approx</th>
<th>Population served</th>
<th>Māori population</th>
<th>Quintile 5 population*</th>
<th>Drive distance to urban hospital</th>
<th>Hospital</th>
<th>Beds</th>
<th>Resident Medical Staff</th>
<th>ED</th>
<th>Theatre</th>
<th>Specialist Outpatient Service</th>
<th>Primary Care on site</th>
<th>Ownership structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaitaia</td>
<td>Kaitaia</td>
<td>5,000</td>
<td>21,000</td>
<td>40%</td>
<td>50%</td>
<td>2 hours to Whangarei</td>
<td>Kaitaia</td>
<td>26 + maternity</td>
<td>RHM</td>
<td>Yes</td>
<td>Day surgery</td>
<td>Yes</td>
<td>DHB</td>
<td></td>
</tr>
<tr>
<td>Wairoa</td>
<td>Wairoa</td>
<td>4,300</td>
<td>8,000</td>
<td>55%</td>
<td>64%</td>
<td>2 hrs to Hastings</td>
<td>Wairoa</td>
<td>11 + 3 maternity</td>
<td>GP and RHM</td>
<td>Yes</td>
<td>No</td>
<td>Visiting</td>
<td>DHB</td>
<td></td>
</tr>
<tr>
<td>West Coast</td>
<td>Greymouth</td>
<td>10,000</td>
<td>33,000</td>
<td>9%</td>
<td>13%</td>
<td>3 hours Christchurch</td>
<td>Grey Base</td>
<td>80 approx including 10 maternity</td>
<td>RHM and Specialist</td>
<td>Yes</td>
<td>Full surgery</td>
<td>Resident and Visiting</td>
<td>DHB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Westport</td>
<td>3,500</td>
<td>7,000</td>
<td>10%</td>
<td>11%</td>
<td>1.5 hrs to Grey, 4.5 hrs to</td>
<td>Buller</td>
<td>10 + 2 maternity</td>
<td>GP and RHM</td>
<td>Yes</td>
<td>No</td>
<td>Visiting</td>
<td>DHB</td>
<td></td>
</tr>
<tr>
<td>Central Otago</td>
<td>Alexandra and Clyde</td>
<td>6,000</td>
<td>27,000 (incl. Wanaka)</td>
<td>8%</td>
<td>0%</td>
<td>2.5 hours to Dunedin</td>
<td>Dunstan</td>
<td>24, no maternity</td>
<td>RHM</td>
<td>No</td>
<td>No</td>
<td>Visiting</td>
<td>After-hours GP service only</td>
<td>Local Community Health Trust</td>
</tr>
</tbody>
</table>

RHM = rural hospital medicine doctors; ED = emergency department. Information accessed from hospital, DHB and SNZ websites (see text); * NZDep13
early 2000s, and a story board describing this period lined the main hospital corridor. Although there was no visible story of threatened closure at Wairoa, several wards were closed and boarded up and people described how full surgical services had been provided two or three decades ago. The footprint of Buller hospital indicated that it had been bigger in the past, and a redesign and rebuild process for a new 12 bed hospital with integrated primary care services was under way.227 Grey Base Hospital’s footprint was also larger than the number of beds being actively used due to earthquake-risk related structural concerns. Foundations for a new 70 bed Grey Base Hospital with attached integrated primary care services were being dug during the study site visit.

The supporting major urban hospital and central management was within the same DHB as the rural hospital for Kaitaia, Wairoa and Central Otago. Christchurch Hospital in Canterbury DHB was the major hospital for the West Coast communities. The West Coast DHB and Canterbury DHB had a shared senior leadership and central management, with a shared Chief Executive. Many people in senior roles were based in Christchurch, with a smaller number based in Greymouth.

Noting the variation between the four sites as outlined above, the major difference between the findings of the four sites was between the Central Otago site and the other three sites. As noted, the Central Otago site was in a significantly socioeconomically advantaged area, and access to local private specialist outpatient services was available. This provided a choice to the community to pay to access a private service locally, or travel to the main urban centre for a free service. This option was not available at the other three sites visited. Community members in the Central Otago site still saw themselves as being at a disadvantage to urban based people, although their level of disadvantage was not as great as those community members in the other three regions, who did not have the option of this choice available to them. Despite the advantage for many people living in the Central Otago region to the choice of paying for local specialist services or traveling for free services, the access needs of local Māori, who could not
afford to access the private local services, were similar to the access needs of Māori in the other areas visited.

5.2 The study participants

The views of 109 participants, participating in eight focus groups and 34 interviews, were collected between June and November 2016. At two provider interviews, two people had participated, at their request, and the remaining 31 provider interviews were one-to-one. One community participant was interviewed individually. Table 5.2 describes the participants involved at each site.

Participants in community and Māori focus groups were a mix of working and non-working people, including retired people, parents and unemployed. Participants were ranged in age from their 20s to 80s. People’s current or previous occupations ranged from the service industry, health services, small business owners, farmers, horticulturalists, teachers and civil servants.

Table 5.2 Research participants

<table>
<thead>
<tr>
<th>Site</th>
<th>Community focus group (number per group)</th>
<th>Māori hui focus group (number per group)</th>
<th>By interview</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaitaia</td>
<td>7</td>
<td>11</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>Wairoa</td>
<td>8</td>
<td>7</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>West Coast</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Central Otago</td>
<td>13</td>
<td>14</td>
<td>9</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>39</td>
<td>36</td>
<td>109</td>
</tr>
</tbody>
</table>

There were six to thirteen participants in the four community focus groups. Many of the residents had lived in the area all their lives. Participants were a mix of people of European and Māori origin.
Seven to 14 people participated in the four Māori hui focus groups. In one of the four Māori hui, most of the participants were Māta Waka (Māori from other tribal regions) which reflected the demographic of the local Māori population, whereas in the other three sites most or all of the participants were Tangata Whenua (Māori from the local area). As mentioned in the Methods chapter, at one of the Māori hui some of the conversation was in te Reo Māori. I was not able to access this in translation, but the speakers gave an approximate translation into English immediately afterwards. The content of the discussion at this hui at times had a spiritual component as people described their views through the lens of Te Ao Māori. In contrast at the other hui, conversations were largely in English and the content of the conversations was less immersed in the Te Ao Māori world view.

Twenty-two clinicians and 13 managers were interviewed, as shown in Table 5.3. Nine participants interviewed were bringing the central DHB perspective, and 26 had a rural provider view. Over half of all doctors interviewed were trained outside NZ. All the nurses and most of the managers interviewed were trained in NZ. Four of the five executive clinical leads were doctors with one nurse. Of the five rural hospital medical leads interviewed, two were GPs as well as rural hospital medicine doctors, and three were solely rural hospital medicine doctors. Most of the GPs interviewed had practised in the area for over a decade, with the longest being 32 years of practice in the same town. Many of the longstanding GPs had worked at the local rural hospital in the past and three of the eight interviewed currently did so. The rural hospital doctors who were not also GPs had been in their roles for five to ten years. One of the rural hospital managers was a nurse by background and two were Allied Health professionals. Two of the Māori health provider managers were nurses by background and one GP interviewed was the clinical lead for the local Māori health provider.

<table>
<thead>
<tr>
<th>Interviews</th>
<th>Central DHB view</th>
<th>No.</th>
<th>Rural provider view</th>
<th>No.</th>
<th>Total</th>
</tr>
</thead>
</table>

88
This section has introduced the study sites and study participants to the reader. The next section describes the findings from thematic analysis of the data relating to the principles of health care quality that are important to rural communities.

5.3 The Rural Triple Aim

This section presents the theme of the Rural Triple Aim, describing the important principles underpinning health care quality for rural communities as identified by participants. There was general agreement among community and health provider participants about nine important principles contributing to health care quality for rural communities. The individual, population and system components of the New Zealand Triple Aim for Quality Improvement,\textsuperscript{12} was adapted to incorporate rural health perspectives. The categories within this theme are presented below within the individual, population and system components of the Rural Triple Aim and shown in Figure 5.2.
5.3.1 Improving quality, safety and experience of care

The following three categories were the rurally focused aspects of the ‘Individual’ component of the NZ Triple Aim.12

5.3.1.1 Patient- and whānau-centred care including care location preferences

This category included two principles expressed by participants. Firstly, patient and whānau-centred care required patients and their families being partners in decision making:

“So, good quality, efficient and effective health care is really important, but I think that goes hand in hand with patient and whānau-centred care; patients and whānau having a say and being involved in how that care is delivered.” PS2

For people living in rural settings, this included taking their social and cultural contexts into account and considering their preferences for where they wanted to receive care as part of shared decision making processes. Different people would have different
priorities and might make different decisions about where they wanted to receive care as a consequence. The trade-off point for wanting to be cared for locally rather than being transferred to an urban hospital would be different for each person, and clinicians should take this into account.

Secondly, and as a corollary, health services needed to enable these preferences to be enacted. The provision of patient- and whānau-centred care meant that whānau should be supported to be with their loved ones while they are in hospital, whether that was locally or at a distant location.

5.3.1.2 Care as close to home as can be done well

Participants indicated that care should be provided in the most appropriate setting to be provided safely, as close to home as possible. This acknowledged that what was achievable in different settings would differ. If care could not be provided in a particular setting safely, the person should be transferred to a setting where it could be:

“Well, I guess I always think if I’m treating a patient, about the decision about whether you transfer them or not, I think to myself: am I giving the same standard of care that they would get in the base hospital? If I’m not, they should be in the base hospital.” RHD3

5.3.1.3 Quality is everybody’s job

Focusing on quality was the job of all health providers, not just the dedicated quality improvement team. This was particularly relevant in small hospitals, as the staffing levels meant that specific quality-related roles were few and often part-time:

“... everybody is responsible for doing audits, for checking their own work, for coming up with ideas, for managing the day to day processes, because otherwise quality is somebody else’s job.” RHMan3
Health care needed to be informed by best practice evidence and providers needed to be up to date across the broad skill set rural providers required. Passing on knowledge to the next generation of health care workers was seen as part of this.

5.3.2 Improved health and equity for all populations

The next three categories present participants’ views relating to the NZ Triple Aim’s ‘Population’ component as relevant to rural settings. These include how care is delivered across different sites and issues of equity from a rural perspective.

5.3.2.1 Consistent care across settings

Common things should be done well and unwarranted variation in care across different provider settings should be reduced. The same standard of care should be aimed for, and this should be monitored and audited. “Kia ora [hi] auntie” (CG1) – the easy familiarity that working in small places brings – should not be an excuse for substandard care.

5.3.2.2 Team-based care across distance

Team-based care working over distance should be the norm. Health care teams in different facilities should have clear communication channels and processes so the patient journey through the system was smooth and there were no delays, breaks in service or barriers to access:

“In the whole of New Zealand, no matter where you are, if you can’t get that care here directly then you should be confident that whoever is providing that care directly is linking you into another centre that is going to provide that different type of care.” MH4.

5.3.2.3 Equitable health care for Māori and the whole rural community

When services were planned and provided, participants thought that the health of the whole region, and the component rural communities within the region, particularly
rural Māori, should be taken into account. This included identifying equity issues of access and outcomes and addressing them:

“Lastly, through all that we achieve equity - not equity of input, but equity of outcome. That would be the whole framing of quality.” ECL3

This should underpin resource allocation decisions. Distance, transport and cost for rural people, particularly for rural Māori, were important equity challenges. Focus was needed on supporting people of limited financial means to access services, particularly when they and their families needed to travel to distant services. The wider determinants of health such as housing, education and employment within rural communities also needed to be considered.

5.3.3 Best value for public health system resources

The final three categories represent participants’ views of a rural focus on the NZ Triple Aim’s ‘Population’ component. These relate to sustainability of local services, the role of networks and concepts of value.

5.3.3.1 Sustainable service models

Participants described how service planning needed to consider the longer-term sustainability of local rural services and the workforce required to provide those services. This was a balancing factor to ‘closer to home’ as some services needed certain patient volumes or economies of scale to be able to provide high quality services sustainably:

“...high quality, but it’s also about that sustainability of it as well.” RHMan4
5.3.3.2  Health networks improve patient flow

Participants indicated that health care should be efficient and cost-effective. Improving patient flow between service providers and settings reduced waste within the health system which maximised the benefit from the health dollar for the rural community:

“It clearly does not do much for quality, but also if you're inefficient, you use resources doing things that are for nobody's benefit. Therefore, somebody else is losing.” ECL3

Well-functioning local networks between smaller and larger hospitals were seen as a way of avoiding duplication and wasted effort by rural health services.

5.3.3.3  Value is more than value for money

Many participants felt that value was a broader idea than just value for money, while accepting that money was the unit of measure in the health system. This was most clearly articulated by people presenting the Māori world view, for whom the concept of “value for money” was seen as a Western medicine construct. Value for care, valuing the person and their whānau’s experience of care, and providing timely respectful care were described. It was noted that if value was the focus, the money would follow as the service provided would be better quality:

“You know, there’s value - there’s money value ... and it is about, okay taking the monetary value away. I know the money is there, but if you get both right, you’ll get it right, and at the end of the day it will be a lesser cost. It’ll be a lesser cost monetary, and it will be an added value to the person, because they received the right care - respectful care - the right care at the right time at the right place, which means that their hospital stay should be a little bit less.” MP4

The following sections outline the seven themes that shape the quality of health care that rural communities experience, and the identified focus areas that will improve the quality of health care delivered, as developed from the interview data. The first of these seven themes relates to Access.
5.4 Summary

This chapter was the first of three chapters presenting the Interview Study findings. It described the four study sites and the participants interviewed, and the Rural Triple Aim has been presented, reflecting the principles of quality that were relevant to health care services for rural communities. The next chapter presents four planning and community focused themes from the Interview Study’s seven themes regarding key aspects of providing and improving health care quality for rural communities.
6 The Interview Study findings: Health care quality for rural communities - planning and community themes

The previous chapter described the study participants in the Interview Study and presented the theme of the Rural Triple Aim, describing the principles of health care quality through a rural lens. Seven themes relating to key elements that shape the quality of health care that rural communities experience, and that can improve the quality of health care delivered were developed, as shown in Figure 6.1 below. This second of three Interview Study results chapters presents the first four themes that are concerned with system planning and community-oriented concepts. The remaining three themes related to the delivery and measuring of high-quality health care for rural communities are presented in Chapter 7. The focus of the interview study was on hospital-level health care delivery, but many of the concepts described in this and the next chapter were presented by participants as being relevant in the context of rural general practice and community-based health services, as well as hospital services. The first four themes of whole of system planning and resourcing, Māori focused service design, greater community participation, and access are presented in detail below.
6.1 Theme 1: Whole of network planning and resourcing

This section describes the theme relating to need to plan and resource services across the whole health service network. The term ‘health service network’ describes health services and providers from community care and general practice, rural hospitals and urban hospitals, including highly specialised urban hospitals, that collaborate to provide safe, sustainable integrated services that meet the needs of communities within a geographical area\(^7\) (see §2.1.4.1, page 21). For rural communities, the health service network includes the local community providers and primary care providers, the staff at the local rural hospital and/or aged residential care facility (if present) and staff at the urban hospital(s) that local services refer to. These may be within a single district health board (DHB) boundary or may include urban hospitals from neighbouring DHBs. Tertiary referral urban hospitals are often in a different DHB boundary, for example the five regional cancer treatment centres for the NZ’s 20 DHBs.

The section presents the view that rural people don’t get ‘a fair go’, with the current system considered overly urban-centric. The value of a clear definition of rurality for
the health services context to assist resource allocation is described. The notion of fair distribution of resources to equitably address rural communities’ needs is described, and suggested ways to do this outlined, as shown in Figure 6.2.

**Components of a whole of health service network approach**

- Fair distribution of resources
- Whole of network approach to planning and resourcing
- Fair distribution of costs
- An agreed rurality definition for health
- Planning and funding health networks

**Figure 6.2 Components of a whole of health service network approach to planning and resourcing health services**

**6.1.1 An equitable distribution of resources across the whole system**

The concept of ‘a fair go’ is deeply entrenched within the NZ psych, and in the policy sense, relates to fairness of process and fairness of outcome. Participants recognised that health funding was finite, and the demand of people’s expectations could never be met by what was able to be provided, but participants expressed concern that the current split of resources between rural and urban communities was not fair. Fairness was seen as closely linked to equity, and participants considered that health care planning and delivery favoured urban areas. Funding needed to be more evenly allocated:

“It’s the bottom line, quality. Like you say everything is down to money, there’s only so much money, it should be distributed evenly.” CG1
Population based funding (which has a rural adjustor within the formula, see §2.1.4.2, page 26) was criticised as not being adequate to fund rural services, given distances over which services needed to be provided and the extra costs related to achieving adequate staffing levels. Other participants acknowledged that population-based funding did not work for rural communities, but pragmatically accepted that some services would need to be provided elsewhere, and thought the focus should be on getting the balance right between local provision and having access to services where expertise needed to be concentrated.

Some participants noted that the national trend over recent decades towards population urbanisation and medical specialisation meant that hospital care could no longer be adequately provided within the workforce resources of rural communities, as it was in the past. Providing high quality care for rural communities through networks with larger services, with more clinician and patient travel was seen as the only option for the future. Having said that, it was a more expensive way of doing things than in the past, and the central health funders needed to understand that:

"[Urban hospital] is the solution, but what I’m saying is what the Ministry [of Health] have got to understand: it’s more costly. So they have to put some more dollars in to allow for that.” RHN4

The funding models applied to rural hospitals were seen as being developed for urban hospitals with certain assumptions of patient volumes underpinning the calculations. These assumptions were not applicable in rural hospitals staffed by generalists, where spare capacity needed to be maintained to meet with quickly fluctuating demand, where extra time was needed for generalists to seek input from specialist colleagues regarding keeping or transferring more complex patients, and where extra staff training was needed to maintain competencies across a wide range of skills. This underlying difference in cost structures was noted as not being understood by urban-based planners and funders.
6.1.2 An equitable distribution of costs across communities

Participants commented that the extra cost of providing rural health services needed to be balanced against the goal of improving equity in outcomes for poor people living in rural settings. The burden of out-of-pocket costs on rural people when they needed to travel for services (discussed further in §6.4.4) needed to be considered when planning where services were provided, as travel costs were shifted onto patients disproportionately in rural areas:

“That’s the thing; it still costs to come up, but it’s not costing the DHB. They’ve shifted the cost onto the people” CG2

Some participants commented that some urban people had the view that rural people should just accept their health outcomes would be worse because they chose to live in a rural setting, but this raised the question of whether it was fair that rural people should pay more for their health care when everyone paid taxes equally. One participant commented that if services provided in cities were changed to reflect how rural people accessed services, so that urban people had to pay hundreds of dollars to travel to receive services that were currently provided locally by the public system for free, “there’d be a riot”.(PS3)

A core question was raised, without any easy answers, of why people living in rural communities should have to subsidise their own health care more than their urban counterparts:

“So, the overall system costs do not take into account the cost of the individual. Without a shadow of a doubt, the rural communities pay more for their healthcare delivery than anybody else. ... If you’ve got a way of breaking that circle, I’d love to hear it, but I honestly don’t know one.” PS3
6.1.3 An agreed rurality definition for health purposes

The perceived lack of agreed consistent definitions of where or who was rural in the context of rural health in NZ was seen as hindering discussion and policy around rural health issues. Participants described various definitions of rurality, as “Rural is like beauty. It’s in the eye of the beholder.” (GP/RHD1) In general, ‘rural’ was seen as a gradient from small town to remote isolated clusters of people. Participants identified a combination of population density, distance from other places, isolating geography and the resulting challenges to access services when defining rurality. Rurality, and rural health, were talked about as overlapping but with some distinctions. Some participants in small towns did not think of themselves as rural, although they thought that their health services would be considered rural.

Some participants noted that the health statistics around outcomes for rural people varied depending on how rurality was defined. The Statistics New Zealand definition of rural, relating largely to population density was seen as not fit for purpose for rural health discussions. The Rural Ranking Scale (RRS) had provided a useful way of defining rurality in the health care context, before being superseded:

"The definition of rural that we came up with, with the rural ranking scale was actually quite important at the time, because it allowed us to say who was in and who was out."GP/RHD1

Participants noted that a more nuanced nomenclature would consider more than population size and include distance from other services and what was provided locally as well. One participant suggested a four-tier concept of rurality for health services, of rural – “in the middle of nowhere with a general practice, and the pharmacy’s not even there” (PS4); semi-rural – “it’s a long way away from the big hospital, but it’s got a lot of its health services in place” (PS4); semi-urban – a small town near a large urban area; and urban - large town or city. Some participants thought that appropriate definitions of rurality should be agreed as this would aid decision making about fair distribution of resources and policy development, funding and provision of services that met rural
communities’ needs more adequately. Others described the issue was one of equity rather than rural health per se, and the issues facing poor people in rural settings were similar to those facing poor people living in large cities.

6.1.4 Solutions – planning and funding health service networks

Participants expressed the view that services should be adequately resourced, and fairly distributed across the region’s health system. A whole of system, patient centred approach needed to be taken to resource allocation, rather than just rolling over support for existing structures and historical contractual arrangements. Reviewing the funding allocation to better address the realities of providing care to rural communities was suggested. Outcomes based funding for the health service network, or capacity-based funding for rurally based services were suggested as alternative ways to fund integrated rural services compared to the current model.

Some participants noted that shifting funding from where it had been historically allocated (often in urban settings) to where it might be most needed (for example, in rural settings) was a difficult task as it involved balancing centralisation against dispersed delivery, and dealing with the “stranded overheads” of existing infrastructure and staffing costs:

“So there is always a tipping point - a balance if you like, between centralisation and dispersed service delivery. … you can have great ideas of delivering a service to a rural population but to do that and to shift services - not always, but sometimes - will increase the overall cost to the system … So it is often about disinvestment decisions.” PS3

The tension between care closer to home and economies of scale was always part of the resource allocation decision making. The benefits of keeping people healthy were noted to be of particular importance in rural areas, given the extra cost and difficulties involved in treating rural people who became unwell. General practice had great potential to provide more care closer to home for rural people, but funding needed to be provided so patients did not incur more user charges. Otherwise rural patients would
be further subsiding their care to avoid the need to travel (which incurred its own financial and other costs), which was not a decision that urban people generally had to make. Shifting funding towards high needs areas and ‘upstream’ to primary health care and public health measures was always competing with the historical hospital focused service provision, but with collective will it could slowly change, as evidenced by one DHB’s commitment to shift of one or two percent a year of total funding to primary and public health services.

There was also a view that it was not entirely about funding, but also about how people approached working together, and how services were configured to provide a single system view. The following planning decisions were seen as enabling people to work as one system: changing funding and contracting models to focus on patient care outcomes and integrated care whilst meeting the reporting requirements to the MOH in the background; enabling flexible working practices; examining how technology could reduce the administrative burden on providers; and making relevant process and outcome information visible across the whole system.

This section has been concerned with the theme of planning and resourcing health services networks taking a rural view. The next section addresses the theme of service design focused on the needs of Māori.

6.2 Theme 2: Māori focused service design

This section relates to the consistent view from both the community and Māori focus groups, and interviews with Māori health providers, that more should be done within the health system in NZ to focus on cultural competence and improving Māori health outcomes. These categories within the theme of Māori focused service design are shown
6.2.1 Making mainstream services welcoming for Māori

The consequence of a lack of culturally respectful services was that it added an additional barrier for rural Māori to accessing services, over and above socioeconomic barriers:

“So, if Māori people don't feel welcomed or culturally respected, then those are significant barriers to them seeking hospital care alongside simply putting diesel in a car that's got a warrant.” ECL2

Some mainstream health providers (i.e. those health providers that were not specifically providing services for Māori) within hospital and community settings were seen as not being respectful of Māori and their tikanga (customs, cultural practices, norms and protocols), while noting this varied in different sites visited. These situations were considered unacceptable given the range of training opportunities available. (see §7.2.2, page 137 for linked concept of cultural capability in the theme of ‘capable workforce’).
Māori participants expressed a range of views about the acceptability of telehealth consultations. Some found the lack of kanohi ki te kanohi (face-to-face) did not sit well with them:

“Our Kaumatua [older men] and kuia [older women] have had tele-med, but they say that the aroha [love, warmth] was not the same as kanohi ki te kanohi.” MH4

Others were very comfortable with the concept of virtual consultations, noting that they ‘Skyped’ their grandchildren often, and valued the resulting reduced need to travel. Expanding transport systems between hospitals to respect the importance of having whānau to travel with and support the patient was suggested, as this would make accessing services more acceptable to Māori.

Better ongoing education of health providers was considered necessary. Providing te Reo Māori language courses, Māori tikanga courses and Te Tiriti o Waitangi courses in the work environment were suggested to improve mainstream hospital services’ responsiveness to Māori needs. Greater senior DHB leadership commitment to cultural competence was identified as an enabler, as senior leadership needed to drive this work from the top for it to be embedded throughout organisations. Having Māori people in senior leadership roles was an enabler for main stream services to meet the needs of Māori, although they needed to be well supported and taking a long term view to avoid burnout:

“There is a fine line between doing your job and working hard and getting your Māori health plans out, and pushing the barrow - and you’ve got to push the barrow, but you’ve got to be a little bit careful around that, because if you go too far ... the whole thing gets to your wairua [spirit] and it just splits you up. So, what you’ve got to do is you’ve got to look at the long game…” MH4

In general, the Māori support services provided in hospitals was highly valued. The access to karakia while in hospital provided was very important, as was “clearing a
room when someone had passed” (died) through appropriate karakia (MH1). The Māori support staff’s ability to liaise with clinical hospital staff on behalf of the patient and their whānau was also highly valued. Some commented that Māori focused services in hospitals needed to be more visible and of a better standard particularly when comparing South Island hospitals to North Island hospitals:

“Although they have that whānau room at the hospital, there’s nothing whānau about it.” MH3

Clinical staff who could speak te Reo Māori were seen as definite assets, particularly for older people for whom te Reo Māori was their first language. Having a basic understanding of te Reo Māori was suggested as part of the undergraduate clinical curriculum:

“The Pākehā doctors don’t have to be fluent; just basics just to make them relax, and then go back into English” MH2

People mentioned that not all Māori could speak te Reo Māori and many preferred to have their clinical conversations in English, but the option of speaking in te Reo Māori was seen as an asset.

6.2.2 Including Māori providers in the network

Māori hui and provider participants discussed the importance of acknowledging and building partnerships with Māori providers. Māori providers were noted to provide social support and help navigating the wider system of government departments as well as strictly health related areas. They were seen as an essential for both providing a Māori voice, and in providing access to Māori-friendly health services in their communities. Having strong Māori health providers in rural communities was seen as a way of protecting Māori against some of the difficulties of living rurally and accessing health services. Māori hui participants spoke of the importance they placed on the local
Māori provider service, without which they would have no voice, much more limited access and “We’d all be stuck wondering what the hell to do”. (MH3)

Local Māori providers needed to be included at the planning table and in service delivery within the health service network to ensure that Māori received services that were culturally user-friendly. The skills and knowledge of Māori providers needed to be fully utilised to ensure that main stream services met the needs of Māori and that Māori had a choice to use Māori provider services. There were also successful examples of overlap between Kaupapa Māori services (services provided according to Māori principles and practices) and mainstream services at some sites, with Kaupapa Māori services linked directly into general practice and rural hospitals. Building such relationships took time and was founded on respect and integrity:

“We need to be at that planning table right at the very beginning, so that right from the beginning... we’re all understanding what we’re going to do in each other’s space, because there’s always going to be those links...” MP4

The provision of culturally appropriate services were seen as being under-resourced and the Māori workforce at risk of burnout as the task was so large and demanded a lot of personal energy. Māori provider services were seen as maximising “value for care” (MH4) as the needs of the whole whānau were addressed, which provided greater long term value than just dealing with the immediate health issue facing an individual and warranted increased funding to improve health outcomes for Māori whānau.

6.2.3 Focusing on the impact of service design on Māori outcomes

Participants commented that impact of service change on Māori outcomes were often not adequately considered. For some participants, equity for Māori was a stronger driver than ‘rural health’ per se, noting that issues of Māori inequity were not solely a rural concern:
“I’m sort of more about health and equity than rural health. I think there’s a part of our population that can facilitate whatever they need from a health system. ... For me it’s sort of more about the health inequity space that we need to be focusing on. Is that different in a rural location than it is in the middle of Mangere [Auckland], I’m not sure. I think the systems issues are the same.” RHMan1

Participants commented that the outcome gap between Māori and non-Māori was complex, and barriers to Māori seeking healthcare included but were not limited to financial issues alone. Services needed to be designed with the intent to reduce, not increase inequities.

This section has described the theme related to Māori focused service design and provision. The next section describes the theme of community participation more broadly.

6.3 Theme 3: Community participation

This section describes the theme of community participation in general. The notions that planners and providers should be more receptive to the needs and wishes of their communities and the potential for greater community participation in service design and provision are described below, as shown in Figure 6.4.

6.3.1 Greater responsiveness to community input

Health services were seen as having to change to meet people’s expectations and needs. Services needed to adopt a person and whānau centred approach, where design was guided by the needs and wishes of people in communities, rather than meeting the needs of organisations providing services. Communities may design something different to how things had previously been provided.
Having genuine consultation and stronger community input into how services were designed and provided was seen as important. Patients and community could become more involved in quality improvement through better patient experience feedback processes, increasing community awareness of the importance of giving feedback, and tracking patient feedback over time to monitor improvements. Understanding and reducing the impact of distance and travel for rural people was another example of where this approach could make a difference.

6.3.2 Value of greater community participation

This category related to the largely untapped potential of community involvement in designing and providing services that meet the needs of rural communities. Community participation in health services was seen as having tremendous potential to influence change positively. The sense of community connectedness was seen as being stronger in rural areas. Rural communities would pull together to fundraise and support local people and services. Participants noted that involving members of communities in the
development and implementation of different approaches to delivering health care allowed them to develop ownership of the solutions. It also improved the design as they understood what was important for their health and when they become unwell. Some commented that their DHB central management was missing an opportunity if only they would relinquish some control and trust rural communities to make decisions in their communities’ best interests within available resources:

“I don’t think even [DHB centre] kind of understands how tightly knit our community is and how willing we are to make compromises and get things moving. I think if they realized that they would probably give us more opportunity to show that instead of trying to control us from a distance.” GP/RHD1

Formal interface committees such as DHB consumer councils and advisory groups were well regarded when in place and more of this type of participation was suggested. Local people voluntarily acted as reference points or connectors, who people turned to for advice and help, both in community and hospital setting:

“Yeah, hospital volunteers - Friends of the Hospital .... because if somebody’s down from [small town] and they’ve got no family and they’re bed-ridden and they can’t get their washing done and things like that.”CG4

Other opportunities included people within the local community being formally employed as community-based health navigators and support workers.

This section described the theme of community participation. The following section describes the theme of access for rural communities to health services.

6.4 Theme 4: Access

The theme of access included access to information, to local and distant health services and to whānau support, as shown in Figure 6.5. The role travel played in extra costs
experienced, and the burden this placed on people of limited financial means are outlined. Areas to focus on to improve access are described.

Components of access for high quality rurally focused health services

![Components of access for high quality rurally focused health services](image)

*Figure 6.5 Components of access for high quality rurally focused health services*

6.4.1 Being rural

Many positives of living rurally were described, such as access to open spaces, a slower pace of life and less traffic, “Rush minute, not rush hour” (GP2), connectedness with the land, connectedness between people within rural communities and community self-sufficiency:

“That’s what rural is to me; you care about each other.” RHD2

Despite these positives, distance and travel were seen as part of what you accepted if you lived in a rural place. Poor access to civic, retail, telecommunications and health services and lack of choice were seen as the burden of living rurally. Financial, time and family disruption costs were associated with accessing services. Financial hardship
exacerbated access issues particularly for people with limited mobility or no transport of their own which made them reliant on others when accessing services in rural areas with limited or no public transport.

Some participants commented that they choose to live rurally, but with that choice came trade-offs. Others noted that people may not actively choose to live in rural communities as it may be where they were born, or the only place they could afford to live, and the extra burden of availability and affordability of access they faced was not faced by people living in urban settings:

“... but there is a significant cost of being rural as opposed to being urban, and that's around access to services.”MH4

The nature of rural living was noted as changing. Community connectedness of old was weakening (for example, fewer people were members of the Country Women’s Institute), and people were becoming more socially isolated:

“You've got a lot of aunties out there who are lonely. You need to get family to call them and see them, and we don't realize that.”MH1

In parts of the country the composition of rural communities was changing with changing patterns of land use, rural migration from cities, and the ‘gentrification’ of rural spaces. Some rural areas were becoming unaffordable for locals to live in, particularly Central Otago/Lakes area and, to a lesser extent, Northland. This was seen as leading to growing disparities within rural communities as “uber-rich” (MP3) enclaves developed.

From a health care perspective, the main cost to people of being rural was access to health care, both in terms of limited availability of local health services and the need to travel to larger hospitals at distant sites for services not provided locally.
6.4.2 Access to information

The approachability of health services through consistent, easily accessible information was seen by participants as an important first step to good quality health care. Participants noted that general information about local health services including mental health services, information about how best to access acute services, information about transport options and support services when receiving care at the urban hospital was sometimes difficult to find:

“I never really understood what was available, probably until my third or fourth [cancer chemotherapy] treatment” MH4

Inconsistent messages from different parts of the health system added to confusion. These were particular issues for new people moving in to rural areas. The approachability of health services could be improved by providing easily accessible information using multiple communication channels (e.g. printed and web-based) with consistent messaging from different parts of the health service network.

6.4.3 Access to local health services

Limited choice of general practice services and unaffordable urgent care out of normal business hours were noted. While this was not unique to rural communities, some communities did not have access to local free hospital emergency departments as an alternative. Access to ambulance services were also noted as difficult in some rural areas, due to the cost incurred when ambulances were called and limited availability of volunteer drivers.

Many participants expressed the view that rural people preferred to be treated at their local hospital if they could. Strong emotional connections between rural people and their local hospital were noted, as the local hospital represented stability and safety, the place where people entered and left the world. Rural communities had fought to retain health services, particularly hospital services, and these hospitals enjoyed strong
ongoing support. It was less costly to be treated locally and whānau could be close for support, without the burden of having to travel for hospital visiting. Some participants noted that particularly for local Māori, being able to die in their home area was very important, and could influence their decision about accepting hospital transfer:

“Whereas reasonably often people won’t want to be transferred because actually they think they’re probably going die anyway, and it’s much more important that they do that here, than being somewhere else for that little chance that something might go right” RHD2

Central Otago was the only site visited where private specialist clinics (a private specialist appointment cost around $NZ350) and radiology services were provided locally. Participants there noted that many people chose to use these services in preference to public hospital services provided ‘locally’ at a rural hospital an hour’s drive away, or at the urban hospital several hours away, as the cost of private services was a better alternative to taking time off work or taking children out of school, the cost of petrol and the inconvenience factor. Despite Central Otago being wealthier than the other sites visited, (which likely contributed to the private services being available), not everybody could afford to access local private services and were further disadvantaged as a result:

“I just thought that it’s funny, because I’m on the DPB and I’m expected to travel, whereas people that probably can afford to travel get the luxury of being able to go to [local private service] because they can afford to pay.” MHx

There was a range of services provided in rural communities that participants thought could be more available, acceptable and affordable. Improving the affordability of primary care services, particularly outside of normal business hours was frequently mentioned. Greater access to locally provided palliative care services, community rehabilitation services and mental health services was raised. More marae (meeting

3DPB: domestic purposes benefit for solo parents
4The location numerical identifier has been omitted to maintain location anonymity
venue and land communally owned by Māori sub-tribes) based health services would improve acceptability of services for Māori.

Making specialist and urban hospital-based services more available in rural communities through face to face or virtual satellite clinics was suggested, with greater use of videoconferencing technology for the latter. It was acknowledged that some services would always need to be travelled for, but if a people-centred equity focus was taken, the balance between patients travelling versus specialists travelling might warrant reconsideration.

6.4.4 Access to urban health services

Participants recognised that there were times when they needed to go to the city hospital for treatment and, although it placed a large burden on families, this was acceptable when specialised services requiring high-level technical expertise were necessary. Well-functioning pathways for people who needed health care at a distant site were required, with appropriate transport options available:

“Well I just think good quality is having access to the services required within a reasonable time frame.” CG1

People needed to travel for time critical health problems, e.g. heart attacks, and for pre-planned care requiring more specialised services than what could be provided locally, e.g. cancer treatment. In both instances people incurred costs in terms of time, money and disruption to their lives. They required access to money, transport, whānau support and the ability to reorganise work and family commitments in a way that urban people did not experience.

When transferring patients urgently to and between hospitals, the mix between fixed wing, helicopter and road ambulance transport was seen as a difficult balance between cost, patient and staff travel time, and the risk involved when leaving rural areas without immediate road ambulance response. Rural transfer services in Australia were
noted as being highly developed with central coordination and funding and the process of transfer was easier than in New Zealand. Improving central coordination of urgent transfer was suggested to improve the efficiency of transfer services and release rural hospital clinicians from needing to sort out transfer process details, freeing them to focus on the care of the unwell patient:

“Timeliness to transfer is vital...If things are time critical there must be systems in place to meet that timeframe... I think a move ... towards having a more streamlined and centralised process, that allows the clinician at the bedside, to concentrate on clinical care, and allow somebody else to sort out where they're going, how quickly and who’s going to get there, would just be amazing.” GP/RHD4

A central coordination centre could also coordinate telehealth input from urban specialists to rural colleagues for urgent advice.

When rural patients were admitted to urban hospitals, it was suggested that a ‘rural flag’ be developed and added to patient clinical records for easy recognition of rural patients in urban hospitals for family support, discharge planning and follow-up appointments. ‘Rural liaison officers’ in urban hospitals to focus on the needs of rural patients and their families when staying away from home were also suggested.

For planned travel, all sites provided mixes of DHB funded and voluntary services, with regular bus or shuttle services for patients (and in most areas, a support person) to get from the rural hospital to the larger urban hospital. It was suggested that shuttle buses be big enough to allow more than one whānau member to accompany patients. A day room for patients and whānau to use at the urban hospital while waiting for appointments and return transport was suggested, with refreshment facilities and somewhere to rest when unwell. One study site had a transfer ambulance shuttle which filled the gap between full hospital ambulance transfer and shuttle services, that was well regarded by community participants. Better coordination of appointment and transport options would improve patient experience, such as coordination of
appointment times for rural people so that planned appointments are not at the beginning or end of the day, and multiple appointments were planned together.

All rural people were affected by having to travel for health care, but this was magnified for poorer people. The true costs of travel were not covered by the National Travel Assistance (NTA) funding, and the process of claiming reimbursements after expense were incurred disadvantaged people without ready access to money reserves. The NTA processes were seen as needing to change and mechanisms for accessing funding in advance needed to be developed:

“so [mother]’s got to now get $20 worth of food [that week] so that she can get $100 worth of petrol, to take him [to urban hospital] to get refunded three weeks later. Things take so long.” MH3

It was suggested that the NTA should become accessible through any rural GP’s referral rather than the current hospital or specialist-only referral requirement. Allowing general practices to allocate petrol vouchers when patients needed to travel was suggested. One rural hospital had established a single health travel desk incorporating funded and volunteer transport and a locally based NTA coordinator which had substantially improved people’s satisfaction with the process.

Increased funding was seen as part of the solution with “more emphasis on transport, safe transport and regular transport” (GP3). Questions were raised about how much health care should cost to access, should be it equitable across the region, and how much money should planners apportion towards subsidising access. This connected to the idea of rural people getting a ‘fair go’, and the feeling that this was not happening:

“My experience is patients don’t necessarily want gold-plated; they just want to make sure they’re getting a reasonable service, and it’s fair. They want a fair go. Quite often people in rural communities don’t get a fair go, because of the distance issue.” ECL3
People felt that the availability and affordability of health services for rural communities should be supported more than it was, so that rural people did not disproportionately bear the cost of accessing services as was currently the case.

6.4.5 Access to whānau support

Participants described the importance of having whānau support when rural people were admitted to urban hospitals. This was particularly important for Māori patients, but it applied to everybody, and patient recovery was thought to be quicker with family around.

For rural people with limited finances, families often could not afford to accompany them when they were admitted to urban hospitals. The dislocation from their loved one and the poor information flow resulting from this separation created anxiety:

“...but for a lot of people, if they have to go off to [city hospital], immediately it cuts them off from their natural family supports, because the whānau can’t afford to go there. So you’ve got this individual off in [city hospital], no credit on the phone, and even if they had credit well there’s no coverage - no cell phone coverage in the wop-wops. So, no-one knows what’s happening - at least we haven’t heard that you’re dead, and no news is good news, as far as that goes.” CG2

The financial impacts of having to take time off work, and the disruption of being away from home to support whānau were significant on those with limited discretionary income:

“We’re a single working family, and so if I have to go to [city hospital], which is two and a half hours away, he’s got to take days off work. Days off work means no money for us. No money for us means no food for the kids. It’s the trickle-down effect.” MH3

All places visited had hostel arrangements for whānau to stay at when loved ones were in urban hospitals, which people paid for. Having whānau’s needs for transport and
accommodation routinely planned for when patients were transferred to distant hospitals would improve the patient and whānau experience considerably. Expanding visiting hours policies would allow family and friends to visit rural patients for longer periods. Greater ability for a family member to stay in hospital with the patient and be their active support person was suggested. This was seen as likely to increase the acceptability of being admitted away from home and increase understanding of, and therefore adherence to, follow-up arrangements.

This section has described the importance of access to information, services and whānau support in creating and improving high quality health care for rural communities.

6.5 Summary

This chapter has described the first four of seven themes concerned with delivering and improving health care quality for rural communities. The themes presented were whole of system planning and resourcing, Māori focused service design, greater community participation, and access. The next and final chapter of the Interview Study results present the remaining themes of ‘one service, many sites’ health service networks, capable workforce, and rural-appropriate quality measures.
7 The Interview Study findings: Providing and improving health care quality for rural communities, delivering and measuring high quality services

This is the second of two chapters presenting the key elements in providing and improving the quality of health care delivered to rural communities, as shown in Figure 6.1 on page 97. The previous chapter outlined four of these seven themes, relating to system planning and community-oriented concepts. The three themes related to the delivery and measuring of high-quality health care for rural communities, of ‘one service, many sites’ health service networks, capable workforce and rural-appropriate quality measures are presented here. As noted in Chapter 6, while the focus of the interview study was on hospital-level health care delivery, many of the concepts described by participants were inclusive of rural general practice and community-based health services, as well as hospital services and were seen as interwoven in rural settings.

7.1 Theme 5: ‘One service, many sites’ health service networks

This section describes the theme of ‘One service, many sites’ health service networks. Effective health service networks were seen as crucial for delivering high quality health care to rural communities. As service users, community participants did not see clear distinctions between general practice, rural hospitals, secondary and tertiary hospitals, and services were expected to be co-ordinated:

“If any one of my whānau come in here I would expect that whilst the surgeon or the doctor on the ward or whatever may not be the one that we need for that particular thing - that they are connected to [city] or somewhere. And I just know that is happening; that would be my expectation” MH4

Participants noted that health providers who worked together over distance needed to see themselves as one team working over different sites. Agreement about what
services would be provided at different sites within the network was also important, focused on the patient journey rather than what suited providers.

Participants described four important categories in the theme of a ‘one service, many sites’ patient centred health system for rural communities, where care was provided as close to home as could be done safely. These were 1) culture change and building relationships; 2) network architecture; 3) information technology to support the system architecture; and 4) clear consistent processes. These are shown in Figure 7.1 and described in more detail below. It is worth noting that workforce is fundamental to effective service provision. While workforce is included as a separate theme, the two elements are interdependent.

Components of the ‘One Service, Many Sites’ health service network

- Developing the culture
- Developing the network structure
- Information technology
- Consistent processes between sites

Figure 7.1 Components of the ‘One Service, Many Sites’ health service network
7.1.1 The current state

Participants noted that the barriers to developing a ‘one service, many sites’ approach across health service networks included lack of understanding, trust and respect between urban hospital specialists (and their junior staff), rural hospital medicine (RHM) doctors and rural GPs, each for the other groups. This resulted in misunderstandings of the capabilities of each group, and what each expected from the other in terms of clinical support for acute care and for providing ongoing patient care as close to home as possible. This underpinned a lack of willingness to trust each other and share responsibility for patients:

“There’s a disconnection, the gulf, the lack of communication - the lack of willingness probably on both sides, to share responsibility, and then lack of protocols to share responsibility.” ECL3

This was most marked in the behaviour of junior medical staff (house officers and registrars) at urban hospitals, who did not understand the context of the rural setting. There was a perception that urban hospital specialists did not consider themselves responsible for the health care of all patients within the health service network that their hospital supported. Participation was seen as voluntary, based on the good will and motivation of particular clinicians, rather than an obligation of the role. There was no framework that encouraged or required them to support rural providers as there would be if such responsibilities were systematised and mandated. Some participants noted that while nursing staff in urban hospital wards were keen to send patients to the rural hospital when urban wards were approaching capacity, this seemed not to be reciprocated when the rural hospital was nearing capacity. Poorly co-ordinated transfer or discharge planning from urban hospitals left staff in rural hospitals and community-based services feeling undervalued.

A lack of trust and respect, poor relationships and difficult personalities were all noted by participants as barriers to people working together over distance. The “status quo bias” (GP/RHD1) was noted as a strong barrier to change:
“There’s a status quo bias that humans have and probably a negativity bias as well that makes us cling to the status quo rather than embracing change... I think we underestimate that human default setting for resistance to change.” GP/RHD1

Participants commented that change was seen as someone else’s job and reluctance to change from colleagues could become demoralising for local change agents.

7.1.2 Developing the culture of ‘one service, many sites’

The key aspects identified by participants in developing a culture of ‘one service, many sites’ included ‘one team’ thinking, good relationships and communication, and leadership commitment. These are explored below.

People who worked across the whole network needed to see themselves as part of the same team. A culture of “systems-responsible” people (GP4) focused on patient needs was required. The larger hospital staff needed to consider the smaller hospital and surrounding district as part of their responsibility, with closer connections between general practice, rural hospitals and aged residential care staff locally:

“For me, ideal would be that there’s a single team. It really does not matter whether you’re a GP owning your own practice, or you work in a rural trust or you work with the DHB; you see yourself as a single team for that patient.” PS3

Clinical team engagement in change processes was key to making progress. Good relationships based on mutual respect between the clinical teams in different settings were critical. This was built on communication and trust. Mutual respect for each other’s skills, being prepared to help others within the system and putting the patient in the centre of clinical decision-making facilitated change:

“... you could have a policy and a procedure for certain things, but that’s not going to make the difference to breaking down the barrier. The
difference is going to be that the teams are actually communicating, and talking and building a relationship, and trusting each other...” RHMan2

Participants commented that people were generally busy with their ‘day job’ and struggled to have time and energy to devote to thinking about the broader system and change process. Strong clinical leadership and support from senior management was seen as crucial to bring about the required culture change. Opportunities needed to be deliberately created for discussion and planning between people at different sites within the network and staff needed to be released from clinical duties to participate. Investing time in staff building relationships across the network would return better quality service delivery as a result:

“When you know people, and they’re professional colleagues - not a name - they’re a person you know, then you develop trust, and you have an understanding of people’s capacities and skills.” ECL2

Commitment from DHB leaders to make working at or supporting rural hospitals part of urban hospital-based health providers’ roles was needed. This included appointing people to a geographical area rather than a hospital, or through joint appointment roles across different sites. Regular opportunities for staff at smaller hospitals to spend time maintaining skills in urban centres had helped when in place and could be expanded.

Participants suggested the following approaches to develop a ‘one service, many sites’ culture. These approaches had either been used successfully, had been seen operating in other areas or were thought to be useful, and ranged from informal ‘sharing the same air’ approaches to formalised network embedding. They included

- people making the effort to pick up the phone to communicate across the network;
- opportunities to meet with colleagues across the network at educational meetings (virtually or face to face) or when people are visiting other services;
• establishing formal channels for communication between different partners within the network, such as formal network liaison committees;
• new staff orientation that included people visiting the other parts of their network;
• regular job swaps and secondments;
• having staff work across different settings as part of their role;
• formalising the ‘one service, many sites’ network through formalised agreements, shared patient pathways and job descriptions that clarify the extent of people’s responsibility.

Breaking change processes down in to small understandable pieces focused on the patient journey made it easier for staff to take the small steps needed to reach the end goal. Developing more leaders to progress the change agenda within larger organisations was required. Stable rural and urban workforces enabled these relationships to develop more easily, and adequate staffing numbers avoiding staff feeling overburdened.

Making information about the whole health system visible across the network was seen as helping to change behaviour, for example reporting emergency department occupancy across the health service network. Funding arrangements across different organisations needed to enable investment in activities that benefited the whole network.

7.1.3 Developing the network structure to support a ‘one service, many sites’ approach

This category describes the components of the health service network needed to provide high quality care for rural communities, how components should interact, and where responsibilities lay. The network together needed to define what services would be provided, where, across the network, and common definitions to describe hospitals...
of different sizes and service levels needed to be developed. Participants described the structural elements in the health service network as outlined below.

**Primary and community care services** Primary care, aged residential care, local Māori providers, community care and social care provided in the rural community were key elements of the health service network. Rural general practices were seen as the place where continuity of care for the person and their *whānau* was centred. Community pharmacists were noted as important stable parts of local health services. An increasing role for community based clinical nurse specialists and nurse practitioners in rural communities was envisaged, particularly in health care of the elderly and aged residential care. The importance of including Māori providers in the network was described in §6.2.2, page 106.

**Rural Hospitals** The strengths of rural hospitals were seen as generalism and teamwork. The advent of the vocational scope of Rural Hospital Medicine (RHM), and a cadre of competent generalist doctors with a skill set increasingly understood and trusted by urban specialists, had increased the capability of rural hospitals:

“So, I’ve noticed a difference in trust levels from our colleagues at base hospital; they seem much more inclined to send us people back who are still reasonably sick so they can be treated closer to home, or there’s a lot less angst when you’re referring somebody - they take your word for it.” RHM2

Noting that rural hospitals were located where they were for historical reasons, rural hospitals were seen as hubs where acute illness could be diagnosed and treated close to people’s homes when they needed more diagnostic input or observation than could be provided by their rural general practice team. Generalist rural hospital doctors could rapidly differentiate patients needing intervention for serious problems that could not be reasonably provided in a small hospital and transfer those patients to the larger hospital in their network. Good telehealth and transport linkages allowed transfer processes to work smoothly. Some inpatient capacity was needed, particularly for older
frail people who needed their immediate treatment in an inpatient setting, and would be done a disservice by being transferred to the larger urban hospital, as it made a timely return to home more difficult. The concept of rural hospitals being extended wards of urban hospitals was suggested by some participants.

Rather than trying to be all things to all people, most participants thought rural hospitals should focus on what they did well, and work with their larger hospital colleagues for services they were not able to provide. The loss of general surgery capability over the years at some of the rural hospitals visited was lamented by some. The mobile surgical services bus\(^5\) visited rural hospitals without surgical capacity and the access to low-risk day surgery provided was highly valued by the community. Rural hospitals provided a venue for visiting specialists to provide care, either in person or through virtual clinics. There was a general opinion that more outpatient services could be provided at rural hospitals.

Rural hospitals also provided a hub in the rural community for providing community-based health services. There was potential for the hub role to expand and include greater ranges of health services working in an integrated model. It was suggested that public health and social care services, and services working in the social determinants of health arena, such as housing, education, employment and justice services, could be included in rural hubs. There were inherent risks noted in moving into this largely uncharted territory of greater inter-sectoral working, but the impact of poverty, poor education and youth unemployment was noted to be significant in rural communities and warranted the effort.

_Urban hospitals_ There was general agreement that urban hospitals should be where high complexity services were provided, particularly surgical and other interventional services, such as coronary angioplasty. These were services where economies of scale

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\(^5\) Mobile Health provide the Mobile Surgical Services bus that visits 24 rural communities throughout NZ to provide elective day surgery services and rural health professional education. See [http://www.mobilesurgical.co.nz/](http://www.mobilesurgical.co.nz/) for further details.
and concentration of expertise was seen as the appropriate approach. It was where specialist doctors were located although they would travel out from that central location to provide clinical support to health providers and some clinical services to patients at the rural locations.

Participants noted the importance of getting the interconnection and balance of services between sites right. Clinicians and managers from the different sites within a health service network needed to collaboratively plan and agree what services should be provided where in the network, with urban specialists supporting rural clinicians in a ‘hub and spoke’ arrangement. The balance of what was done where would be different in different health service networks, considering local factors such as distances between sites, geography, local population demographics and staffing capacity. Successful examples in operation were the agreed ‘fly over’ policies for trauma and cardiac conditions where patients would be transferred directly from the rural hospital to the tertiary hospital for definitive care when that was the agreed clinically appropriate approach, with reduced delay for patients.

Decisions should be guided by providing care as close to home as could be done safely. This required honest appraisals about whether existing service configurations in the health service network were providing care of sufficient quality for patients:

“So, if you can’t deliver the same quality of service then we should be thinking about should we be delivering that service in that place? It comes back to the conversation we had right at the beginning; where’s the best place to deliver care? If we can’t deliver the right quality of care in a rural setting then maybe we should not be trying,” PF4

Systematising good will into agreed processes with the funding altered to support this, with clarity around who was responsible for different aspects of the service over distance was required. It was acknowledged that where the balance sat would change as the skill set of generalists increased and technology advanced. Service sustainability was a critical part of this model.
As the interview process progressed it became clear that there was inconsistency in the terminology used to describe hospitals of different sizes or providing different levels of service. Participants used the terms ‘rural hospital’, ‘provincial hospital’, ‘primary care hospital’, ‘base hospital’ and ‘secondary hospital’ for hospitals that were designated as rural hospitals by the Faculty of Rural Hospital Medicine. The terms ‘base hospital’ and ‘secondary hospital’ were both used to describe larger urban hospitals. The term ‘tertiary hospital’, to describe hospitals providing highly specialised services, was the only term used consistently:

“Rural and provincial [hospital] I use almost interchangeably. ... I’d probably use tertiary, secondary and primary; primary being outside the hospital, secondary being in a hospital - probably in a hospital, and to call it a secondary hospital I would probably include the ability to operate, so an operating theatre.” RHD4

For some participants, the presence of onsite specialist services was the defining point between a rural and secondary or base hospital, for others, the presence of a 24-hour surgical service. Other participants categorised different types of hospitals based on size of the community served, the needs of the community and isolating geography, rather than services provided or the medical workforce providing services. Within the ‘rural hospital’ term, participants described a gradient of smallness, from facilities with several overnight beds with medical services provided by rural GPs, through facilities with more than 20 beds and a full complement of rural hospital medicine doctors, to facilities even larger with some resident specialists.

For one participant, changes in the medical workforce from GPs to RHM doctors within one physical hospital site had changed how they described the hospital, from a “cottage hospital” to a “really good secondary care” hospital (PS2). Another participant saw that ownership was important in defining hospital definitions, as DHB ownership implied their hospital was secondary, whereas if the hospital were community owned it would become a rural hospital. Conversely, staff at the rural hospital owned by a community
trust in the study described it as providing secondary care, which was consistent with
the description on the trust’s website.²²³

It was noted that the model of care was changing at the smaller base hospitals around
the country, such as at Grey Base Hospital. Generalists and specialists were both
employed on site, and it was listed as a rural hospital by the Faculty of Rural Hospital
Medicine.

The different meanings attached to words used to describe different hospital types was
noted as potentially causing confusion. People tended not to have thought much about
the terms they routinely used. The need to develop agreed definitions for hospitals that
reflected the staffing and services provided across the health service network was
identified. It was considered that this should be done at a national level, led and
endorsed by the MOH, but that local nuances would always exist.

7.1.4 Information technology’s ability to support the network

This category relates to the participants’ suggestions of how technology could support
high quality hospital care for rural communities, whilst acknowledging the need for the
right balance between face-to-face services and using telehealth technology across the
network.

A greater role for telehealth in how rural services were provided was seen by many
participants as the way of the future. For planned care, it was frustrating for patients to
have a six-hour return trip to have a short conversation with a specialist. When
appropriate for the needs of the consultation, most participants preferred the
convenience of a telehealth consult as it saved time, disruption to family life and work,
and travel costs for patients and their whānau, although a few participants still
preferred the personal touch of face-to-face consultations, as noted by some older
community focus group and Māori hui participants (see §6.2.1, page 104). Telehealth
was also useful when specialist travel was disrupted by weather. The renal service in
Northland and the child health service on the West Coast were examples where virtual consulting was an integral part of the clinical pathway and its use improved patients’ experience and reduced unnecessary travel. Oncology, dermatology and cardiology were other areas where virtual consultations had been used or were seen as easily implementable.

Three sites had integrated telehealth into their unplanned acute care pathway, between the rural hospital and the larger hospital. It was useful for advice when providing urgent care to patients, either before or instead of transfer to a larger hospital, and patients’ experience was positive:

“I was laying back in the bed and they had the screen up in front. I could not make out everything that was on it, but my son was standing there next to the doctor. They brought a doctor on line, a senior doctor, and they were standing there. He [the doctor with me] was talking to someone in [large hospital] and they were explaining everything on the screen, of what was going on. Oh, it was just amazing.” CG4

Embedding virtual consultations as usual practice was seen as a change management process in itself, to overcome clinician reluctance. Older staff members were viewed as being more resistant to adopting new technology and practices. Clinicians on both ends of a technology link needed to want to use it and be familiar with how to use it for it be successful. The resistance to using virtual consultations was seen as coming from the urban hospital clinicians as its value was not as clear to them, and one participant commented that “It's almost that it's a bit annoying for them...” (PF2) Despite this, there was general agreement that adoption would increase inevitably with time, as people became more familiar with the technology, and developed processes around its use.

The success of implementation seemed to be related to enthusiasm and support from clinicians and management, particularly at the central site, rather than the actual technology and where it was sited. Implementation strategies employed included ‘working with the willing’ and promoting successes by enthusiastic clinicians to bring
slower adopters on board. Developing clinically focused ‘hooks’ helped promote different behaviour. One site successfully “flipped” (RHMan4) the reporting to specialists on telehealth usage from reporting the number of telehealth sessions a specialist had undertaken to reporting the distance travelled by patients to each outpatient clinic:

“So just changing that report created new conversations with the specialist... So, we’ve actually started to get a much wider audience of different specialists looking at how we can provide services through tele-health.” (RHMan4)

Processes that created a decision point for clinicians about face to face or virtual follow-up care helped to change behaviour. An enabling management environment encouraged staff to look for new opportunities and give them a go.

Clear protocols and practical support for telehealth use needed to be in place, such as technical support, booking processes and how to conduct virtual consultations, particularly as people were becoming familiar with it. Having a clinician (often a nurse) with the patient helped planned virtual consultations go smoothly. Developing a structured way to include telehealth within clinicians’ regular workflow was important, so that it was not an add-on to their existing workloads. The siting of telehealth units needed to be agreed between clinician users at both ends of the network and used regularly so that when units were needed in a clinical situation (particularly when urgent) clinicians were familiar with how to establish the link quickly. Older clinicians need dedicated time to learn new skills, which was often done in their own time. The system leaders needed to be committed to making telehealth work at the larger and smaller sites within the network, and adequately resource its implementation.

Telehealth was seen as part of the overall service design for integrated care pathways and needed to be balanced with in-person services. Ongoing face to face contact between larger hospital clinicians and rural clinicians produced less tangible but definite benefits. Continuing education opportunities with the rural clinicians and
building and maintaining relationships between clinicians allowed the network to function effectively, as well as videoconferencing for professional development and case discussions. Face-to-face consultations developed relationships and rapport with patients.

Other applications of technology to improve clinical care were noted. Different information systems within primary care, mental health, community services and between different hospitals were seen as barriers to integration. Many community and hospital settings were still using paper based clinical records and different administrative computerised systems were used across all settings. Developing shared electronic health records that all health care providers within the health service network could access was seen as fundamental to improving the quality of care delivered. Shared or viewable electronic health records across different hospitals and with general practice were highly valued by participants where available. Electronic e-referrals and agreed electronic health pathways improved patient flow and ensured referrals did not fall through the cracks.

Affordable reliable rural broadband and fibre to the door was seen as critical. Connectivity, coverage and reliability issues in rural settings needed improvement. The videoconferencing system commonly used in DHB hospitals required a large band width that many rural areas could not support. Easy interoperability between different videoconferencing systems using newer lower band width solutions were being used in some areas and needed to become the norm.

7.1.5 Clear consistent processes between different parts of the network

This category describes participants’ views that clear, easily accessible processes, policies and protocols needed to be developed, agreed and consistently applied by all parts of the network.
Clarity for the patient, and the system, about who was leading the patient’s care, and who were key members of the care team at different stages in the patient journey across different parts of the network was seen as important. This would also reduce waste, for example patients who travelled for planned surgery that had to be postponed because certain tests or resources were not in place prior.

Consistency of handover processes was critical within and between sites to provide continuity and high quality patient care. Communication tools such as the ISBAR tool\textsuperscript{229} (a structured process for communicating between clinicians about a patient), as shown in Appendix 14, was used at one site. Another site had developed its own patient transfer checklist to aid consistency.

Several participants suggested that a central coordination centre to support telehealth and patient transfers for the whole of New Zealand be established, similar to the Queensland approach where coordination of all acute patient transport and specialist telehealth support for the entire state were provided.\textsuperscript{230} This would provide ready support to rural clinicians acutely and allow coordination of air transport across the country to minimise patient transfer delay and maximise efficiency. One site was working directly with an Australian telehealth provider to support the implementation of telehealth into their clinical workflows.

Participants noted that consistent processes for admission from general practice into hospital, transfer between rural and urban sites, and discharge home needed to be agreed, widely available and applied. While the decision to transfer should be based on what was best for each patient, common standards and processes needed to apply relating to the transfer process, with some flexibility to accommodate inclement weather. These related to the mode of transfer (for example time critical or personnel critical transfers by air), the staff skill required for the transfer, and formal handover processes at each end. It appeared that different regions had different approaches to how transfers were manned with local nurses, depending on volume of transfers, but there should be an agreed skill set for staff who accompanied patients on transfers. How
that was provided would differ depending on local circumstance, with the ongoing tension again between generalism and specialism noted, here in the nursing context of general nurses and specialised transfer nurses.

Different sites had different approaches to returning patients to their rural community from the urban hospital, which sometimes left discharged patients stranded in urban settings to find their own way home. Consistent discharge planning provided opportunities for improving patient journeys, including involving primary care practitioners in the discharge process, and planning follow-up care for rural people that was easy to access.

This section has described the health service network required for high quality rurally focused health services. The health workforce is interwoven into the network structure and together these could be described as the model of care or service delivery model for successful health service networks operating over distance. The next section considers the rural health workforce.

7.2 Theme 6: Capable workforce

This section describes the theme of the aspects of a capable workforce, as outlined in Figure 7.2. Health care providers needed to be able to communicate and build relationships and be competent in understanding and respecting Māori views and cultural needs. The role of rural generalist clinicians and urban hospital-based clinicians are described. The importance of maintaining and developing existing and new workforces to support successful networks is covered.
Workforce components of high quality rurally focused health service network

Communication & relationships
Capable workforce
Cultural capability
Rural generalists
Current & future workforce support
Urban hospital clinicians

Figure 7.2 The components required for a capable workforce in a high quality rurally focused health service network

7.2.1 Communication and relationships

Communication and relationships were key components of quality, both with patients and whānau, and with other members of the health care team, including those at distant sites.

Including patients and their whānau in decision making was important. Participants discussed the value of listening, caring, compassion, kindness, and not being rushed. Making patients feel valued and treating them respectfully was perceived to be at least as important as clinical expertise. Staff in smaller hospitals were perceived as having more time to care. The perceived ability of smaller hospitals to be able to bend the rules to meet the needs of patients, such as allowing a dying patient’s dog to stay with him in hospital, was appreciated.

Participants valued teamwork and communication between health providers. The relationships between the clinical teams in rural and urban hospital settings was seen
as critical for good quality care for rural patients. People wanted to receive their health care as close to home as could be done safely. For this to happen reliably, health care providers in different settings needed to work together. Professional respect was important. Trust and confidence held a network together:

“What makes it work is trust and confidence, building relationships, clear pathways, clear referral processes; all of that. It does not just happen... I know that I pick up the phone, I want to talk to such [and] such, they're actually going to talk to me and they're going to understand my context.” ECL4

As noted in §7.1.2, established relationships with long term staff made this easier, compared to when there was high staff turnover or high locum usage.

7.2.2 Cultural capability

Māori participants indicated that providing care that was respectful of one’s culture was core to being competent. Respect and connectedness were recurring ideas:

“The cultural stuff; Te Ao Māori view, but if we go broader than that, too - it’s respect. It’s respect that this a person in front of you, that this person is potentially a grandma, has a number of kids, she could have been a nurse at one time so don’t make assumptions of who the person is, and always provide the absolute best care that you absolutely can...”MP4

Providing holistic care and recognising that Māori were connected to their wider whānau and their presence was important when people were unwell. Understanding the role of te Reo Māori and karakia in people becoming well when they were hospitalised, and tikanga, especially around death, were important.

Understanding Māori views of health, such as Te Whare Tapa Whā and Te Wheke was also discussed. Whilst the views expressed were mainly in relation to Māori service
users, the importance of respecting people's culture, wherever they were from, was also noted.

7.2.3 Rural generalists

Medical and nursing participants described the elements required in a competent rural health practitioner. These included clinical skills, personal attributes and interpersonal skills. The clinical skill set required was related to having a broad skill set with well-developed emergency care skills and the ability to deal with “everything coming through the door” (RHN1). It was important to be able to work more independently than in an urban setting, because “you don’t have a whole layering of sub-specialists that step in and take over” (ECL4), but also to know one’s limits and when to call for help. A good rural practitioner was seen as being flexible as a person, being relaxed about being on-call, enjoying autonomy, while being good in a team.

Nurses in rural hospitals had greater responsibilities in the patient care team than nurses in urban hospitals, for example triaging patients at night and undertaking certain diagnostic or treatment actions under standing orders. This was suggested as being parallel to the registrar-consultant team process practiced in urban hospitals. The ability to run effective interdisciplinary teams across hospital and general practice was also part of this, and two of the sites visited described active daily interdisciplinary collaboration around inpatients and patients in the community who were at high risk of admission.

People needed to be happy to live and work in a small community. Participants noted that there was an interdependence that came with living and working in a small community, as today's patient was “the mechanic that you needed tomorrow to fix your car” (GP/RHD1) and this required a higher level of interpersonal functioning than required in more anonymous city settings:

“You can’t be arrogant and rude, because you’re just so interconnected with the community that you serve...you have to be humbler in a rural
area because of the higher interaction that you have with your patients.”

GP/RHD1

Job satisfaction was described as coming from the breadth of the scope of practice, the sense of teamwork and the close connections locally with other health care providers and other agencies within the local community, that tended to be diminished in larger settings. The generalist approach where the needs of the whole person were able to be considered and the person able to be understood within their whānau context was also highly valued.

The broader skill set required by rural health providers compared to urban colleagues was seen as a both a positive and negative – it provided more job satisfaction, but also meant having to do more than urban colleagues, particularly in the amount of emergency care provided, and out of hours on-call required, which could be stressful. Rural clinicians experienced difficulties getting relief locum cover which could make getting time away from work difficult.

Professional isolation and social challenges for health care providers and their families were noted, particularly the lack of anonymity in a small community:

“If living in a fishbowl is impossible for you, you won’t survival in rural.”

GP/RHD1

Other challenges of limited employment for partners and schooling opportunities for children were reported.

The increasing skill set of RHM doctors was seen to be improving the quality of rural hospital care and was noted as having potential to further evolve. Expanding the scope of RHM doctors into special interest areas such as geriatric medicine, cardiology, oncology, paediatrics, gynaecology and endoscopy, as part of a team with the network’s specialists in these areas was discussed. Some areas were developing these linkages.
These expanded roles kept people's work interesting, improved the ability of a team of generalists to provide care for rural people locally, and enhanced the sustainability of RHM roles at rural hospitals by increasing the number of doctors available for the on-call roster. The potential to expand rural hospital medicine and rural GP scopes of practice through appropriate training to include GP obstetricians, GP anaesthetists and GP endoscopists was raised, and a small number of RHM doctors planned to embark on this path.

Some participants raised the risk that increasingly highly skilled RHM doctors may not want to work in smaller rural hospitals where they were really needed, without easy access to CT scanners and other supports that the larger rural hospitals had. Smaller rural hospitals were seen as too small to employ RHM doctors exclusively without them working as GPs as well. Dual RHM and rural GP training was seen as part of the solution, and the continued ability for GPs to work in smaller rural hospitals without being RHM trained. As the numbers of dual trained rural GP and RHM doctors increased over the next few years, it was thought that supply and demand would increase the attractiveness of communities with small rural hospitals.

7.2.4 Supportive urban hospital clinicians

While urban hospital clinicians working on the wards were not interviewed as part of this study, participants described the characteristics of supportive urban hospital clinicians and identified unhelpful behaviours during the course of the interviews and focus groups.

Some participants commented that some urban hospital medical specialists did not support generalists to work at top of the generalist scope of practice and were not willing to devolve work to, or work with, generalists. This was attributed in part to specialists’ lack of confidence or experience in non-traditional ways of practicing:

“Our ED specialists are still coming to grips with the fact that part of their role is backing up GPs in a rural hospital.” ECL1
It was also attributed to specialists wanting to protect their professional ‘patch’:

“I think that's just one example of how ... we’re not really prepared to bring in a doctor to compete in our space, because it's kind of seen as competition, rather than assistance. ... There’s not enough work for me - I can’t bring anyone else in, let alone a generalist.” GP4

The increasing numbers of rural generalists was seen by one participant as having increased this behaviour. Some specialists were seen as using quality as a way of retaining control over processes.

Urban clinicians who saw it as part of their responsibility to support rural clinicians to provide care to rural communities were highly valued. “Rurally focused urban specialists” (GP4) (a term coined during the development of the Transalpine Health Service on the West Coast) were designated urban specialists whose formal role included supporting one or more rural areas. At other sites, certain urban medical specialists had taken it upon themselves to work with their rural GP and nursing colleagues, as they saw that this was the best way to provide care to their dispersed rural patients, as examples of “systems-responsible” (GP4) clinicians as outlined in §7.1.2.

A willingness by urban colleagues to try new ways of working such as telehealth technology, and trust the judgement of rural colleagues and responded accordingly was valued. Urban clinical leaders who made the effort to visit their rural hospital colleagues (doctors and nurses) were highly regarded.

7.2.5 Supporting the current and future workforces

Having a competent, well-trained rural workforce was a key element in the success of rural health services:
“We haven’t quite understood - I think it’s the system actually - workforce is always going to be our constraint. So, we have to get better at using it.” PF4

Workforce shortages and the impact of the ageing workforce were seen as not unique to rural communities, but the effects were felt more acutely due to the already small staff numbers. Rural workforce shortages impacted on patients, who needed to travel if services could not be provided locally; and on rural clinicians as working short-handed reduced job satisfaction. Shortages led to high use of locum staff which reduced continuity in patient care, and locums were often unaware of local network processes. Having locum staff to fill gaps in rosters could make more work for the permanent staff, “clean[ing] up their messes’ (RHM2). Workforce shortages were noted to impair teams’ ability to innovate to meet local demand. One participant commented that innovations always worked as long as there was adequate staffing resource.

Urban health providers in a well-functioning health service network could support rural services when recruitment and retention issues meant rural services were understaffed. Protecting permanent staff from burnout and rural departure was important as it was seen as more efficient, and probably safer, for staff to maintain already established relationships with other health providers than continually re-establish relationships with new staff. It was noted that there was a virtuous cycle of job satisfaction linked to workforce stability:

“I think you meet a critical mass, and once you meet critical mass, it becomes a good place to work...Once you get that permanent staffing, a bit more recognition for what we do, and you get to know people, you actually get to keep your patients with the advice, and follow the advice [from the urban hospital]. It makes the job more satisfying, and if you're satisfied in your job, you stay.” RHM2

Good orientation for new staff to their immediate area and the parts of the wider network that they needed to interact with was important in staff retention. Existing staff making people from other settings feel welcome when visiting or orienting to new
settings would assist this. Providing good peer support and clinical oversight for rural practitioners avoided professional isolation. This was seen as particularly important for allied health professionals who were often sole practitioners in rural areas.

Interconnected workforce planning and investment was required to meet the needs across the whole network. Local solutions could develop when innovative thinking was applied, freed from the traditional 'craft group' role constraints of what a nurse or a physiotherapist does, for example. Greater roles for unregulated workforce were discussed roles, including roles such as health care assistants, health navigators, Kaiawhina (assistants) and Māori health workers. These were roles where lay people could be trained to provide support for people and/or undertake some limited clinical skills under the oversight of the regulated workforce (doctors, nurses, allied health professionals) while freeing up the capacity of the clinicians to work at the top of their scope.

Regarding rural clinical training, all sites visited had active connections with student and junior staff training programmes in medicine, nursing and allied health areas. Some had formal RHM training programmes running and all were involved in nursing first year entry to practice (NETP) programmes. Connections to academic institutions and teaching students were noted to improve job satisfaction and provide impetus to keep one's skills and knowledge current.

Students and junior staff exposed to rural learning settings were seen as more likely to work in rural areas in the long term. Those students and junior staff who would eventually work in urban settings but spent some of their training in rural settings were seen to be more able to support their rural colleagues from the urban part of the network as they understood what it was like in the rural setting.

Rural communities were supporting their local young people to train in the health workforce through scholarships, but it was noted that it was hard at times to get the local students to apply. ‘Homegrown’ was generally seen as a good way to retain staff,
both for the local community or for New Zealand as a whole. Greater use of the Health Workforce New Zealand's voluntary bonding scheme,\(^6\) which allowed for annual payments in return for working in hard-to-staff rural communities, was suggested as a way of encouraging young health professionals to work in rural communities.

This section has examined the theme of workforce in improving health care quality. The next section addresses the final theme of the Interview Study, the theme of quality measures to improve quality for services provided to rural communities.

### 7.3 Theme 7: Quality measures appropriate for rurally focused health services

This section turns to the theme of quality measures appropriate for rurally focused health services and their contribution to improving quality for hospital services provided for rural communities. It relates to views regarding the quality of health care across rural and urban settings, and the importance of contextualising quality to the local situation. It outlines suggested appropriate quality measures for services providing hospital care for rural communities and how these could be used drive quality improvement. These concepts are shown in Figure 7.3 and described below.

#### 7.3.1 Quality as experienced across rural and urban settings

Participants expressed a variety of opinions regarding whether the quality of health care experienced in rural and urban settings should be the same or different. There was a general perception that the quality of care provided in smaller rural hospitals was different from larger urban hospitals. Staff working at rural hospitals were seen to have more time to provide patient centred care, with more of a family feeling:

“They know some of the nurses. They’ve got their own GP looking after them in hospital. The family can visit and help out a lot more. From the

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patient’s mental health perspective, there’s a huge difference between being a number in a big secondary or tertiary hospital, and being back closer in a rural hospital.” GP/RHD1

This compared to the view that staff in urban hospitals were overworked and struggled to have time to care as they were so busy with clinical tasks. Participants expressed concern that their whānau were not getting the best care in urban hospitals, so were reluctant to leave them alone, but because visiting hours policies were stricter, they had to do this.

**Quality measures for high quality rurally focused health services**

![Diagram of quality measures]

Participants who were rural health providers thought that providing whole person care through a generalist approach was better quality care. Most community participants agreed, but a few thought that the care received was better in larger centres, and noted that the familiarity of a smaller hospital sometimes risked masking poorer care:

“...So the care up here [rural hospital] was quite minimal. ... The care in [urban hospital] was definitely clearly better than here. When we got to
[large city hospital] it was really clear that the care down there just superseded everything we had come across ... and it probably saved her life, and the care was just clearly way better." CG2

In terms of the ideal, participants were generally of the view that quality as experienced from the patient’s perspective should be the same in smaller and larger hospitals:

“I think wherever you are, quality should be the same.” RHN1

A few people thought that quality should be measured differently because of the underlying difference in services being provided at larger and smaller hospitals:

“I guess they’re trying to achieve different things, aren’t they? So maybe they would need to be measured differently.” RHD3

Many participants noted that while, from the patient perspective, quality should be the same in different settings, how quality outcomes were achieved would be different in different settings.

7.3.2 Common quality measures across rural and urban settings

Participants suggested a range of measures that could monitor improvements in the quality of health care provided to rural communities, and these are summarised in Appendix 15. Measures fell into two categories, those relating to the patient experience, and those relating to the systems within which care is provided. The majority of views were that the measures used should be the same for rural and urban settings, and focused on patient experience and outcomes:

“If you’re looking at it from a patient’s perspective Carol, it should be measured the same. If the patient’s at the end of it, we should be delivering the same standard of service irrespective of where we’re delivering it.” PS4
In particular, universal aspects of good quality patient care such as hand hygiene, fall prevention, and procedural interventions should be measured consistently:

“It’s only one quality for [fixing] a Colles’ fracture; it’s either done or it’s not - one quality.” GP4

Other suggested universal quality measures included standardised mortality ratios, length of stay, communication, and patient experience.

7.3.3 Rurally focused quality measures

In addition to universal quality measures above, rurally focused quality measures were suggested to reflect the differences in how services were provided in the rural context. These are shown in Table 7.1 and include measures of access to services and timeliness of treatment, and equity and fair distribution of resource. The largest group of rurally focused quality measures suggested were related to the transfer of care between hospitals, and transfer of care home. Patient transfers between hospital settings were frequently raised as a high risk activity that required diligent focus:

“One of the main safety concerns I always have is about patient transfers. I think that’s one of the most unsafe things we do... In theory they should not really be, when they’re being transferred - they should not be in a lesser standard of care to what they’ve come from, but that pretty much always happens, so you’ve just got to judge how much lesser is okay and how much isn’t.” RHM4

Communication between staff at different hospitals, with the transporting staff and with the patient’s family before, during and after transfer; and the timeliness of and skill level of those undertaking transfer and the patient experience during the transfer were seen as important quality measures.
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<tr>
<th>Measure Type</th>
<th>Suggested measures</th>
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<tbody>
<tr>
<td>Access</td>
<td>Access to services</td>
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<td>Network structures and processes</td>
<td>Timeliness of care</td>
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<td>Planning the transfer</td>
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<td>Is the transfer needed?</td>
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<td>Is the transfer to the right place of care for that patient?</td>
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<td>Is the mode of transport appropriate and timely?</td>
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<td>Is the time from decision to patient leaving, appropriate?</td>
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<td>Is setting up the transfer easy?</td>
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<td>Is the family informed about the transfer process?</td>
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<td>During the transfer</td>
<td>Is there clinician to clinician handover at start of transfer?</td>
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<td>Is the patient comfortable?</td>
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<td>Are the staff trained and skilled for the transfer?</td>
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<td>Is the right data captured during transfer?</td>
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<td></td>
<td>Are staff comfortable during transfer?</td>
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<td>At the end of the transfer</td>
<td>Are the receiving hospital expecting the patient, and ready for their arrival?</td>
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<td></td>
<td>Can the staff get back to their start point easily?</td>
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<tr>
<td>Handover of care from hospital to community setting</td>
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<tr>
<td>Fair distribution of resource</td>
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<td>Value for money measures</td>
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When patients were discharged from an urban hospital, communication between different hospital sites and general practice was also seen as important. This allowed appropriate transport to be in place when people returned home and prepared rural general practice teams to expect the person back into their community, so follow-up could be arranged once the person was back home.
Monitoring these measures was seen as important as it would allow quality improvement activities to be developed to improve rurally focused services. Developing a nationally agreed suite of measures was suggested. The measures could be monitored across rural communities and health care providers to develop quality improvement approaches that could be shared between similar settings.

7.3.4 Contextualising quality measures to local circumstances

Participants generally agreed that consistent quality measures should be used, and that contextualisation to local circumstances should occur in the interpretation of measures. Contextualising any identified variance within the local setting was important to interpreting measures. Variance did not automatically mean “this one’s good and this one’s bad” (ECL3) and further analysis was often required:

“It might be that we look at the baseline from New Zealand which is largely urban-driven, and say, right, well we’re below that. Then as long as we understand why we’re below it, if it’s an acceptable reason, then that’s okay, and that’s actually the reason for having the quality measures; you can drill down and say, what’s the variance and why does it exist? If it’s an acceptable variance then that’s fine. If it’s not an acceptable variance then what do we need to do to fix it.” RHMan3

Taking patient complexity into account was important when interpreting quality measures. Rural patients transferred to an urban hospital were likely to be sicker than those in rural hospitals, which needed to be considered when analysing rural patients’ outcomes in different settings. The case-mix of patients being treated in different sized hospitals also needed to be understood when interpreting quality measures, for example a tertiary hospital that provided a national service compared to a rural hospital.

7.3.5 Quality improvement approaches

A wide range of quality assurance and quality improvement activities were happening across rural general practices and rural hospitals. Examples of quality improvement
approaches in rural hospitals included daily board rounds or staff huddles to have an interdisciplinary team approach to care every day; visual display boards at each patient’s bed showing important information such as falls risk; processes to allow staff to quickly orientate to new ward environments when moving between wards and hospital sites and staff training focused on patient transfer skills, and regular feedback of audit activities:

“I find the staff doing audits is really good, because then they take ownership, and it’s a good learning thing for them. So when we do an audit, we’ll do an audit and then we’ll do a report on it, and how we’re going to go about it, its plan, do, study, act, and we just work through that.” RHN2

Focusing on the use of patient time as a quality improvement driver was improving the patient experience. This included a focus on useful versus not-useful time whilst a person was admitted, and distance people travelled to receive outpatient care. The importance of clinical leadership in making quality improvement part of everybody’s daily work routines and responsibility was noted.

Maintaining the broad range of skills required to work in a rural hospital was noted as a significant budgetary and staffing challenge but was critical to maintaining quality. There were few staff with dedicated quality roles in smaller rural hospitals but the expectation was that all the quality aspects that the larger urban hospitals covered would be met, which could be challenging. One site had the services of a quality improvement co-ordinator working across several rural hospitals.

Further developing national rural hospital networking opportunities was suggested, for example regular virtual meetings for rural staff with a quality improvement focus. Credentialing for rural hospitals, benchmarking between similar rural hospitals and having rural hospital medicine departments within relevant DHBs was suggested. For GP-led smaller rural hospitals, guidance around the skills-based courses that GPs should attend would be useful.
This section has described how quality was considered in urban compared to rural settings, and how measures could be used to improve health care quality provided for rural communities. Inter-hospital transfer was noted as a high-risk part of the patient journey, and quality measures to drive quality improvement in this and other areas were suggested.

7.4 Summary

This chapter has described the last three of seven themes concerned with providing and improving health care quality for rural communities. The themes presented were ‘one service, many sites’ health service networks, capable workforce, and rural-appropriate quality measures. The next chapter discusses the findings of the Interview Study, by summarises the findings, considering the findings in the light of existing literature and discussing the strengths and limitations of the Interview Study.
8 The Interview Study discussion

The previous four chapters have described the methods and results of the Interview Study and this chapter discusses these findings. A summary of the main findings is first presented, then the study's findings are discussed in the context of existing literature. Finally, the strengths and limitations of the Interview Study design are discussed.

8.1 Summary of findings

The views of 109 participants, gained through eight community and Māori focus groups and 34 interviews from four NZ rural communities were analysed. The two North Island study sites had significant Māori populations, as well as high levels of socioeconomic deprivation, whereas the two South Island sites had much lower Māori populations, and lower levels of socioeconomic deprivation, but further travel distances to urban facilities. Although focused on hospital care, participants contributed views on the wider health system. Thematic analysis of the data identified the following themes.

‘The Rural Triple Aim’ was developed as an adaptation of the NZ Triple Aim\textsuperscript{12} for rural contexts, outlining participants’ views of the principles of high quality rurally focused health care services. It described patient- and whānau-centred care including location of care preferences, as close to home as can be done well, with quality everybody’s job; consistent team-based care across distance equitable for Māori and the whole rural community; and sustainable health service networks focused on value, where value was more than value for money, and included value for care and improving patient flow across distance.

Seven themes were presented describing the key elements identified by participants relevant to providing and improving health care quality for rural communities, particularly when they required hospital level care. These were elements relating to system planning and community-oriented concepts of whole of system planning and resourcing, Māori focused service design, greater community participation, and access;
and elements related to delivering and measuring quality services of ‘one service, many sites’ health service networks, capable workforce and rural-appropriate quality measures. The elements described are summarised below.

Adequate equitable resourcing for the whole health service network was needed. It appeared that people from rural communities subsidised their health care in ways their urban counterparts did not, which raised questions of equity, particularly for poorer rural people. Agreed rural definitions for health service planning and provision were required. Developing an agreed definition of rurality for health purposes would assist planning and resource allocation processes. Services were seen as needing to be adequately resourced, and fairly distributed across the whole region’s health system so that rural communities got a ‘fair go’. Outcomes based funding for the health service network or capacity-based funding for rurally based services were suggested as alternative funding mechanisms.

Māori focused service design related to the consistent view that more should be done within the health system in NZ to focus on cultural competence and improving Māori health outcomes. Making main stream hospital services welcoming to Māori and including Māori providers in the network as well as focusing on the impact of service design on Māori outcomes were required.

Community participation needed to be embraced for its potential to contribute positively to service design and delivery that meet the needs of rural communities. Services needed to be responsive to community input. Genuine consultation and stronger community input into system co-design and ongoing service provision was needed.

Appropriate access to local and distant services, information and whānau support was required. The approachability of services available to rural communities could be improved through consistent, easily accessible information through multiple media channels. Acceptable and affordable local service provision could be improved by
attention to what services could be provided locally, including using telehealth. Appropriate transport options for planned and urgent care were needed to make distant services accessible, including reviewing the National Travel Assistance funding to make accessing distance services affordable and acceptable, particularly for people with lower incomes, and better coordination of transfer services. Support was needed for whānau to make it affordable and possible to go with patients when they needed distant services.

Rural hospitals were important to local communities, and people preferred to receive care there if possible. ‘One service, many sites’ health service networks of primary and community care services, rural hospitals and urban hospitals could deliver coordinated consistent care with agreement about what services were provided at different locations across the network to support the delivery of high-quality health care to rural communities. Key elements included building a ‘one team’ view, based on relationships and communication over distance, and leadership commitment to this process. A common language to describe the roles of hospitals of different sizes and service levels within the network would help the network structure to evolve. Realising information technology’s full potential to support the network through telehealth becoming part of usual care was discussed, and suggestions were made to increase uptake to bring about the change in clinical behaviour to facilitate this. The importance of clear consistent processes between different parts of the health service network, particularly relating to communication and coordination of services; and admission, transfer and discharge processes, were highlighted.

A capable workforce was required, able to communicate and build relationships and competent in understanding and respecting Māori views and cultural needs. Rural generalist clinicians and supportive urban hospital clinicians were necessary to make the system function. The importance of workforce development was underlined, including staff retention and job satisfaction, a greater focus on generalism in workforce planning and developing new workforces, and recognising the importance of rural clinical training.
It was agreed that the quality of health care experienced by patients and their whānau should be the same regardless of rural or urban hospital location, but how it is achieved would vary in different settings and quality standards needed to reflect and be interpreted in the context of what was done in rural settings. The development of quality measures to assess and improve quality, both universal and rurally focused, particularly around the patient transfer process, were suggested. Once contextualised to the local situation they could be used to drive quality improvement approaches.

8.2 The Interview Study findings in the context of other research

8.2.1 The Rural Triple Aim

This thesis contextualises the NZ Triple Aim for rural settings. The IOM’s quality framework has six pillars of quality, being care that is safe, effective, patient centred, timely, efficient and equitable. The IHI’s Triple Aim explicitly takes into account population health and per capita cost as well focusing on the individual patient experience of care. Many quality frameworks used internationally are generally based on one of these two models and are compared in Table 8.1. The NZ Triple Aim has been adopted by the NZ health system with modifications to explicitly include equity, and focus on best use of resources rather than cost reduction.

This thesis has developed a Rural Triple Aim, taking the underlying values of NZ’s Triple Aim for Quality Improvement and adapting the elements to be particularly relevant to health care quality for rural communities. This includes considering people’s preferences for where treatment is provided, and a focus on as close to home as can be done well, in contrast to the NZ Triple Aim’s focus on the individual’s improved quality, safety and experience of care. It includes explicit reference to team-based care over distance, and a focus on equity for Māori and the whole rural community, compared to the NZ Triple Aim’s improved health and equity for all populations. It notes the importance of service sustainability and health service networks in the system, with acknowledgement that value in the rural setting is more than value for money, expanding the NZ Triple Aim’s best value for public health system resources.
specific health frameworks of *Te Whare Tapa Whā* and *Te Wheke* are focused on health from a Māori world view, and while not being specifically rural models reflect the values of rural Māori, such as the importance of the family, land and heritage in health, as well as the physical, emotional and spiritual wellbeing of the person. Although *Te Whare Tapa Whā* and *Te Wheke* have elements of quality within them, they are not quality frameworks per se.

No literature was found that previously describes a rural version of the IHI’s Triple Aim. The IOM has developed a rural quality framework for the US based on their six elements of quality. The Queensland state government in Australia developed guiding principles for high quality rural health services in their state that has many of the elements as the Rural Triple Aim (person focused, health outcome focused, quality, safe sustainable, accessible, culturally appropriate, with formal linkages to higher level specialist services, enabled by telehealth) but without the explicit focus on value in the Rural Triple Aim proposed here.

### 8.2.2 Quality elements for rurally focused health services

Seven elements needed for high quality rurally focused health services were constructed from participants’ views of what was important for high-quality hospital-level care for rural communities. These were 1) adequate resourcing that was fairly distributed, 2) Māori focused service design, 3) community participation, 4) access, 5) health service networks with appropriate structures and processes including information technology, 6) a capable workforce, and 7) rurally focused quality measures. These findings were similar to the IOM’s conceptual framework for a core set of services and infrastructure needed for rural US health systems. They proposed five key areas to focus on: 1) being focused on community level population needs, 2) rurally focused quality improvement structures, 3) workforce and community capacity development, 4) adequate finances and 5) investing in information and communications.
### Table 8.1 Dimensions of health care quality – comparisons of international frameworks

<table>
<thead>
<tr>
<th></th>
<th>Institute of Medicine(^{103})</th>
<th>World Health Organisation(^{105})</th>
<th>National Quality Board, NHS England(^{106})</th>
<th>NHS Scotland (^{107})</th>
<th>Institute of Healthcare Improvement Triple Aim (^{11})</th>
<th>Bodenhiemer and Sinksy’s Quadruple Aim (^{115})</th>
<th>Australian Safety and Quality Framework for Health Care(^{111})</th>
<th>Triple Aim for Quality Improvement, NZ (^{231})</th>
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<td>Patient experience</td>
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<td>Organised for safety</td>
<td>Improved health and equity for all populations</td>
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<tr>
<td>Safe</td>
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<td>Safe</td>
<td>Safe</td>
<td>Patient experience</td>
<td>Patient experience</td>
<td>Consumer centred</td>
<td>Improved quality, safety and experience of care</td>
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<td>Timely</td>
<td>Accessible</td>
<td>Acceptable/ patient-centred</td>
<td>Caring and person centred</td>
<td>Person-centred</td>
<td>Patient experience</td>
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<td>Improved quality, safety and experience of care</td>
<td>Improved health and equity for all populations</td>
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<td>Patient-centred</td>
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<td>Uses resource sustainably</td>
<td>Per capita cost</td>
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<td>Improving the work life of providers</td>
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</table>

103 Institute of Medicine
105 World Health Organisation
106 National Quality Board, NHS England
107 NHS Scotland
11 Institute of Healthcare Improvement
115 Bodenhiemer and Sinksy’s Quadruple Aim
111 Australian Safety and Quality Framework for Health Care
231 Triple Aim for Quality Improvement, NZ

Page 157
Despite these similarities, their findings were focused on funding and providing services for and in rural communities without reference to the roles of developing networks with larger hospital providers for when people from rural communities needed care that was not available locally. Similarly, Moscovice and Rosenblatt’s five areas that contributed to quality rural health care, being 1) good quality local core services with stable appropriately trained staff, 2) community input into system design, 3) information technology investment, 4) developing a rural set of standards for quality measurement and 5) assessing the impact of the health care system on the whole community’s health. These findings are similarly consistent with the Interview Study elements but do not focus on the connections between the rural and urban hospitals needed to provide the whole range of services that rural communities needed, and the needs of indigenous peoples are not considered in either of this or the IOM framework.

Weinhold’s framework, which describes the aspects that shortages of sufficient health care in rural areas and the reasons behind them, is intended to help understand where to focus efforts to improve service quality. The shortages described are provider shortages, maldistribution of providers, quality deficiencies, access limitations and inefficient utilisation of health care service. Weinhold’s shortages can be seen as describing elements of sufficient care as a capable, appropriately distributed workforce, of rigorous quality with good continuity and coordination of care, with good access and efficient utilisation of resources integrated across the health system. This reverse view of these shortages are similar to the elements the Interview Study described, although community participation and fair distribution of resources are not clearly articulated by Weinhold. Weinhold’s ideas are presented from a deficit perspective, and Malatzky and Bourkes’ challenge to move away from a deficit discourse of rural health towards one that focuses on and encourages the positive aspects of providing health care in rural settings seems more useful.

Humphrey’s description of sustainable rural health services considers quality, along with access and cost, as the components of sustainability and links these to interrelated dimensions of economic, professional, organisation, cultural and environmental aspects. In contrast, the Interview Study findings were framed around quality, with
sustainability one of those elements. Bourke’s framework for understanding rural health provides a conceptual approach to understand the rural health services in their local context situated within the wider health and social system to identify where influence can be applied to improve rural health outcomes. The ability of various actors to influence how services are structured and provided, and the influence of structural components on individuals’ ability to influence is explicitly included in the framework. The role of individual actors and their ability to influence and be influenced was not a strong feature in the Interview Study, but was identified by some participants as an underlying reason for why some change failed.

8.2.3 Key areas for improvement for rural health services

The Interview Study identified key areas to improve the quality of health care for rural communities, by improving the seven elements of high quality rurally focused health services described in 8.2.2. These were 1) whole of system approach to planning and resourcing of the network; 2) Māori focused service design so that both main stream and Māori provider services met the needs of Māori and improved Māori outcomes; 3) community participation in system design and provision; 4) easier access to information, local and distant services and whānau support when patients needed to travel; 5) development of ‘one service, many sites’ health service networks, focused on culture change, information technology, and clarity about what services were provided where within the network with good processes to support this; 6) workforce development and training, and 7) rural-appropriate quality measures to drive improvement.

The Interview Study’s findings were largely consistent with the ten common key focus areas identified in the international literature as important to improving the quality of health care provided to rural communities, as noted in §2.3.1 on page 42. These include comprehensive primary health care, stable, well trained workforces with expanded scopes of practice, integrated local health services, leadership and community governance, access, including transport to distant specialist care in urban settings, information technology including telehealth and electronic health records, regional networks, rural
academic networks; flexible, efficient and sustainable funding and contracting aiming for equitable access and a rurally focused set of quality measures.

These findings are also largely consistent with the NHC report that identifies factors to address when designing the delivery of appropriate accessible health services for rural NZ. These include the distance and time for people to get to services, and services to get to people; access to services including appropriate patient transfer systems; community participation in service development; Māori focused ways of working with whānau ora approaches; partnership and collaboration within the rural community and networks with larger providers; and service sustainability, mindful of the changing nature of the rural environment, physically, demographically and culturally. The NHC report did not identify the role of rural hospitals in these networks or rurally focused quality measures, as outlined in the Interview Study.

The seven themes for providing and improving high quality health services for rural communities outlined above are discussed individually in more detail below.

8.2.4 Whole of system planning and resourcing

The Interview Study findings indicated that rural people subsidised their health care in the way urban people did not need to, as noted in §6.1.2, 6.4.4 and 6.4.5. This raised questions of equity and fairness, particularly for poorer rural people. The focus of the Interview Study was on hospital-level services, but the importance of primary care services came through in the study findings regardless, and costs of primary care services were an issue for rural people, particularly those of limited financial means. This is supported by other NZ findings. Mungall noted that good quality accessible care for rural communities requires disproportionately more funding than for urban communities, and this should be recognised and planned for.

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Some participants in the Interview Study noted that they might not see themselves as rural, but saw their health services as being rural, and others identified the need for a better definition of ‘rural’ for health planning and provision purposes. This echoes calls for a rurality definition in NZ that is more appropriate for rural health purposes. Concerns exist that differences in outcomes for people living in small town and rural communities seen in other countries may occur in NZ, but are being masked in the data due to inadequate rurality definitions. Rurality definitions are thought not to be able to detect ‘true’ levels of access to health services, particularly hospital services, that different rural communities experience. The resulting mis-categorisation of people with ‘rural’ levels of access as being ‘urban’, and vice versa, is postulated to be confounding NZ rural health outcome data.

As the services and provider mix at small secondary hospitals in small towns (IUAs) in NZ are changing, the distinction between urban and rural levels of hospital-level health services for rural communities will become more blurred. Comparing NZ Census data with information on hospital location shows that 23% of people living in small towns (IUAs) in NZ have access to a secondary hospital, 41% to a rural hospital and 36% have no hospital in their town. Independent urban areas are generally among the most deprived areas of NZ, particularly in the North Island, and have worse health outcomes than people living in urban or truly rural communities, for both non-Māori and Māori (with Māori having notably worse rates than non-Māori). This may suggest that any differences in health outcomes for people living in small towns in NZ could be due to sociodemographic and ethnicity differences in the populations rather than their different access to hospital and other health services.

Some participants advocated for rural definitions that more accurately detected differences in health outcomes for rural people, while others expressed a view that Māori health outcome differences were more the issue that needed addressing, rather than rural health outcomes across the board. This reflects the concerns raised in the NHC report that deprivation and ethnicity linked with distance compounds the negative effects on health outcomes for rural people. In a study of breast cancer survival in NZ women, the authors conclude that “rather than being concerned that more needs to be done for rural women in general, it is rural Māori women where we need to make
extra effort.” These findings support the findings from the Interview Study that services need to be equitably distributed, but indicate that it is important to understand where the inequalities lie for people living in rural communities and target services to address them. Given that NZ is a ‘modestly rural’ Western country, that distances are large but not on the scale of countries such as Australia, US and Canada, and that socioeconomic disadvantage and ethnicity explain a lot of difference between outcomes for people living in rural compared to urban communities, developing a definition of rurality that will help inform this conversation is important so that resources can be applied to maximise health gain.

8.2.5 Māori focused service design

The Interview Study identified the need for services to be designed with the needs of Māori as high priority, both in mainstream and Māori provider services, with a focus on improving Māori health outcomes. This is consistent with the existing literature that recommends monitoring health outcomes based on ethnicity, increasing cultural competency in the health workforce, and providing access to health services both by Māori and for Māori, as well as ensuring mainstream services are responsive to the needs of Māori.

8.2.6 Community participation

The findings from the Interview Study that emphasised the importance of community participation were in keeping with the findings of the published literature. Kilpatrick and colleagues describe the spectrum of community engagement and participation as ranging from giving information, consulting and feedback; to influence policy and planning and partnership with shared decision making; to delegation where control of designated aspects are handed over to communities; through to control of the entirety of an issue. The study participants talked of community participation in all of these aspects, with the whānau ora approach described in the NHC report reflecting the designated or entirety of control end of the spectrum.
8.2.7 Access

All the key access issues identified in the international literature and included in the Levesque access framework,\textsuperscript{120} modified for rural contexts as outlined in Figure 2.7 on page 35, were identified by study participants. The Interview Study findings confirmed findings of previous NZ research that access for rural communities to local and distant services is a major concern.\textsuperscript{127,128,232} The study findings also confirmed others’ findings of the importance of local hospitals to rural communities, and people’s preference for care there if possible.\textsuperscript{26,83,94,96} Connectedness to the community is another aspect of quality that is shown as a strength of rural hospitals in the literature,\textsuperscript{26,94,95,159} and this was consistent with findings of this study.

When people needed to receive care at distant sites, transport was a key issue. The costs of travelling noted by Fearnley and colleagues\textsuperscript{130} resonated with the comments of participants in this study. The importance of \textit{whānau} support when people needed treatment at distant sites and the need to better enable this identified in the Interview Study was focused on more strongly here than in literature I had been able to identify.

8.2.8 Developing a ‘one service, many sites’ network.

The findings of the NZ literature that explored health care provision for rural communities through health service networks was confirmed in this research.\textsuperscript{130,31} The importance of respect, communication, interprofessional team work and clinical and managerial leadership in successful networks, that I had previously noted,\textsuperscript{1} was confirmed across the four study sites of the Interview Study. The importance of the developing cadre of rural hospital medicine doctors in enabling more generalist care closer to home for rural communities\textsuperscript{1,33} was confirmed. The elements of the ideal emergency transfer process from rural hospitals to larger urban hospitals described by Lloyd and colleagues\textsuperscript{34} and summarised in §2.3.2, page 46, were confirmed in the Interview Study.

The Interview Study identified the need to have an agreed network structure that defined the kinds of services provided at different sites within the network, with the potential for expanded roles for rural hospitals to become hubs for a wider range of
health services for the local community. This was consistent with other study findings that looked into how different parts of networks are defined and how health service networks function. The role of rural hospitals, and the quality of care they provided to their communities, needs to be considered in the context of their local health service networks.\textsuperscript{24,84} The rural hospital workforce needs to be based on generalism,\textsuperscript{2} in medicine, nursing and allied health professions. Teamwork within and between these professional groups is essential to providing high quality services. The other key linkages are between rural hospital teams and local primary and community services\textsuperscript{26,94,95,158} and between rural hospital teams and larger hospital/s that supported rural hospitals\textsuperscript{1,24,158} so seamless integrated care is provided from patients’ perspectives. Rural hospitals are seen to be facilitating care in, or as close to people’s home as possible. For acute care, rapid diagnosis is important so that appropriate treatment plans, at appropriate venues, can be instigated.\textsuperscript{160} Rural hospitals could be used as local centres at which diagnostic access and interpretation expertise sat, to support general practice teams who were often stretched to provide ambulatory care to the community.\textsuperscript{3} Rural hospitals (or community hospitals as termed in England) could bridge across primary care, community hospital “core service” of inpatient beds, clinics and emergency care, and secondary care oriented services such as day surgery and diagnostic capacity, to serve the needs of their rural community.\textsuperscript{93} Systematised and formalised networks between smaller and larger hospitals and primary and community based services have been or are being established in rural Scotland,\textsuperscript{234} Queensland\textsuperscript{78} and Ontario\textsuperscript{235}.

The MOH’s National Health Board in 2010 outlined its view of how regional clinical networks would develop across NZ to deliver integrated care in 2010.\textsuperscript{77} The roles of hospitals were envisaged as changing, with tertiary centres supporting secondary and “community” hospitals to provide care in community rather than inpatient settings. Some smaller hospitals were envisaged to become more like large extended primary care services with visiting specialised clinical teams, more community-based diagnostics and fewer complex procedures. Secondary hospital clinicians would likely be spending more time supporting colleagues in smaller hospitals, travelling to provide outpatient clinics and would use electronic communication more. Training the future workforce would be a key part of preparing for these changes. Many aspects of this
description are similar to the description of health service networks in the Interview Study.\textsuperscript{77}

The lack of consistent language to describe different hospitals was clear in the National Health Board report, as the report refers to “community hospitals”, “lower intensity hospitals”, “typical provincial general hospital(s) providing core secondary services” and services in “large provincial centres” for different NZ hospitals. \textsuperscript{77} Participants in the Interview Study were also inconsistent in the use of different terminologies and definitions of hospitals and identified the need for agreed terminology to describe hospitals of different sizes and capabilities to minimise confusion. In rural Ontario, Canada, rural hospitals are being redefined as rural health hubs.\textsuperscript{235} Queensland Health,\textsuperscript{78} The NHS Scotland, \textsuperscript{234} and NZ\textsuperscript{77} have all developed frameworks to describe hospitals of different sizes and functions and how they interrelate (see Table 2.4, page 22).

There has been significant change in health workforce and technology over the last decade. The advent of telehealth has changed the level of care complexity that smaller hospitals can provide 24/7, and what can be provided in people’s homes and general practice settings. Clinical workforce roles, the mix of generalists and specialists at each site and how individual services interact within health services networks are also changing.\textsuperscript{1,2,4} Terminology needs to evolve to be able to describe the way services are currently provided and be flexible enough to allow for further development of the current trends emerging in NZ and internationally. Redefining the language used to describe hospitals and health services will enhance health service networks’ ability to evolve, as people will have a common language to describe new ways of working. This would ideally be centrally co-ordinated with buy-in from local and regional health planning and provider teams, with support from national professional bodies.

\textbf{8.2.9 Capable workforce}

Weinhold and colleagues\textsuperscript{10} found that continuity and care coordination is difficult, with providers overstretched and working at top of scope. These findings challenge the views expressed by participants in the Interview Study that rural health care providers knew
their patients and that informal networks in rural communities provided a safety net to prevent people falling through system gaps that was not present in urban areas.

Wilkinson suggested that multiskilled health professionals working in a generalist model should become the norm across the urban-rural continuum, rather than be the sole remit of rural health settings. This would avoid continued development of rural-specific skills that risked a rural ‘dead end’ for health professionals who might want to spend part, but not all, of their career in a rural setting. The move towards greater generalism in how health services are provided across the urban-rural continuum has been called for in NZ and internationally, such as the Royal College of Physicians (London) calling for greater focus on the role and training of generalist physicians. This was not a strong topic of discussion in the interviews but is a natural corollary of the type of future network that participants were describing. The importance of developing a ‘rural pipeline’ with undergraduate exposure to rural health and postgraduate opportunities to develop the competencies required to be a rural practitioner was identified by participants in the Interview Study, and this is supported by existing literature.

8.2.10 Using quality to drive improvement

The Interview Study found that quality measures for rurally focused health services needed to be a mix of measures universal to all hospitals, and rurally relevant measures, including particular focus on hospital transfer processes, with results interpreted in the context of local environments to improve quality. This is consistent with findings in international literature, that the quality of care that each rural hospital provides should be assessed in its context. Like should be compared with like, both in terms of patient demographics and co-morbidity, and the severity of illness being treated. An example would be using patient clinical complexity levels for specific diagnostic related groups. Universal quality indicators for rural and urban hospitals tend to compare uncomplicated acute myocardial infarction, heart failure and pneumonia measures. Measures of how well hospitals are performing for their patients within the wider health service networks that they are situated have been suggested. Clear pathways of care and communication need to exist to facilitate
rapid transfer to larger hospitals when definitive care can not be provided locally.\textsuperscript{160} This could be measured in indicators such as transfer timeliness;\textsuperscript{158-160} communication linkages with primary care and the larger hospital/s within the local network, including information technology usage; and pathways of care for patients with clinical presentations where transfer is likely.\textsuperscript{158} One NZ study has investigated inter-hospital emergency transfer processes,\textsuperscript{34} but there is little other published NZ literature on developing appropriate quality measures for rurally focused services.

8.3 Strengths and limitations of the Interview Study

In this section the strengths and limitations of the Interview Study undertaken will be discussed, referring to study validity and relevance, as outlined in §3.2.1.2\textsuperscript{188,190} and shown in Table 3.1 on page 53.

8.3.1 Strengths

The Interview Study was pragmatic health services research to specifically understand stakeholders’ views on dimensions of health service quality. The processes used to undertake the data collection and analysis are described in detail in Chapter 4, including coding frameworks and mindmaps of developing themes in Appendices 10 through 12. The processes used are also presented using the COREQ-32 reporting criteria in Appendix 13.

Particular attention has been paid to reflexivity, regarding my own views and values, and how these may have influenced how participants interacted with me and how I analysed the data. I had a moderate degree of insider status,\textsuperscript{198} and this was particularly relevant for the West Coast interviews, as noted in §3.3.4.1.2, page 60, and §4.4.2, page 75. As outlined in §3.1, page 49, I had already formed views about what was important in providing high quality rurally focused health services. It could be argued that these views would reduce my ability to be open-minded about views expressed by participants, especially if these views were contrary to my own. During data gathering phase, I was conscious of my pre-existing ideas and actively sought out alternative concepts and counterarguments that challenged my existing views. I kept a reflective
diary during the interview and analysis process, and ideas and thoughts noted were discussed with my supervisors. My supervisors checked my data analysis as I progressed. While analysing the data I actively sought out alternative perspectives and aimed to appropriately develop categories that did not fit my pre-conceptions. The sub-theme relating to use of language to describe different types of hospitals (see §7.1.3, page 129) was an example of an unexpected finding from the data. The views captured in sub-theme §6.4.1, page 111, relating to growing social isolation for some people within rural communities, and the gentrification of some rural communities are other examples of concepts that challenged my pre-conceived ideas.

The purposive selection of a large number of interviews and focus groups conducted over four different sites across the North and South Islands with different sociodemographic compositions and access to different sized rural hospitals allowed a wide range of views to be gathered. This increases the transferability of findings to other rural communities in NZ, particularly those with access to rural hospitals, noting that each rural setting has its own context, and not all findings will be applicable to all settings. By virtue of the close connections between primary and community care and hospital care in rural communities, the study includes themes that relate to primary and community care locally in rural communities, and to hospital care in larger urban settings, as well as to care in rural hospitals. The most obvious difference across the four sites was the levels of socioeconomic deprivation, with very low levels of deprivation in Central Otago, and a different baseline setting of what ‘normal’ was in that site. The experience of Māori participants in each setting was similar, regardless of the proportion of Māori in the local population.

8.3.2 Limitations

This research involved asking participants how they conceptualised quality and how to improve quality. There was a risk that participants felt the need to be overly positive about their experiences due to their emotional investment in living and working in rural communities and a desire to protect rural health services from perceived external threat, as noted in §2.1.4.3, page 27. The thematic analysis findings come from four rural communities in NZ. The sampling frame included rural communities with access to
rural hospitals and so the findings are less applicable to rural communities without rural hospitals. Having said that, participants in each focus group came from small towns or rural areas that did not have a rural hospital nearby, and 1 or 2 providers in two of the four sites visited did not work in towns with a rural hospital nearby. There has been no validation testing of the themes identified, for example through a larger survey to quantify the extent to which these findings are held by a wider rural population. Testing the applicability and utility of the themes developed here to a wider rural audience would be a useful area of further research.

Due to the nature of the research funding from the Health Research Council, the interviews were not doubled coded, but a selection of my coding of interviews and focus groups were reviewed by my supervisors (SD, RG and TS), as noted in §3.3.4.1.1, page 58. There were changes in the supervisor team assisting me throughout this thesis as discussed in §3.3.4.1.1 and §4.5.1 on pages 58 and 78. These transition points led to some ‘stopping of the flow’ of the thesis but the overall learning experience and final product was improved for the exposure to a broader range of expertise, and my rural clinical advisors were helpful sounding boards to test the development of my interview schedule and the developing themes.

As a Pākehā researcher, I am cautious to interpret data presented from a Māori perspective. I identified a Māori advisor (Associate Professor Sue Crengle) who agreed to assist me, but due to time constraints on both our parts I did not avail myself of her expertise. I was also not able to have the te Reo Māori text from Māori hui focus groups translated which is likely to have reduced the depth of my understanding of the ideas being expressed. I am not confident that my findings have respectfully captured and analysed the views of Māori expressed in the data and study findings are presented with that caveat.

While the views of participants who lived and worked rurally as well as the views of the senior leaders in the health systems that the rural areas sat within have been sought in this research, the perspective of urban hospital-based clinicians and managers are not included in this research. This is a missing part of the overall picture. Seeking the views
of urban hospital providers who support rural communities and analysing the resulting data in comparison with the findings of this study would be valuable future research.

8.4 Summary

This chapter presented the findings of the Interview Study undertaken as part of this mixed methods research. The findings were discussed in the light of the international and NZ literature relating to understanding and improving rural health care quality, particularly focused on hospital-level care. The strengths and limitations of the qualitative design were then discussed.

The next three chapters relate to the quantitative Hospital Harms Study. The next chapter describes the methods used in that study.
9 Methods for the Hospital Harms Study

9.1 Introduction

The following three chapters present the quantitative study within this mixed methods research. The aim of the Hospital Harms Study was to investigate whether populations in rural settings had different experiences of hospital harm (harm as a result of hospital admission) compared to urban populations. The approach taken was to analyse a pre-existing patient data set of 9076 general practice clinical records covering a three-year period which included equal number of rural and urban patients, in which all health care harm had been identified. Patients whose clinical records showed that they had experienced a) hospital admissions and b) hospital harm were identified. Analysis of hospital admission and hospital harm data allowed estimation of the risk of hospital admission and hospital harm for rural compared to urban patients. This chapter describes the methods used to undertake this investigation. Chapter 10 describes the results and Chapter 11 presents a discussion of the findings.

This chapter first presents an overview of the process taken. Next, the process to identify patients who had hospital admissions and who experienced hospital harm during the study period is described. Finally, the approach taken to analyse the data and the statistical methods applied is outlined.

9.2 Overview of the approach used

The Health Research Council (HRC) funded ‘Safety, Harms and Risk Reduction Project’ (SHARP) study, collected patient data from 9076 randomly selected general practice clinical records from 44 randomly selected large (4500 or more patients), medium (2000–4499 patients) and small (<2000 patients) general practices, covering a 3 year period (2011 – 2013) to investigate patient harm in the general practice clinical record. Participating practices needed to be using the MedTech32 patient management system. Equal numbers of records were selected from rural practices (practices located in areas defined by Stats NZ as rural areas or independent urban areas [see §2.1.1.3, page 10 for more detail]) and urban practices in each group of large, medium and small
practices. The eight general practitioner (GP) researchers in the SHARP Study analysed all records to identify health care harms as recorded in the general practice clinical record. In addition a clinical pharmacologist researcher reviewed a selection of records to focus on medication-related harms. Appendix 16 summarises the methods used for the SHARP study as outlined in the original HRC application.

I undertook a secondary analysis of the SHARP study data to investigate whether rural patients (patients living in rural settings) had different risks of hospital harm or different patterns of hospital harm severity or preventability compared to urban patients (patients living in urban settings). This involved the following steps:

1. identifying the patients who had hospital admissions during the study period through reviewing the SHARP patient record data;
2. identifying hospital harm by reviewing all health care harms noted in the SHARP research and identifying harms experienced as a result of a hospital admission;
3. comparing the risk of hospital admission, the risk of hospital harm and the rate ratio of hospital admission resulting in harm for rural patients compared to urban patients controlling for the sociodemographic factors of age, sex, ethnicity, and socioeconomic deprivation, and exploring plausible interactions between pairs of these variables (including both location and sociodemographic variables);
4. analysing hospital harm relating to inter-hospital transfer and the severity and preventability of hospital harm experienced by rural patients compared to urban patients controlling for sociodemographic factors;
5. analysing the association between hospital harm and total occupied bed days and comparing this for rural and urban patients for patient records where full length of stay data was available, controlling for sociodemographic factors and general practice size;
6. analysing whether different definitions of rurality influenced the risk of hospital admission and risk of hospital harm, by applying five alternative rurality definitions to the data based on the Rural Ranking Scale (RRS) of participating general practices, general practices’ distance to the nearest urban hospital, distance to the nearest hospital, and drive time (as opposed to road distance) to the nearest hospital.
Findings were reported as proportions (to describe categorical data), risk ratios (for binary outcomes, using Poisson regression), and incidence rate ratios (for count outcomes, using Poisson regression or negative binomial regression as appropriate).

9.3 Preparing the data for analysis

This section describes the processes used to identify patients with hospital admissions, and patients who experienced hospital harm. The accuracy of the method applied to identify hospital admissions within the data is examined. The approach to assessing inter-rater reliability in the original data set is described, and how the analysis approach altered in response to inter-rater reliability findings. Definitions developed to support the analysis are described.

9.3.1 Identifying patients with hospital admissions

This section describes how hospital admissions were identified in the patient records of the original SHARP Study dataset.

9.3.1.1 General practice records data extraction

The original data set from the SHARP Study was comprised of 47 password protected Microsoft Excel files. These files contained the records of 9076 patients, extracted from the MedTech32 general practice patient management systems of the 44 participating general practices. Each distinct record had been allocated a unique anonymised study identification (ID) number. Within each Excel file, different worksheets represented the various ‘tabs’ that are the basic structure of the MedTech32 electronic patient clinical record, being:

- patient consultation notes;
- classifications (a list of diagnoses that the person has);
- past history;
- medications;
- medical warnings;
- Accident Compensation Corporation (ACC) information;
• inbox (e.g. letters and results received);
• outbox (e.g. letters sent, tests ordered);
• immunisations;
• screening information.

9.3.1.2 Process of identifying patients with hospital admissions

In the MedTech32 patient management system, the ‘Inbox’ tab contains electronic records of all incoming letters, laboratory and radiology results, discharge summaries, scanned documents and other pieces of information that are sent from an external source to general practices relating to each patient. Many ‘Inbox’ records are received and filed electronically, such as laboratory results, and others are filed according to local idiosyncratic filing terminologies. Hospital admissions (or hospital discharges as they are referred to in hospital records) are recorded in the ‘Inbox’ as proforma electronic discharge summaries, scanned copies of paper-based hospital discharge summaries, or letters informing the practice that a hospital admission had occurred. Some letters are received electronically, and others come by post or fax and are scanned in to the patient ‘Inbox’ at the practice. The general practice clinical team may write a comment next to the ‘subject’ line in the record that may summarise the content of the document (e.g. “discharge from hospital”, “gall bladder”) or give directions to other members of the team about patient management (e.g. “for review 2 weeks after operation”).

Each of the 47 Excel workbooks had 4000-9000 separate Inbox entries with the associated study ID numbers, and I viewed all these entries to identify potential hospital admissions. I particularly focused on subject entries titled ‘discharge summaries’ (including discharges from hospitals and from other health care providers, such as Accident and Medical clinics), ‘operation notes’, ‘letters’ (some were from private specialists indicating an operation had been done), ‘new referrals’ (some were from private specialists indicating an operation had been done), and scanned documents. I read all the associated free text of entries which represented the ‘comments’ practitioners manually added for all entries that were clearly not laboratory and radiology entries, looking for suggestions that a hospital admission had occurred, such as “aortic aneurysm”. I examined in more detail entries I had identified as potential
hospital admissions. Where there was no associated text, or it was not clear if the ‘Inbox’ entry related to a hospital admission, I referred to the ‘Patient consultation notes’ worksheet for that individual to help clarify if a hospital admission had happened. I labelled entries as hospital admissions only where it was clear from the records that the patient had definitely been admitted to a hospital. I also recorded a short explanation of the reason for each hospital admission.

By way of example, in download ‘0’, there were 8613 individual inbox entries for 316 individual patient ID numbers. These included all laboratory and radiology entries, as well as letters, discharge summaries, ACC documents and documents scanned in by the practice. After initial scanning of the inbox entries, 343 possible admissions were identified. After detailed reading of these possible admissions, including removing multiple entries regarding the same admission, 79 hospital admissions were identified in 50 patient records, indicating that 15.8% of the 316 individual patient general practice records examined contained at least one hospital admission.

9.3.1.3 Counting hospital admissions

In the study, a hospital admission was defined from the patient perspective of being door-to-door from their home. This captured different hospital journeys experienced by patients and could include transfers from one hospital to another. Inter-hospital transfers were noted and recorded when patients were transferred between hospitals in different towns or cities. Transfers between hospitals working as one unit in a town or city were not considered to be transfers, e.g. from Dunedin Public Hospital to Wakari Hospital (also in Dunedin).

Readmissions to hospital soon after hospital discharge were counted as separate admissions.

9.3.1.3.1 Inclusions

All identified admissions to any public or private hospital were included. Day stay admissions, which were generally for surgery but also included interventional investigations such as coronary angiography and oncology chemotherapy, were
included. All hospital admissions for maternity events and mental health admissions were included. Because of the way that information of maternity events was represented in the patient records, most maternity related admissions were for surgical intervention in the birthing process, such as caesarean section.

9.3.1.3.2 Exclusions
Emergency department attendances that did not result in a hospital admission, outpatient attendances and sleep studies were excluded. Procedures where some services admitted patients to day surgery units, and other services performed them as clinic-based procedures were excluded. These included gastrointestinal endoscopy; urological endoscopy (cystoscopy); transurethral ultrasound and biopsy (TRUS) prostate biopsies; vasectomies; and simple colposcopy.

9.3.1.3.3 Completeness of hospital admission identification
The method to identify hospital admissions as described will have underestimated the total number of hospital admissions in the study group. Some public hospitals sent their hospital discharge information to general practices in an electronic format that was able to be fully read after the data extraction process, whereas others did not. Few uncomplicated birthing and mental health admissions were identified and these were likely to be under-represented. Private hospital discharge data across the country was sent in a variety of formats, some being as 'New referral' entries, some within 'Letter' entries and others as 'Discharge summary' entries. Any documents recording hospital admissions that were paper-based and scanned into the medical record would only be identifiable if the free text 'comment' section identified this.

9.3.1.3.4 Blinding and reliability of coding
I was blinded to whether patients were attending rural or urban based general practices during this identification process, although on occasion there was an indication or suggestion of rural or urban status when reading individual patient record content. Resources did not permit having admission data extracted independently by another person.
9.3.1.4 Information regarding length of stay in hospital

Many hospital discharge summaries and letters in the dataset were in a readable format and included dates of admission and discharge so the length of stay (LOS) for each admission could be calculated. When patients were transferred between hospitals during one admission, the LOS at each hospital was added to calculate the LOS for the entire admission.

Data in the SHARP Study was assigned a non-identifiable patient identification number generated for the study, as part of the study design. This was not the National Health Index (NHI) number (unencrypted or encrypted) so could not be matched to other health data sets, such as the national data collections held by the Ministry of Health (MOH) which record information about hospital admissions. Occupied bed days (OBD) is a measure of inpatient hospital care utilisation collected and used by the MOH and DHBs.\textsuperscript{237} It is applied to individual admissions, when it is synonymous with LOS, and calculated as ‘discharge date minus admission date’. Day stay admissions are hospital admissions where patients are discharged on the day of admission, so have an OBD or LOS of zero, and therefore not counted in OBD totals. Occupied bed days also indicate total hospital care utilisation over a specified time period, for example, total OBD per annum.

For each patient record with complete LOS data for all admissions recorded, I calculated total OBD by adding the LOS for all admissions per patient over the three year study period. I calculated the mean LOS per admission by dividing the total OBD by the number of overnight admissions over the three year period, removing all day stay admissions (LOS=0) from this calculation. I also noted the total number of day stay admissions per patient.

9.3.2 Identifying patient harms

This section describes how patients who experienced hospital related harms were identified through analysis of the harms data in the main SHARP Study.
9.3.2.1 Identifying patients who had a harm related to a hospital admission

The SHARP Study researchers identified 2999 individual harms which were recorded in a 'master harms' file. Each harm had a preventability and severity score determined as discussed in more detail in §9.3.4.3. I examined each entry and coded each harm as to whether it was a harm related to a hospital admission or not. In many instances it was clear from the free text entered by the original SHARP researchers if the harms were related to hospital admissions, for example:

a) ‘post-op wound infection in knee joint replacement’ (clearly as a result of being in hospital);
b) ‘reaction to 5 month old immunisation’ (clearly not related to a hospital admission).

Where the free text in the ‘master harms’ file did not clearly indicate whether the harm was hospital related or not, for example ‘wound infection resistant to penicillins’, the clinical record within the Excel files was examined to determine if the recorded harm was a result of a hospital admission. If no evidence of a hospital admission was identified, the harm was recorded as unrelated to a hospital admission.

9.3.2.2 Inclusions

All harms identified by the SHARP Study that were the result of a hospital admission with a discharge date that fell within the study period were included and coded as hospital harms.

9.3.2.3 Exclusions

All hospital related harm that occurred before the study period were excluded, even if it caused a further hospital admission within the study period (e.g. leakage from silicone breast implant requiring removal).
9.3.3 Assessing the accuracy of the approach used to identify hospital admissions

In some instances, patients were identified as having a harm relating to a hospital admission through analysing the ‘master harms’ file, although an associated hospital admission had not been identified. In these records, the allocated admission status was not changed but the information was used to assess the accuracy of the method used to detect hospital admissions, as discussed below.

Of the 195 patient records with an identified hospital-related harm, 172 (88.2%) had an associated hospital admission identified. The method of identifying hospital admissions described in Section 1.3 did not identify the other 23 patient records (11.8%) that contained a hospital related harm, as shown in Table 9.1.

On review of these 23 patient records, the two main reasons for not detecting hospital admissions were firstly, that the process for identifying a hospital admission in the ‘In-box’ document did not detect an admission, and secondly, that there was no documentation received from the hospital in the patient record to indicate a hospital admission. In 13 records (6.7% of the 195 patient records with identified hospital harm), an ‘In-box’ document that indicated a hospital admission had not been identified. In 2 of these cases I missed a discharge summary that was reasonably obvious, and in the other 11 cases the data were in a form not readily readable. In a further 9 records (4.6% of the 195 patient records with identified hospital harm) there was no inbox document indicating a hospital admission. This suggested that the practice was using a hybrid of paper and electronic filing of letters from hospitals, the document might have been missed for some technical reason in the file extraction process, or that the hospital in question did not send a discharge summary to the patient’s general practice. In these patient records, harms were identified by the SHARP Study primary researchers through the line by line reading of patient consultation notes, classification, allergies and history notes. In one patient record, I could not identify the original patient record retrospectively to analyse the reason.
Table 9.1 All hospital harms by hospital admission identification status

<table>
<thead>
<tr>
<th>Status of harm</th>
<th>Reason</th>
<th>Number (%) for all hospital harms</th>
<th>Number (%) for harms not linked to an identified admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital admission identified</td>
<td></td>
<td>172 (88.2)</td>
<td></td>
</tr>
<tr>
<td>No hospital admission identified</td>
<td></td>
<td>23 (11.8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discharge summary not detected</td>
<td>13 (56.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No discharge summary in patient record</td>
<td>9 (39.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not clear</td>
<td>1 (4.3)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>195 (100)</td>
<td>23 (100)</td>
</tr>
</tbody>
</table>

Table 9.2 compares the demographics of the two groups. There was no difference in rural or urban status (p=0.573). Patients whose admission was not identified through my processes were younger (median age 47 vs 64 years old, MWU p=0.005) and more likely to be female (73.9% vs 45.6%, p=0.045), but no significant difference in ethnicity, sociodemographic status or practice size was noted (all p≥0.140).

As it was impossible to know the number of undetected admissions that had occurred that did not lead to a hospital-related harm, the 23 hospital harms where associated hospital admissions were not identified were excluded from further analysis.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Hospital admission identified n=172*</th>
<th>No hospital admission identified n=23*</th>
<th>p-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean in years) and standard deviation (SD)</td>
<td>60.4 (19.9)</td>
<td>47.8 (21.2)</td>
<td>0.005 a</td>
</tr>
<tr>
<td>Sex:</td>
<td></td>
<td></td>
<td>0.045 b</td>
</tr>
<tr>
<td>Male</td>
<td>83 (48.3)</td>
<td>6 (26.1)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>89 (45.6)</td>
<td>17 (73.9)</td>
<td></td>
</tr>
<tr>
<td>Prioritised ethnicity:***</td>
<td></td>
<td></td>
<td>0.351 c</td>
</tr>
<tr>
<td>European</td>
<td>140 (81.4)</td>
<td>17 (73.9)</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>18 (10.5)</td>
<td>5 (21.7)</td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>7 (4.1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>7 (4.1)</td>
<td>1 (4.4)</td>
<td></td>
</tr>
<tr>
<td>NZ Dep status:</td>
<td></td>
<td></td>
<td>0.140 c</td>
</tr>
<tr>
<td>Quintile 1</td>
<td>27 (15.7)</td>
<td>3 (13.0)</td>
<td></td>
</tr>
<tr>
<td>Quintile 2</td>
<td>34 (19.8)</td>
<td>5 (21.7)</td>
<td></td>
</tr>
<tr>
<td>Quintile 3</td>
<td>30 (17.4)</td>
<td>7 (30.4)</td>
<td></td>
</tr>
<tr>
<td>Quintile 4</td>
<td>26 (15.1)</td>
<td>5 (21.7)</td>
<td></td>
</tr>
<tr>
<td>Quintile 5</td>
<td>32 (18.6)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>No data on quintile</td>
<td>23 (13.4)</td>
<td>3 (13.0)</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td></td>
<td></td>
<td>0.573 b</td>
</tr>
<tr>
<td>Urban location</td>
<td>79 (45.9)</td>
<td>12 (52.2)</td>
<td></td>
</tr>
<tr>
<td>Rural location</td>
<td>93 (54.1)</td>
<td>11 (47.8)</td>
<td></td>
</tr>
<tr>
<td>Practice size:</td>
<td></td>
<td></td>
<td>0.708 b</td>
</tr>
<tr>
<td>Large practice</td>
<td>60 (34.9)</td>
<td>8 (34.8)</td>
<td></td>
</tr>
<tr>
<td>Medium practice</td>
<td>62 (36.0)</td>
<td>10 (43.5)</td>
<td></td>
</tr>
<tr>
<td>Small practice</td>
<td>50 (29.1)</td>
<td>5 (21.7)</td>
<td></td>
</tr>
</tbody>
</table>

*Values are count (percentage) unless otherwise indicated **Source of p-values: a=Mann-Whitney U test as age not normally distributed; b=Pearson’s chi squared test; c=Fisher’s exact test (applied when less than 80% of cells have expected counts above 5); ***Prioritised ethnicity is defined in Section 8.3.7 below
9.3.4 Assessing Inter-rater reliability

This section describes the steps undertaken to assess the inter-rater reliability for hospital harm identification in the sub-group of SHARP Study patients with identified hospital admissions.

9.3.4.1 The background to inter-rater reliability

Inter-rater reliability is important when reviewing clinical records to detect adverse events and patient harm. It reflects how consistently various raters come to the same conclusion for specific cases, e.g. whether a harm had occurred. The kappa statistic is a commonly used index to assess the degree of agreement for binary, ordinal, and nominal scale measures between two raters taking into account agreement as a result of chance. The kappa statistic can be weighted in various ways for ordinal categories, to indicate the closeness of agreement between two raters (e.g. on a 10 point scale, one rater assigning a score of 1 and the other a score of 2 have better agreement than one assigning a score of 1 and the other a score of 9) or unweighted for nominal or binary categories. Kappa statistic values of 0.00-0.20 indicate poor agreement, 0.21-0.40 slight agreement, 0.41-0.60 moderate agreement, 0.61-0.80 substantial agreement and 0.81-1.00 almost perfect agreement. In a systematic literature review of the reliability of clinical record review to assess the presence or absence of adverse events, one out of 24 studies showed slight agreement (kappa of 0.34), 13 studies showed moderate agreement, 9 studies had kappa of substantial agreement and two showed nearly perfect agreement. Kappa statistic values above 0.40 were chosen as the cut-off for acceptable inter-rater reliability for the Hospital Harms Study, with 95% confidence intervals used to inform this judgement.

9.3.4.2 The SHARP Study process

The SHARP Study researchers had an initial full day’s training on coding, and there was ongoing feedback and discussion between researchers throughout the study period. Every harm identified from within the team of researchers was then assessed by the two lead reviewer researchers, and a final decision about whether a harm had occurred was made.
Blind double reviewing by pairs of the 9 researchers (8 GPs and one clinical pharmacologist) was undertaken for a random sample of 1400 patient records for the 9076 records in the SHARP study group. This process aimed to check for agreement between researchers on harm detection, numbers of harms detected and harm preventability, and identify areas where extra training might be required. Where there were discrepancies between the identified harms in double reviewed records, the two lead reviewer researchers decided whether each identified harm had occurred by referring to the clinical record. The preventability and severity coding attributed by the original researchers was not revisited.

9.3.4.3 Inter-rater reliability for the Hospital Harms Study

Presence of any hospital harm and number of harms The Hospital Harms Study used the harms identified and categorised by the SHARP Study researchers. Of the 1561 patients in the Hospital Harms Study with identified hospital admissions, the records of 258 (16.5%) had been double-reviewed by pairs of the 8 GP researchers who undertook the primary record reviews in the SHARP Study. I noted whether each reviewer had identified any hospital harm for each patient whose records had been double reviewed. I identified and reviewed all harms in the ‘master harms’ file for these patients. If the descriptions of harm identified by the 2 GP researchers sounded compatible, I judged this as the same harm. If the harm being described by each GP researcher was obviously referring to different harms these were judged to be separate harms. Examples of text extracts from the original SHARP Study ‘master harms’ file illustrate this in Appendix 17. Harms that occurred out of the hospital setting were excluded from analysis. I calculated inter-rater reliability for detection of any hospital harm and the number of hospital harms using the kappa statistic with confidence intervals function in Stata 15, with bootstrapping for non-binary outcomes of number of hospital harms and preventability and severity of individual hospital harms.

Of the 258 double reviewed records of patients with identified hospital admissions, 135 records (52.3%) were coded as ‘no hospital harm’ by both researchers, 48 records (18.6%) as ‘at least one hospital harm’ by both researchers, and 75 records (29.1%) were discordant. This indicated moderate agreement between researchers for the presence or absence of hospital harm (kappa statistic for any hospital harm
The number of hospital harms detected by pairs of researchers ranged from no harms to 6 harms (see Appendix 17) and showed slight agreement only (linearly weighted kappa statistic for number of hospital harms=0.298 [0.231-0.379]).

Preventability and severity of harms Of the 48 patient records where both researchers indicated at least one hospital harm, 22 individual hospital harms were identified by both researchers. This was comprised of a single hospital harm in 14 records and two hospital harms in 4 records. Harm preventability was coded by SHARP Study researchers according to the 6 categories used as shown in Table 9.3. The SHARP Study researchers applied the standard of a “reasonable doctor”\textsuperscript{195} when judging a harm as preventable or not. The preventability codes assigned by each GP researcher were compared for these 22 hospital harms and showed substantial agreement (unweighted kappa statistic for preventability=0.732 [0.341-1.000]). Harm severity was coded by researchers using a four-point ordinal scale of 1=mild, 2=moderate, 3=severe or 4=death. The severity codes assigned by each GP researcher were compared for these 22 hospital harms and also showed substantial agreement (linearly weighted kappa statistic for severity 0.637 [0.268-0.886]).

<table>
<thead>
<tr>
<th>Code</th>
<th>Harm preventability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>not preventable, standard treatment</td>
</tr>
<tr>
<td>2</td>
<td>not preventable, originated in primary care</td>
</tr>
<tr>
<td>3</td>
<td>not preventable, originated in secondary care</td>
</tr>
<tr>
<td>4</td>
<td>preventable, originated in secondary care</td>
</tr>
<tr>
<td>5</td>
<td>potentially preventable, in primary care</td>
</tr>
<tr>
<td>6</td>
<td>preventable and primary care</td>
</tr>
</tbody>
</table>

The inter-rater reliability kappa statistics for presence or absence of hospital harm, the number of hospital harms, harm preventability and harm severity are shown in Table 9.4. The original study intention was to analyse the hospital harms data by number of harms, and type, preventability and severity of harms, as well as the presence or
absence of any harm. For the number of hospital harms, the kappa statistic’s upper 95% CI did not meet the criterion of a value above 0.40, as shown in Table 9.4, and analysis using the number of hospital harms was therefore not undertaken. Further analysis of harm preventability and severity differences between rural and urban settings was undertaken using ‘any preventable harm experienced by patients with hospital admissions’ and ‘most severe harm experienced by patient with hospital admissions’ rather than analysing harm preventability and severity by individual hospital harms.

Table 9.4 Kappa statistics for variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample size n=</th>
<th>Unweighted kappa statistic (95% CI)</th>
<th>Linearly weighted kappa statistic (95% CI)</th>
<th>Continue analysis?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital harm/no harm</td>
<td>258</td>
<td>0.401 (0.310-0.493)</td>
<td>N/A, binary</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of hospital harms</td>
<td>258</td>
<td>0.215 (0.152-0.292)</td>
<td>0.298 (0.231-0.379)</td>
<td>No</td>
</tr>
<tr>
<td>Preventability of harms</td>
<td>22</td>
<td>0.732 (0.341-1.000)</td>
<td>N/A, categorical</td>
<td>Yes, modified definition</td>
</tr>
<tr>
<td>Severity of harms</td>
<td>22</td>
<td>0.557 (0.181-0.839)</td>
<td>0.637 (0.268-0.886)</td>
<td>Yes, modified definition</td>
</tr>
</tbody>
</table>

9.3.5 Harm detection, preventability and severity

For the 172 patient records with any hospital harm identified, each record was reviewed to determine whether the identified harms were detected at time of admission or subsequent readmission or only through the general practice clinical record. Hospital harm was recorded as preventable if any identified hospital harm for a patient was coded as preventability category 4 (preventable, originated in secondary care) in the original SHARP Study data (see Table 9.3). The highest severity coding of any identified hospital harm using the original SHARP Study data was recorded, with the alteration of combining categories 3 (severe) and 4 (death) into a combined category of 3 “severe, including death”, as only 3 deaths occurred in the sample.
9.3.6 Defining admissions resulting in harm

The SHARP Study researchers identified every harm they noted in the patient record. As noted above in §9.3.4.3, the inter-rater reliability for the presence or absence of hospital harm was acceptable, but not for the number of hospital harms. To allow for this, I categorised the hospital harm data into a binary variable, of hospital admissions that resulted in any harm, and hospital admissions that did not result in harm. In the 1561 patient records where I had identified one or more hospital admissions, 206 hospital harms were recorded in 188 separate admissions for 172 patients. These 188 hospital admissions resulting in harm and 172 patients in whom hospital harm occurred became the numerators for hospital harms analysis.

9.3.7 Ethnicity groupings

Data on ethnicity was provided in the general practice patient records, using Statistics NZ definitions and Level one codes into the following categories of Māori, Pacific, Other (including Asian, MELAA, Other, and Residual categories from Statistics NZ’s codes), and then European, with priority given to the first relevant ethnicity category in this order. For example, if a patient identified as Māori, Asian, and European, they were prioritised as Māori; and if a patient identified as Asian and European, they were prioritised as ‘Other’.

The ‘Other’ category included all other ethnicities that were not coded as Māori, Pacific or European (383/9076 patients, 4.2%), and records where there was no information recorded regarding ethnicity (162/9076 patients, 1.8%). These included patient records coded as Chinese (72), Indian subcontinent (68), South East Asian (23), Other Asian (149), Middle Eastern (9), Latin American (15), African (11), and Other (36). It also included 18 records with uninterpretable ethnicity codes and 144 with no ethnicity code. While this group was not interpretable due to its heterogeneity, coding these categories together allowed for interpretable comparisons between pairs of Māori, Pacific, and European ethnicities.
9.3.8 Assigning weightings to patients

Patient records in each of the six study groups (combinations of size being large, medium, or small and location being rural or urban practice) were assigned a weighting according to their practice group to make patients within each group representative of all such patients nationwide for statistical modelling purposes. The weightings were calculated according to the formula:

\[
\text{Practice group weight} = \frac{\left(\text{number of practice of that group nationally} \times \text{mean number of patients in that group nationally}\right)}{\left(\text{number of practices of that group in the sample} \times \text{mean number of patients per practice in sample}\right)}
\]

or

\[
= \frac{\text{total number of patients in that group nationally}}{\text{total number of patients in that group in the sample}}
\]

9.3.9 Alternative measures of rurality

The SHARP Study defined rural general practices as those located in rural areas or independent urban areas, and urban general practices located in main urban or satellite urban areas using Statistics New Zealand definitions.\textsuperscript{38} Alternative measures of rurality were created using data collected from the participating practices to analyse the effect of different rurality definitions on the study’s findings regarding admission risk and hospital harm risk. The alternative definitions of rurality used were based on an existing rurality measure developed by NZ rural health sector experts, the rural ranking scale (RRS),\textsuperscript{57} and the findings of the literature review that distance was a major barrier to accessing health services,\textsuperscript{10,121,123,124} and the rationale that the ease of access to hospital care may be associated with patients’ experience of hospital harm.

The SHARP Study collected practice level data from participating practices at the commencement of the study in 2011 (see Leitch et al.\textsuperscript{38}). This included information about practice distance from the nearest hospital of any type, and distance from nearest
“Base hospital”, and the practices’ Rural Ranking Scale (RRS) as described in Section 2.2.1.4 and Appendix 2. A score of 35 or more categorised GPs as rural. Fourteen of the 24 rural practices provided their RRS score. For the 10 practices that did not, the ‘New Zealand Annual Rural Workforce Survey 2002’ data was referenced for this information. Distances of the practice from the nearest hospital and nearest “Base hospital” (which was taken to mean a secondary hospital in an urban setting) and drive time from the general practice address to the nearest hospital was calculated using Google Maps.

The five alternative rurality measures developed are shown in Table 9.5. The RRS was used to provide binary (rural/urban) and three-part rurality categories. Three-part categories using distance of the general practice to the nearest major base hospital, distance of the general practice to the nearest hospital by type (near to urban hospital, near to rural hospital and far from rural hospital), and drive time to nearest hospital were also created.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Category 1: Urban</th>
<th>Category 2: Rural</th>
<th>Category 3: Rural II</th>
</tr>
</thead>
<tbody>
<tr>
<td>0. Standard definition: Statistics NZ</td>
<td>Urban: urban classification</td>
<td>Rural: rural and independent urban classification</td>
<td>No third category</td>
</tr>
<tr>
<td>1. Rural Ranking Scale (RRS) 2 part definition</td>
<td>Urban: RRS&lt;35</td>
<td>Rural: RRS≥35</td>
<td>No third category</td>
</tr>
<tr>
<td>2. Rural Ranking Scale 3 part definition</td>
<td>Urban: RRS&lt;35</td>
<td>Mid Rural: RRS 35-49</td>
<td>Most rural: RRS≥50</td>
</tr>
<tr>
<td>3. Nearest Base Hospital (NBH) Distance</td>
<td>Close: Practice≤20 km from NBH</td>
<td>Intermediate: Practice 21-50 km from NBH</td>
<td>Far: Practice&gt;50 km from NBH</td>
</tr>
<tr>
<td>4. Distance to nearest hospital by location</td>
<td>Urban - all 31 km or less</td>
<td>Rural, &lt;30 km</td>
<td>Rural, ≥30 km</td>
</tr>
<tr>
<td>5. Drive time to nearest hospital</td>
<td>15 minutes or less</td>
<td>16 to 30 minutes</td>
<td>More than 30 minutes (all&lt;60 minutes)</td>
</tr>
</tbody>
</table>
The above section has outlined how the data set was prepared for analysis. The following section outlines the statistical analysis undertaken.

9.4 Statistical Analysis Plan

This section presents the statistical analysis plan used to analyse the study data that was prepared in consultation with the biostatistical supervisor (AG). As it uses a typical format for statistical analysis plans this section includes some repetition of information presented in brief in earlier sections of this chapter, which is elaborated on here.

9.4.1 Aim

The aim of this study was to:

- investigate whether rural patients’ risk of experiencing hospital harm differed from urban patients over a 3-year period as recorded in the general practice patient record;
- investigate whether there were differences in the severity and preventability of hospital harms between rural and urban patients

9.4.2 Research questions

For patients with one or more detectable hospital admission in their general practice patient record:

1. What was the overall risk of admission for patients in the study group? Did this vary by rural and urban location of general practice attended?
2. What was the overall risk of harm for patients experiencing hospital admission? Did this vary by rural and urban location?
3. Were there differences between patients who experienced hospital harm, compared to patients who did not, in the number of admissions, length of admissions or total occupied bed days during hospital admissions? Did this vary based on rural and urban location?
4. Did the severity or preventability of hospital harm experienced by patients with hospital admissions vary by rural and urban location?

5. Were age, sex, socioeconomic status (as measured by NZDep13 quintiles of patient residence\textsuperscript{220}, ethnicity (prioritised Māori, Pacific, ‘Other’, and European) or general practice size (large, medium and small) effect modifiers for associations examined in questions 1-4?

6. In exploratory analyses, did different definitions of rurality affect the association between rural and urban location and risk of hospital admission or risk of hospital harm?

9.4.3 Plan of Investigation

9.4.3.1 Study design

This study was a secondary analysis of a retrospective patient record review study.

9.4.3.2 Study group

The data set comprised the general practice records of 9076 randomly selected patients from 44 randomly selected general practices throughout New Zealand from the SHARP study.\textsuperscript{195} Data covered the 3 year period from 2011 to 2013 (36 months). Similar numbers of patients attending general practices in rural and urban settings were included. Harms experienced by patients as recorded in the general practice patient electronic clinical record had been identified by the original SHARP study research team.\textsuperscript{195}

For the secondary analysis, patients with hospital admissions, and patients that experienced harm as a result of hospital admissions were identified. The data set for analysis included the whole study group for research question 1 and 6 (and question 5 that related to it), and the sub-set of patients with any hospital admission for research questions 2, 3, 4 and 6 (and question 5 that related to it).
9.4.3.3 Outcomes

Hospital admission – an identified hospital admission, which could include inter-hospital transfer between hospitals in different towns or cities as part of the same inpatient hospital experience.

Hospital harm – The experience of one or more harms as identified by the original researchers, (defined as “physical, emotional, or financial negative consequences to patients directly arising from health care, beyond the usual consequences of care and not attributable to patients’ health condition”\(^{200}\)), judged to be the result of a hospital admission through the analysis of the general practice clinical record.

Hospital admission resulting in harm - hospital admissions where any hospital harm occurred.

Where harm detected - Where harm detected, being in hospital (either during hospital admission or a subsequent admission), or detected only in the general practice record.

Any preventable hospital harm – the experience of any hospital harm coded by the SHARP researchers as being preventable and originating in secondary care.

Hospital harm severity - The most severe harm experienced by patients with hospital admissions using a modified version of the severity score assigned by the SHARP researchers to each harm, with the categories of: 1=mild, 2=moderate, 3=severe and death.

9.4.3.4 Exposure

Location. Rural practices, as defined by the SHARP Study as being located in areas coded by Stats NZ as rural areas or independent urban areas (see §2.1.1.3, page 10, for definitions); urban practices, located in main urban and satellite urban areas. Patients were assumed to be living in the location (rural or urban) of the practice they attended.\(^{200}\)
### 9.4.3.4.1 Exploratory alternative definitions of rurality

Patients' adjusted risk of hospital admission and risk of hospital harm were analysed using the 5 alternative rurality definitions as below. In the exploratory analysis, patients were assumed to be living in the assigned location (rural or urban) of the practice they attended:

1. **RRS2**, a 2 part variable based on practices’ rural ranking scale (RRS) score.
   - Urban: RRS<35; Rural: RRS≥35
2. **RRS3**, a 3 part variable based on practices’ RRS.
   - Urban: RRS<35;
   - Mid Rural: RRS 35-49;
   - Most rural: RRS≥50
3. Nearest urban hospital (NUH) distance.
   - Close: Practice≤20 km from NUH;
   - Intermediate: Practice 21-50 km from NUH;
   - Far: Practice>50 km from NUH
4. Distance to nearest hospital by location.
   - Urban: standard urban definition (all within 31 km or less);
   - Rural close,<30 km to rural hospital;
   - Rural far,≥30 km to rural hospital
5. Drive time to nearest hospital.
   - Near: 15 minutes or less;
   - Moderate: 16 to 30 minutes;
   - Far: more than 30 minutes

### 9.4.3.5 Other predictors

*Age* Patient age at commencement of the 3 year study period. Age was analysed as a continuous variable whenever possible to maximise statistical power and in 20 year age bands when this aided explanation of the patterns seen.

*Sex* Male, female, as identified in patients’ records

*Socioeconomic status* Five categories for quintiles 1 (least deprived) to 5 (most deprived) with a sixth category used for patient records where no data was available. Quintiles were as recorded in the general practice clinical record, derived from the NZDep13 quintile for the recorded patient address. NZDep13 scores are area-based deprivation scores derived from aggregated census data regarding internet access, income, employment, qualifications, home ownership, living arrangement and access to transport for individuals living in small geographical areas. Geo-coding allows an

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192
address to be converted into a set of coordinates to link with other data, such as NZDep13 scores.\textsuperscript{243} Patient addresses that are not in a format recognised by geo-coding do not return a quintile score in general practice patient management systems. Misspelt addresses, private bags and post office boxes as addresses, and rural addresses not recorded in a geo-codable format, all contribute to difficulties in geo-coding addresses.\textsuperscript{243,244}

*Ethnicity* as defined in the general practice patient record, using prioritised Statistics NZ definitions and Level one codes, and grouped and prioritised into the following categories: Māori, Pacific, ‘Other’, then European.\textsuperscript{239} ‘Other’ as a category included all other ethnicities that were not coded as Māori, Pacific or European, and patient records where there was no information recorded regarding ethnicity.

*Practice size* General practice size, as determined by the original researchers: large practices (4500 or more patients), medium practices (2000–4499 patients) and small practices (<2000 patients)

*Inter-hospital transfer* Patient transfer between hospitals in different towns or cities, as part of the same inpatient hospital admission experience, during the three-year study period.

9.4.3.6  *Statistical analyses*

The statistical approach used to analyse the data is outlined below. Appendix 18 lists an outline of the tables to be populated through the analysis process.

9.4.3.6.1  *Analytical considerations*

Analyses were undertaken using the Stata-IC 15.1 statistical analysis package.\textsuperscript{245} Appendix 19 contains the data definitions of the Stata do-file, and Appendix 20 contains the Stata do-file created for this analysis.
9.4.3.6.1.1 Sample size and power

The SHARP Study was powered to detect 5% differences in health care harms experienced between rural and urban, and large, medium and small sized practices, with alpha=0.05 and power=0.80, by having randomly selected samples of 1345 patients in each of the six study groups (small medium and large, rural and urban practice groups). All six study groups exceeded this sample size.

As it was not possible to recruit more patient records for the secondary analysis, no formal sample size calculations were performed but the number of events was considered sufficient to allow for the most complex modelling anticipated. Initial calculations of likely sample size that would be achieved for the secondary analysis (as outlined in §3.3.4.2.2, page 63) suggested that at least 1000 patients would have had a hospital admission in the study period, and that there would be at least 150 patients with hospital related harms for analysis. This would allow regression models with 15 variables to be confidently used to analyse binary outcomes while staying within Peduzzi's rule of 10 events per variable (EPV). The retrospective power of the analysis as performed is communicated through the widths of reported confidence intervals.

9.4.3.6.1.2 Model development

Univariable analysis and multivariable analysis was undertaken using Poisson regression, as the admission and hospital harm data were either binary (and so producing relative risks) or count data (and so producing incidence rate ratios) with a mean and variance of similar value. Robust standard errors were used to correct standard errors for binary outcomes. Some models for count data outcomes showed evidence of over-dispersion, for example total occupied bed days, where the raw mean was 7.1 and variance 147.0 (where these would be equal under a Poisson distribution). In developing models for these parameters, negative binomial regression was used to test for evidence of over-dispersion. Due to the use of pseudo-likelihood functions, a likelihood ratio test could not be used so if evidence of substantial over-dispersion was present (given the overall low means this was indicated by the 95% confidence interval values for the scaling parameter being strictly greater than 1), the negative binomial distribution was used to implement the model, otherwise the simpler Poisson
regression model was used. The exception to this was analyses regarding harm severity, where ordinal logistic regression was used, after testing for proportionality using generalised ordinal logistic regression, and results reported as proportional odds ratios.

When developing regression models, evidence of nonlinearity for the continuous variable age was tested for, using the Wald test, through inclusion of the quadratic term age² and cubic term age³. These were retained only when statistically significant.

Clustering of patient records around participating general practices was taken into account using clustered robust standard errors with clustering within practices. Weightings developed from the SHARP study data were applied to the secondary analysis undertaken, to increase the generalisability of the point estimates and associated confidence intervals by more closely reflecting the NZ population. Other variables, such as age, sex, ethnicity, and deprivation could have been incorporated into the weightings if this information was available at the national level broken down by practice size but these data were not available in the primary SHARP Study.

Potential confounders of associations involving practice size and location were controlled for by including age, sex, prioritised ethnicity, socioeconomic status and general practice size in all models. While categorical and continuous age variables were investigated, age as a continuous variable was used for adjusted models.

Potential interactions between age and sex, location and age, location and sex, location and deprivation, location and ethnicity and location and practice size were assessed in the regression models using the Wald test, and retained only if statistically significant. Mean centring was applied to age as a continuous variable when interpreting interactions between age and other variables. Where there was evidence for an interaction between location and another variable in the final model, pairwise comparisons of marginal means were used to obtain differences and 95% confidence intervals, and for binary variables, p values. For variables with more than two levels, contrasts were used to obtain overall p values.
No rural Pacific patients experienced hospital harm, as shown in Table 10.4. When investigating interactions between ethnicity and location for risk of hospital harm, patients of Pacific and Other ethnicity were combined to produce a broader ‘Other (including Pacific)’ ethnicity group. This overcame the resulting quasi-complete separation created by the ‘zero’ cell that occurred for Pacific ethnicity and interactions in this case were tested for using the 3-level ethnicity variable (European, Māori, and Other).

When appropriate, the fit of final models (regarding inclusion of quadratic functions in final models) was compared using Aiaike information criterion (AIC), taking the model with the lower AIC as the selected model. I chose the AIC in preference to the Bayesian information criterion (BIC), as I was interested in finding the best fitting model (as AIC would favour) rather than the simpler, better generalising model that that the BIC would identify. As it transpired, both the AIC and BIC favoured the same final models where quadratic functions were involved.

9.4.3.6.1.3 Reporting findings

Descriptive statistics were presented as means and standard deviations for normally distributed continuous variables, medians and interquartile ranges for other continuous variables, and counts and percentages for categorical variables. The exception to this was relating to hospital bed-day occupancy, where means were reported despite the data not being normally distributed, as means were better indicators of resource use. Associations between categorical variables were examined using chi-squared tests (or Fisher’s exact test if more than 20% of cells had expected cell counts below 5), Poisson regression, (or negative binomial regression when evidence of over-dispersion was present) and ordinal logistic regression to produce percentages, relative risk and incidence rate ratios, and proportional odds ratios. Associations between continuous and categorical variables were performed using independent-sample t-tests (for two groups where data was normally distributed) or non-parametric Mann Whitney U tests for two groups otherwise. P-values were reported to three decimal places and corresponding 95% confidence intervals (CI) given where possible. Effect sizes or ratios were reported to two decimal places, except when this would make the direction of the effect size unclear, in which case three decimal places were used.
Statistical significance was declared when the two-sided p-values were $p<0.050$ and the associated 95% CI were presented to aid in interpreting potential clinical significance. Non-statistically significant tendencies ($0.100 > p \geq 0.050$) were noted where this would be useful in showing a pattern of differences, interpreting other results or generating hypotheses to highlight areas warranting further research.

9.4.3.6.2 Descriptive statistics regarding hospital admission and hospital harm

Data were described by the demographic characteristics of age, sex, ethnicity, NZDep13 quintile, the size of the general practice attended, and rural or urban location, and expressed as counts along with percent of total group size.

General practices participating in the SHARP Study by location and practice size were described and compared to the national population of general practices. The demographic characteristics of the SHARP study group and subgroups who had experienced hospital admissions and hospital harm were described. The demographic characteristics of rural and urban patients for the study group, patients who had hospital admissions and patients with hospital harms during the study period were described, as well as the number of admissions and admissions resulting in harm.

9.4.3.6.3 Risk and rate ratios regarding hospital admission and hospital harm

Patients with at least one identified hospital admission were compared with patients with no hospital admissions during the three-year study period by univariable analysis and results presented as percentages with 95% CI. Unadjusted risk ratios (uRR) and adjusted risk ratios (aRR) with 95% CI and $p$-values, adjusted for the demographic variables of age, sex, location, ethnicity, socioeconomic status and practice size were estimated using Poisson regression with robust standard errors clustered by practice.

Using the same approach, patients who experienced hospital related harm during any hospital admission were compared to those patients without hospital harm during admissions and presented as percentages, with unadjusted and adjusted risk ratios by the different demographic variables again estimated with Poisson regression as above.
The unadjusted (uIRR) and adjusted rate ratios (aIRR) with 95% CI and p-values for the rate of admissions resulting in harm over the 3 year study period were estimated, by different demographic variables of age, sex, location, ethnicity, socioeconomic status and practice size using Poisson regression initially and then with checks for over-dispersion.

9.4.3.6.4 Descriptive statistics regarding hospital stays
For patients with at least one hospital admission, the subset of patients where there was complete data for hospital lengths of stay over the 3 year period, and this sub-set by rural and urban location were described by the demographic characteristics of age, sex, ethnicity, NZDep13 quintile, and the size of the general practice attended, expressed as numbers with percentages.

For the group of patients with full length of stay data, the pattern of admissions by mean number of admissions, lengths of stay and total occupied bed days over the 3 year study period was described.

9.4.3.6.5 Effects of hospital harm and demographic characteristics on hospital stays
The number of admissions, mean length of stay and total occupied bed days for patients who experienced hospital harm and patients who did not were compared, and by rural and urban location, using Poisson and negative binomial regression when appropriate, and presented results as unadjusted incidence rate ratios (uIRR) with 95% confidence intervals and p-values.

The effect of hospital harm and the demographic variables of age, sex, ethnicity, NZDep13 quintile, the size of the general practice attended on total occupied bed days using negative binomial regression was estimated, and the findings presented as adjusted incidence rate ratios (aIRR) with 95% confidence intervals and p-values.

9.4.3.6.6 Patterns of harm experienced
For patients with hospital harm, the type of harm and whether it was detected in the hospital clinical record or only in the general practice record was calculated, by rural and urban location. The risk of experiencing any preventable harm was calculated for
rural and urban patients, and the risk ratio, unadjusted and adjusted for age, sex and ethnicity reported. The most severe harm experienced by patients was calculated by rural and urban location. Maximum harm severity experienced was a three-part outcome variate. After testing for evidence against proportionality using a generalised ordinal logistic regression model, ordinal logistic regression was used to calculate the odds ratio of experiencing a more severe harm by rural and urban location, unadjusted and adjusted for age and sex. The smaller sample sizes dictated that fewer variables could be included in the adjusted models using the 10 EPV guideline described earlier in 9.4.3.6.1.246

9.4.3.6.7 Association with inter-hospital transfer and hospital harm

For patients with hospital admissions, the association between hospital transfer and hospital harm was tabulated and the risk of hospital harm was calculated, for rural location (as all inter-hospital transfers occurred in rural patients) adjusted separately for age and sex, again with fewer variables in the adjusted models due to the smaller sample size.

9.4.3.6.8 Testing the effect of different definitions of rurality

For the 5 different definitions of rurality, the patient group size for the study group, patients with hospital admissions, and patients with hospital harms, and the number of contributing general practices in each category was described. For each of the three final models for the adjusted risk ratio of any hospital admission, the adjusted risk ratio of any hospital harm amongst those with at least one admission, and the adjusted incidence rate ratio of admissions resulting in harm, the impact of each of the 5 different definitions of rurality was calculated by using the alternative rurality definition in the place of the variable ‘location’ in the models. The resulting risk ratios and rate ratios were presented in table form, with 95% CI and p-values.

9.5 Summary

In this chapter the methods applied to analyse the patient hospital harm data have been described. After a brief introduction, an overview of the approach taken was presented. The next section covered the data collection and preparation and the last section
outlined the statistical analysis plan applied to the data. The next chapter presents the results of the analysis using these methods.
10 Hospital Harms Study Results

10.1 Introduction

The previous chapter outlined the approach I used to analyse the Hospital Harms Study data. This chapter presents the results of the analysis. The study group is described. The risk of hospital admission and hospital harm and associations with location and sociodemographic characteristics are explored. The associations between hospital harm and hospital bed day use, and hospital harm and inter-hospital transfer are presented. Finally the effects of different definitions of rurality on hospital admission and hospital harm are described.

10.2 A description of the Hospital Harms Study group

This section describes the general practices included the Hospital Harms Study. The data set used for the Hospital Harms Study was the original data set from the SHARP Study. The included practices in the Hospital Harms Study are compared to all New Zealand (NZ) general practices. The characteristics of the whole study group and the sub-groups of patients with hospital admissions and hospital harm are described and compared by rural and urban location.

10.2.1 The participating general practices

Forty-four general practices (practices) were included in the Hospital Harms Study. These included 18 large (mean enrolled patients/practice=7893, ranging between 4512-16682 patients), 17 medium (mean=3117, [2342-4355]) and 11 small (mean=1420, [660-1992]) general practices made up of 24 rural and 20 urban practices. These practices were the participating practices in the original SHARP Study. More detail on the objectives and methods of the SHARP Study are included in §9.2 (page 171) and Appendix 16. Table 10.1 outlines how the practices included in the Hospital Harms Study varied from the 72 practices randomly selected to be invited to be part of the SHARP Study, and from all 988 general practices in NZ. Practice size is reported using large urban practices as the reference, as over half of NZers attend large urban practices.
Table 10.1 Characteristics of general practices participating in the Hospital Harms Study compared to SHARP Study invitees and all NZ practices (adapted from Leitch et al\textsuperscript{38})

<table>
<thead>
<tr>
<th></th>
<th>All New Zealand general practices in 2014</th>
<th>Randomly selected invited general practices, SHARP</th>
<th>Participating general practices, Hospital Harms Study*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practices*</td>
<td>Enrolled patients*</td>
<td>Mean patients per practice</td>
</tr>
<tr>
<td>Urban large</td>
<td>271 (27.4) 2,180,460 (53.3) 8046 12 (16.7)</td>
<td>8695 7 (15.6) 8534 1501 (16.5)</td>
<td></td>
</tr>
<tr>
<td>Urban medium</td>
<td>263 (26.6) 821,663 (20.1) 3124 12 (16.7)</td>
<td>3153 8 (17.8)* 3054 1543 (17.0)</td>
<td></td>
</tr>
<tr>
<td>Urban small</td>
<td>255 (25.8) 367,213 (9.0) 1440 12 (16.7)</td>
<td>1424 6 (13.3) 1323 1500 (16.5)</td>
<td></td>
</tr>
<tr>
<td>Subtotal Urban</td>
<td>789 (79.9) 3,369,336 (82.3) 4270 36 (50)</td>
<td>4424 21 (46.7) 4386 4544 (50.1)</td>
<td></td>
</tr>
<tr>
<td>Rural large</td>
<td>58 (5.9) 416,226 (10.2) 7176 12 (16.7)</td>
<td>7512 11 (24.4) 7687 1502 (16.6)</td>
<td></td>
</tr>
<tr>
<td>Rural medium</td>
<td>66 (6.7) 203,972 (5.0) 3090 12 (16.7)</td>
<td>3215 8 (17.8) 3415 1537 (16.9)</td>
<td></td>
</tr>
<tr>
<td>Rural small</td>
<td>75 (7.6) 103,149 (2.5) 1375 12 (16.7)</td>
<td>1364 5 (11.1) 1323 1493 (16.5)</td>
<td></td>
</tr>
<tr>
<td>Subtotal Rural</td>
<td>199 (20.1) 723,347 (17.7) 3635 36 (50)</td>
<td>4030 24 (53.3) 4937 4532 (49.9)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>988 (100) 4,092,683 (100) 4142 72 (100)</td>
<td>4227 45* (100) 4680 9076 (100)</td>
<td></td>
</tr>
</tbody>
</table>

Note: *Values are count (percentage) unless otherwise indicated * One practice that submitted data for the overall summary table was not using MedTech, so overall number of participating practices in SHARP Study was 44.
10.2.2 Demographics of the study group

Table 10.2 compares the ethnic composition of the study group for the Hospital Harms Study to the NZ population in 2013. European patients were over represented by almost 6% in absolute terms and Pacific patients were underrepresented by half (3.5% vs 7%) and ‘Other’ patients by nearly one third (6.0% vs 8.9%) compared to the general population. The ‘Other’ category included all patients not identified as Māori, Pacific, European or with no ethnicity data recorded.

<table>
<thead>
<tr>
<th></th>
<th>Hospital Harms Study*</th>
<th>2013 Census population*</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>6889 (75.9)</td>
<td>2969394 (70.0)</td>
</tr>
<tr>
<td>Māori</td>
<td>1326 (14.6)</td>
<td>598602 (14.1)</td>
</tr>
<tr>
<td>Pacific</td>
<td>316 (3.5)</td>
<td>295941 (7.0)</td>
</tr>
<tr>
<td>Other</td>
<td>545 (6.0)</td>
<td>378111 (8.9)</td>
</tr>
<tr>
<td>Total</td>
<td>9076</td>
<td>4242048</td>
</tr>
</tbody>
</table>

*Values are count (percentage) unless otherwise indicated

The study group The demographics of the 9076 patients in the study group are shown in Table 10.3. Consistent with the study design, similar numbers of patients attended rural and urban general practices, and small, medium and large practices. Roughly equal numbers of men and women were included, with a median age of 43 years. The age distribution for the study group showed a bi-modal distribution with peaks in childhood and in later middle-age, as shown in Figure 10.1. Fewer patients residing in areas with higher (more deprived) NZDep13 quintile scores were included, and the NZDep13 quintile scores of the areas where 894 patients resided (9.9%) was unknown.

Patients with hospital admissions Of the study group, 1561 patients (17.2%) had at least one identified hospital admission. There was no difference in the proportion of rural and urban patients who experienced hospital admissions compared to those who did not. The proportion of patients attending small urban practices who
had hospital admissions were lower than the other groups of practices by location and size (p=0.001). The age distribution for patients with hospital admissions was positively skewed towards older age, as shown in Figure 10.2. Patients with hospital admissions were older than patients without admissions (median age for hospital admissions 57 years, vs no hospital admission 40 years, Mann-Whitney-U [MWU] p<0.001). European patients were more likely to be admitted than other patients (p=0.003), with patients of ‘Other’ ethnicity less likely (p<0.001). There was no difference seen for practice size (not including location), sex or socioeconomic status.

*Patients with hospital harm* Of the entire study group 195 patients (2.2%) had at least one hospital harm recorded. Of the 1561 patients with an identified hospital admission, 172 patients (11.0%) had hospital harms resulting from hospital admissions. There was no difference in the proportion of rural and urban patients who experienced hospital harm compared to those with hospital admissions who did not. The positive skew towards older age was more marked for patients with hospital harms, as shown in Figure 10.3. Patients with at least one admission experiencing hospital related harm were older than those with no harm (median age for hospital harm 64 years, vs no hospital harm 56 years, MWU p<0.001). There was no difference seen for practice size (including location or not), sex, ethnicity or socioeconomic status in patients with hospital admissions who did and did not experience hospital harm.
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Subset</th>
<th>Total n=9076*</th>
<th>Hospital admissions n=1561*</th>
<th>Hospital admissions resulting in harm n=172*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Urban</td>
<td>4,544 (50.1)</td>
<td>752 (48.2)</td>
<td>79 (45.9)</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>4,532 (49.9)</td>
<td>809 (51.8)</td>
<td>93 (54.1)</td>
</tr>
<tr>
<td>Practice Size</td>
<td>Large</td>
<td>3003 (33.1)</td>
<td>507 (32.5)</td>
<td>60 (34.9)</td>
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<tr>
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<td>Medium</td>
<td>3080 (33.9)</td>
<td>561 (35.9)</td>
<td>62 (36.0)</td>
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<tr>
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<td>Small</td>
<td>2993 (33.0)</td>
<td>493 (31.6)</td>
<td>50 (29.1)</td>
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<td>1501 (16.5)</td>
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<td>Urban medium</td>
<td>1543 (17.0)</td>
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<td>215 (13.8)</td>
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<tr>
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<td>Rural large</td>
<td>1502 (16.6)</td>
<td>244 (15.6)</td>
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<td>1537 (16.9)</td>
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<tr>
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<td>Rural small</td>
<td>1493 (16.5)</td>
<td>278 (17.8)</td>
<td>26 (15.1)</td>
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<tr>
<td>Sex</td>
<td>Male</td>
<td>4,304 (47.4)</td>
<td>718 (46.0)</td>
<td>83 (48.3)</td>
</tr>
<tr>
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<td>Female</td>
<td>4,772 (52.6)</td>
<td>843 (54.0)</td>
<td>89 (51.7)</td>
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<tr>
<td>Age (years)</td>
<td>Mean (SD)</td>
<td>41.6 (23.8)</td>
<td>53.4 (24.6)</td>
<td>60.4 (19.9)</td>
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<td></td>
<td>Median (IQR)</td>
<td>43 (40)</td>
<td>57 (36)</td>
<td>64 (25.5)</td>
</tr>
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<td>Range</td>
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<td>0 - 104</td>
<td>3 - 92</td>
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<tr>
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<td>20-39</td>
<td>1926 (21.2)</td>
<td>223 (14.3)</td>
<td>19 (11.1)</td>
</tr>
<tr>
<td>Indicator</td>
<td>Subset</td>
<td>Total n=9076*</td>
<td>Hospital admissions n=1561*</td>
<td>Hospital admissions resulting in harm n=172*</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------</td>
<td>--------------</td>
<td>-----------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>40-59</td>
<td>2638 (29.1)</td>
<td>417 (26.7)</td>
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<tr>
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<td>60-79</td>
<td>1834 (20.2)</td>
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<tr>
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<td>80+</td>
<td>494 (5.4)</td>
<td>225 (14.4)</td>
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<tr>
<td>Ethnicity</td>
<td>European</td>
<td>6,889 (75.9)</td>
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<td>140 (81.4)</td>
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<tr>
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<td>Māori</td>
<td>1,326 (14.6)</td>
<td>209 (13.4)</td>
<td>18 (10.5)</td>
</tr>
<tr>
<td></td>
<td>Pacific</td>
<td>316 (3.5)</td>
<td>61 (3.9)</td>
<td>7 (4.1)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>545 (6.0)</td>
<td>61 (3.9)</td>
<td>7 (4.1)</td>
</tr>
<tr>
<td>Socio-economic status - NZDep</td>
<td>Quintile 1</td>
<td>1,966 (21.7)</td>
<td>315 (20.2)</td>
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<tr>
<td></td>
<td>Quintile 2</td>
<td>1,862 (20.5)</td>
<td>321 (20.6)</td>
<td>34 (19.8)</td>
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<td></td>
<td>Quintile 3</td>
<td>1,701 (18.7)</td>
<td>292 (18.7)</td>
<td>30 (17.4)</td>
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<tr>
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<td>Quintile 4</td>
<td>1,354 (14.9)</td>
<td>251 (16.1)</td>
<td>26 (15.1)</td>
</tr>
<tr>
<td></td>
<td>Quintile 5</td>
<td>1,299 (14.3)</td>
<td>231 (14.8)</td>
<td>32 (18.6)</td>
</tr>
<tr>
<td></td>
<td>No data</td>
<td>894 (9.9)</td>
<td>151 (9.7)</td>
<td>23 (13.4)</td>
</tr>
<tr>
<td>All Harms</td>
<td>Any harm</td>
<td>1,504 (16.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No harm</td>
<td>7,572 (83.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital harms</td>
<td>Any hospital harm</td>
<td>195* (2.2)</td>
<td>172* (11.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No hospital harm</td>
<td>8,881 (97.8)</td>
<td>1389 (89.0)</td>
<td></td>
</tr>
</tbody>
</table>

Values are count (percentage) unless otherwise indicated. # In total, 195 patient records indicated hospital harm, and 172 patient records with hospital harm had an identified hospital admission (§9.3.3, page 179, for more detail)
Figure 10.1 Age distribution for the whole Hospital Harms Study group by 5 year age bands

Figure 10.2 Age distribution for patients with hospital admissions, by 5 year age bands

Figure 10.3 Age distribution for patients with hospital harm, by 5 year age bands
10.2.3 Rural and urban comparisons

The previous section presented demographic information on the study group as a whole, and for those with hospital admissions and with hospital harms. This section focuses on similar data, presented by location.

Figure 10.4 shows the proportions of hospital admission and hospital harm for the whole study group, and by rural and urban location.

Summary of the study population and rural and urban sub-groups

<table>
<thead>
<tr>
<th>Study population</th>
<th>9076 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital admission?</td>
<td>Yes</td>
</tr>
<tr>
<td>Hospital harm?</td>
<td>1561 (17.2%)</td>
</tr>
<tr>
<td>Yes</td>
<td>172 (11.0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Urban patients</th>
<th>4544 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital admission?</td>
<td>Yes</td>
</tr>
<tr>
<td>Hospital harm?</td>
<td>752 (16.5%)</td>
</tr>
<tr>
<td>Yes</td>
<td>79 (10.5%)</td>
</tr>
<tr>
<td>No</td>
<td>809 (17.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rural patients</th>
<th>4532 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital admission?</td>
<td>Yes</td>
</tr>
<tr>
<td>Hospital harm?</td>
<td>93 (11.5%)</td>
</tr>
</tbody>
</table>

Table 10.4 compares the characteristics of the study group, patients who had hospital admissions and patients who experienced hospital harm, by rural and urban location. Rural patients represented 49.9% of the study group, 51.8% of the hospital admission group compared to urban patients (p=0.100), and 54.1% of the hospital harm group compared to urban patients (p=0.532).

Practice size Similar proportions of patients were in each practice group, consistent with the study design. For patients with hospital admissions, a lower percentage of rural patients attended large practices than urban patients.
(p=0.042), and a higher percentage of rural patients attended smaller practices than urban patients (p=0.014).

Sex The distribution of sex in the study group differed by location. There were similar proportions of male and female patients in rural locations, but more female patients than male patients in urban locations (p=0.001).

Age There was no evidence of difference in age distribution between rural and urban patients, for the study group (Mann-Whitney U [MWU] p=0.234), those with hospital admissions (MWU p=0.776) and those with hospital harm (MWU p=0.307). By age band there was a lower percentage of rural patients aged 20-39 (p=0.003), and a higher percentage aged 60-79 (p=0.001) compared to urban locations for the study group, but similar percentages for those having hospital admissions or experiencing hospital harm.

Ethnicity A higher percentage of Māori patients (p<0.001) and European patients (p=0.003), and a lower percentage of Pacific patients (p<0.001) and ‘Other’ patients (p<0.001) in the study group lived in rural compared to urban settings. A lower percentage of Pacific patients experiencing hospital admissions (p<0.001) and hospital harm (p=0.003) lived in rural settings.

Socioeconomic status There was a lower percentage of rural patients living in Quintile 1 areas (p=0.005) compared to urban patients in the study group. Otherwise socioeconomic status was evenly distributed by location where recorded although the numerically lower percentage of rural patients living in Quintile 2 areas was just outside the statistically significant level (p=0.056). A higher percentage of rural compared to urban patients had no data on socioeconomic status in the study group (12.9% versus 6.8%, p<0.001) and in patients with hospital admissions (12.4% versus 6.6%, p<0.001).

Hospital harms No difference in the proportion of hospital harms for the study group and patients with hospital admissions was noted by location.
Table 10.4 Characteristics of patients in Hospital Harms Study group, with identified hospital admissions, and hospital harm, comparing rural and urban locations

<table>
<thead>
<tr>
<th>Practice size</th>
<th>Urban location, study group n=9076</th>
<th>Rural location, study group n=9076</th>
<th>Urban location, hospital admission n=1561</th>
<th>Rural location, hospital admission n=1561</th>
<th>Urban location, hospital harm, n=172</th>
<th>Rural location, hospital harm, n=172</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>1501 (33.0)</td>
<td>1502 (33.1)</td>
<td>263 (35.0)</td>
<td>244 (30.2)*</td>
<td>28 (46.7)</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>1543 (34.0)</td>
<td>1537 (33.9)</td>
<td>274 (36.4)</td>
<td>287 (35.5)</td>
<td>27 (43.6)</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td>1500 (33.0)</td>
<td>1493 (32.9)</td>
<td>215 (28.6)</td>
<td>278 (34.4)*</td>
<td>24 (48.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2078 (45.7)</td>
<td>2226 (49.1)**</td>
<td>332 (44.2)</td>
<td>386 (47.7)</td>
<td>35 (44.3)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2466 (54.3)</td>
<td>2306 (50.9)**</td>
<td>420 (55.8)</td>
<td>423 (52.3)</td>
<td>44 (55.7)</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>41.4 (23.7)</td>
<td>41.8 (23.8)</td>
<td>53.2 (25.4)</td>
<td>53.7 (23.8)</td>
<td>62.3 (19.3)</td>
</tr>
<tr>
<td></td>
<td>Median (IQR)</td>
<td>42 (38)</td>
<td>44 (41)</td>
<td>56 (38)</td>
<td>58 (33)</td>
<td>66 (28)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-19</td>
<td>1062 (23.4)</td>
<td>1122 (24.8)</td>
<td>100 (13.3)</td>
<td>98 (12.1)</td>
<td>3 (3.8)</td>
</tr>
<tr>
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<td>20-39</td>
<td>1023 (22.5)</td>
<td>903 (19.9)**</td>
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<td>8 (10.1)</td>
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<td>40-59</td>
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<td>1302 (28.7)</td>
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<td>222 (27.4)</td>
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</tr>
<tr>
<td>Age</td>
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<td>Rural location, study group n=9076+</td>
<td>Urban location, hospital admission n=1561+</td>
<td>Rural location, hospital admission n=1561+</td>
<td>Urban location, hospital harm, n=172+</td>
<td>Rural location, hospital harm, n=172+</td>
</tr>
<tr>
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<td>-------------------------------------</td>
<td>-----------------------------------------</td>
<td>-----------------------------------------</td>
<td>-------------------------------------</td>
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</tr>
<tr>
<td>60-79</td>
<td>855 (18.8)</td>
<td>979 (21.6)**</td>
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<td>276 (34.1)</td>
<td>33 (41.8)</td>
<td>44 (47.3)</td>
</tr>
<tr>
<td>80+</td>
<td>268 (5.9)</td>
<td>226 (5.0)</td>
<td>122 (16.2)</td>
<td>103 (12.7)</td>
<td>15 (19.0)</td>
<td>11 (11.8)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>European 3389 (74.6)</td>
<td>3500 (77.2)**</td>
<td>580 (77.1)</td>
<td>650 (80.4)</td>
<td>65 (82.3)</td>
<td>75 (80.7)</td>
</tr>
<tr>
<td></td>
<td>Māori 564 (12.4)</td>
<td>762 (16.8)**</td>
<td>88 (11.7)</td>
<td>121 (15.0)</td>
<td>5 (6.3)</td>
<td>13 (14.0)</td>
</tr>
<tr>
<td></td>
<td>Pacific 225 (5.6)</td>
<td>61 (1.4)**</td>
<td>52 (6.9)</td>
<td>9 (1.1)**</td>
<td>7 (8.9)</td>
<td>0 (0)**</td>
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<tr>
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<td>Other 336 (7.4)</td>
<td>209 (4.6)**</td>
<td>32 (4.3)</td>
<td>29 (3.6)</td>
<td>2 (2.5)</td>
<td>5 (5.4)</td>
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<td>926 (20.4)**</td>
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<td>Quintile 2 969 (21.3)</td>
<td>893 (19.7)</td>
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<td>833 (18.4)</td>
<td>140 (18.6)</td>
<td>152 (18.8)</td>
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<td>Quintile 4 693 (15.3)</td>
<td>661 (14.6)</td>
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<td>13 (14.0)</td>
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<td>Rural location, study group n=9076+</td>
<td>Urban location, hospital admission n=1561+</td>
<td>Rural location, hospital admission n=1561+</td>
<td>Urban location, hospital harm, n=172+</td>
<td>Rural location, hospital harm, n=172+</td>
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<td>51 (6.8)</td>
<td>100 (12.4)***</td>
<td>7 (8.9)</td>
<td>16 (17.2)</td>
</tr>
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<td>4428 (97.7)</td>
<td>673 (89.9)</td>
<td>716 (88.5)</td>
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<td>91# (2.0)</td>
<td>104# (2.3)</td>
<td>79## (10.5)</td>
<td>93##(1)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4544 (50.1)</td>
<td>4532 (49.9)</td>
<td>752 (48.2)</td>
<td>809 (51.8)</td>
<td>79 (45.9)</td>
<td>93 (54.1)</td>
</tr>
</tbody>
</table>

*Values are count (percentage) unless otherwise indicated #calculated for 195 patient records indicating hospital harm ## calculated for 172 patient records with a hospital harm and identified hospital admission. Within each of study group, hospital admissions and hospital harm, statistically significant differences noted with Pearson's chi-squared test *p<0.05  **p<0.01  ***p<0.001
10.3 Patients with hospital admissions

The previous section described the characteristics of the whole study group. This section explores the subset of patients with hospital admissions and hospital harm, which together form the main focus of the analysis. The risk of hospital admission, of hospital harm and the rate ratio for hospital admissions resulting in harm are investigated. The patterns of admission and harm associated with interhospital transfer, and the types of hospital harm and their associations are presented.

10.3.1 Risk of hospital admission

This section describes patients who were admitted to hospital compared with those who were not, and present unadjusted and adjusted risk of hospital admission, by location and by other sociodemographic characteristics.

Most of the 1561 patients who had been admitted to hospital had one (1052 patients, 67.4%) or two (286 patients, 18.3%) admissions over the three-year study period, as shown in Figure 10.5 and Table 10.5. The highest number of admissions for urban patients was 18, and for rural patients was 23.

The number of admissions experienced was similar by location (urban patients, mean number of admissions 1.67, rural patients 1.63, MWU p=0.156) but urban patients had a higher number of admissions resulting in hospital harm (mean number of admissions urban patients 1.15, rural patients 1.04, MWU p=0.012).
**Figure 10.5** Number of hospital admissions by frequency

**Table 10.5** Hospital admissions and admissions resulting in harm

<table>
<thead>
<tr>
<th></th>
<th>Patients</th>
<th>No. of admissions</th>
<th>Mean no. of admissions per patient (min-max)</th>
<th>No. of patients with hospital harm*</th>
<th>Total no. of admissions resulting in harm</th>
<th>Mean no. of admissions resulting in harm per patient (min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>1561</td>
<td>2578</td>
<td>1.65 (1-23)</td>
<td>172 (11.0)</td>
<td>188</td>
<td>1.09 (1-3)</td>
</tr>
<tr>
<td>Urban</td>
<td>752</td>
<td>1257</td>
<td>1.67 (1-23)</td>
<td>79 (10.5)</td>
<td>91</td>
<td>1.15 (1-3)</td>
</tr>
<tr>
<td>Rural</td>
<td>809</td>
<td>1321</td>
<td>1.63 (1-18)</td>
<td>93 (11.5)</td>
<td>97</td>
<td>1.04 (1-3)**</td>
</tr>
</tbody>
</table>

*Values are count (percentage) unless otherwise indicated; **MWU p=0.012 compared to urban; #No. = number
Table 10.6 compares patients with at least one identified hospital admission compared with patients who had no hospital admission during the three-year study period, and provides unadjusted risk ratios (uRR) and adjusted risk ratios (aRR) by location and other predictors. The findings as shown in Table 10.6 are described in more detail below.

10.3.1.1 Risk of hospital admission by location

There was no evidence of a difference in risk for hospital admission for patients living in rural compared to urban locations in unadjusted (uRR 1.00 [95% confidence interval (CI) 0.84-1.19] p=0.980) or adjusted (aRR 0.98 [0.83-1.17] p=0.844) models.

10.3.1.2 Risk of hospital admission – other predictors and the unadjusted model

Age A higher unadjusted risk of hospital admission was associated with higher age (p<0.001). Patients aged 60-79 years had an associated 2.7 times the risk of hospital admission compared to patients aged 0-19 (uRR 2.67 [2.23-3.20], p<0.001), and patients aged 80 and over had nearly five times the risk of hospital admission compared to patients aged 0-19 (uRR 4.77 [3.94-5.77], p<0.001). The pairwise comparisons within age groups showed highly statistically significant (p<0.001) increasing admission risk associated with higher age for all comparisons except for patients aged 20-39 compared to 0-19, (p=0.067) and patients aged 40-59 compared to 20-39 (p=0.061).

Ethnicity There was evidence of a significant association between ethnicity and unadjusted risk of admission. Pairwise comparisons of ethnicity groups showed patients in the 'Other' group had a statistically significant lower risk of admission compared to Māori, (uRR 0.73 [0.54-0.97] p=0.031), Pacific (uRR 0.55 [0.35-0.88] p=0.013) and European (uRR 0.64 [0.48-0.85] p=0.003) patients. Given the small number of patients in this category, it was not possible to create specific groups to further explore any possible association. Māori had a non-statistically significant lower risk compared to European patients (uRR 0.88 [0.76-1.02] p=0.091), with
no evidence of a significant difference for European or Māori patients compared to Pacific patients.

*Other predictors* There was no evidence for differences in the unadjusted risk of having a hospital admission by practice size or a combination of location and practice size, sex or socioeconomic status (all \( p \geq 0.158 \)).

**10.3.1.3 Risk of hospital admission – other predictors and the adjusted model**

*Practice size* In the adjusted model, practice size was associated with risk of admission \( (p=0.023) \). Patients attending small practices had an associated 24% lower risk of admission over the 3 year period, compared to large practices \( (\text{aRR} 0.76 \ [0.62-0.92], \ p=0.006) \), as shown in Figure 10.6. There was no evidence of a significant interaction between location and practice size \( (p=0.067) \).

![Adjusted risk of hospital admission by general practice size](image)

**Figure 10.6 Practice size and adjusted risk (with 95% CIs) of hospital admission**

*Sex* Females showed a non-statistically significant increase in the risk of hospital admissions compared to males \( (\text{aRR} 1.25 \ [0.98-1.58] \ p=0.69) \)
When developing the adjusted model for risk of hospital admission, the association with age was nonlinear with statistically significant improvement to the model using the quadratic (age^2) and cubic (age^3) terms for age alongside linear age. This showed a slightly higher risk of admission for patients aged under 10, a flattening of the risk of admission from 15-25 years old, with a gradual increase in risk through the late 20s through until the early 50s, with a steeper increase in risk of admission from there onwards, as shown in Figure 10.7.

Sex and age interaction An interaction was seen between sex, age and age^2, as seen in Figure 10.8, which showed statistically significant differences from aged 65 to 95 years old. Women at aged 65 had a higher risk of admission than men, and from age 70 to 95, men’s risk of admission was higher than for women. The final regression model that best fitted the data retained age^3.
Ethnicity A statistically significant association between ethnicity and admission risk was seen ($p=0.010$) Pairwise comparisons showed a reduced risk of admission for ‘Other’ compared to Māori, (aRR 0.66 [0.50-0.86] $p=0.003$), to Pacific (aRR 0.52 [0.32-0.85] $p=0.011$) and to European patients (aRR 0.74 [0.56-0.98] $p=0.036$). Māori patients had a non-statistically significant higher adjusted risk of admission (aRR 1.13 [0.99-1.28] $p=0.073$). There was no evidence of a difference in the adjusted risk of admission for Pacific compared to European patients (aRR 1.43 [0.90-2.28] $p=0.125$) or Māori patients (aRR 1.27 [0.81-1.99] $p= 0.286$).

Other predictors and interactions. There was no evidence for differences in the adjusted risk of having a hospital admission by socioeconomic status ($p=0.820$). There was no evidence of an interaction between location and each of age (including higher order terms [$p=0.273$ for age, $0.196$ for age$^2$]), ethnicity ($p=0.653$) and socioeconomic status ($p=0.922$).
### Table 10.6 Comparison of patients who did and did not have a hospital admission

<table>
<thead>
<tr>
<th></th>
<th>Total n=9076</th>
<th>Any hospital admission n=1561</th>
<th>No hospital admission n=7515</th>
<th>Unadjusted Risk Ratio (95% CI)</th>
<th>p-value</th>
<th>Adjusted Risk Ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>count</strong></td>
<td>count</td>
<td>% (95% CI)</td>
<td>count</td>
<td>% (95% CI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
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<tr>
<td>Urban</td>
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<td>752</td>
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<td>3792</td>
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<td>3723</td>
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<td>1.00 (0.84-1.19)</td>
<td>0.98 (0.83-1.17)</td>
</tr>
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<td><strong>Practice Size</strong></td>
<td></td>
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<tr>
<td>Large</td>
<td>3003</td>
<td>507</td>
<td>16.9 (15.6-18.3)</td>
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<td>83.1 (81.7-84.4)</td>
<td>reference</td>
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<td>2500</td>
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<td>0.88 (0.68-1.15)</td>
<td>0.76 (0.62-0.92)</td>
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<td>Total n=9076</td>
<td>Any hospital admission n=1561</td>
<td>No hospital admission n=7515</td>
<td>Unadjusted Risk Ratio (95% CI)</td>
<td>p-value</td>
<td>Adjusted Risk Ratio (95% CI)</td>
<td>p-value</td>
</tr>
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</tr>
<tr>
<td><strong>count</strong></td>
<td>count</td>
<td>% (95% CI)</td>
<td>count</td>
<td>% (95% CI)</td>
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<td>18.6 (16.7-20.7)</td>
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<td>1.06 (0.81-1.27)</td>
<td></td>
</tr>
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<td>No hospital admission n=7515</td>
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<td>p-value</td>
<td>Adjusted Risk Ratio (95% CI)</td>
<td>p-value</td>
</tr>
<tr>
<td>-------------------</td>
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<tr>
<td>count</td>
<td>count</td>
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<td>count</td>
<td>% (95% CI)</td>
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</tr>
<tr>
<td>Other</td>
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<td>11.2 (8.7-14.1)</td>
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<td>0.64 (0.48-0.85)</td>
<td>0.74 (0.56-0.98)</td>
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<tr>
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<td>p-value</td>
<td>Adjusted Risk Ratio (95% CI)</td>
</tr>
<tr>
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<td>Quintile 3</td>
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<td>743</td>
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<td>1.07 (0.84-1.36)</td>
<td>1.10 (0.88-1.37)</td>
<td></td>
</tr>
</tbody>
</table>

Note: While categorical and continuous age variables were investigated, the latter was used for adjusted models. *Reported to 3 decimal places to show direction of effect.
This section has presented findings comparing patients with and without hospital admission and identified that there was no evidence of association between hospital admission risk and location. Smaller general practice size was associated with lower adjusted risk of admission, and higher age was associated with higher risk of admission.

### 10.3.2 The risk of hospital harm

This section presents findings comparing patients with hospital admissions who did and did not experience hospital harm. The unadjusted and adjusted risk of hospital harm by location and sociodemographic predictors are presented.

Patients who experienced any hospital admissions resulting in harm are compared below with patients with hospital admissions not resulting in harm. Unadjusted and adjusted risks by different demographic characteristics are presented in Table 10.7 and described below in more detail.

#### 10.3.2.1 Risk of hospital harm by location

There was no evidence of a significant difference in the unadjusted risk (uRR 1.17 [0.80-1.70] \( p=0.410 \)) or adjusted risk (aRR 1.01 [0.97-1.05] \( p=0.587 \)) of hospital harm for rural patients compared to urban patients. Age and sex, and age and location showed evidence of interaction in the adjusted model.

#### 10.3.2.2 Risk of hospital harm – other predictors and the unadjusted model

For the unadjusted risk ratios, age was the only variable that showed evidence of association with risk of hospital harm, with this risk increasing for those of higher age (\( p<0.001 \)). This risk was statistically significantly higher for patients aged 40 and over compared to patients aged 0-19 and peaked at nearly four times the risk (uRR 3.92 [1.80-8.54]) for patients aged 60-79. Sex, ethnicity, socioeconomic status and general practice size showed no evidence of an association with the unadjusted risk of harm related to hospital admissions (all \( p\geq0.050 \)).
10.3.2.3 Risk of hospital harm – other predictors and the adjusted model

**Sex** In the adjusted model, no statistically significant association between sex and risk of harm was seen (aRR 1.67 [0.94-2.96] p=0.080), with interaction between sex and age as noted below.

**Age** In the final adjusted model, age showed a quadratic association (including interactions with sex and location) with the risk of harm, as shown below in Figure 10.9, with the risk of harm higher with higher age from childhood until the mid-60s, then steady for patients in their mid 60s into their mid 80s, before becoming higher again.

![Age and risk of hospital harm](image)

**Figure 10.9 The association between age and adjusted risk of harm (with 95% CIs)**

**Age-location and age-sex interactions** From the same model, location and age interacted, as shown below in Figure 10.10, which showed statistically significant higher risk of hospital harm associated with urban patients aged 85 years and older.
An interaction between sex and age (age as a quadratic function) was also seen, as shown below in Figure 10.11, with statistically significant increases in the risk of hospital harm for men 85 years of age and older compared to women.

When the interactions between age and location and age and sex were included, the association seen between unadjusted age and greater risk of harm (uRR 1.02/year (1.01-1.02) p<0.001) was no longer statistically significant in the adjusted model. Older urban patients and older men had higher risks of hospital harm, and when these interactions were taken into account, there was no evidence of association between age and risk of hospital harm (age, aRR 1.02/year (0.98-1.07) p=0.322; age$^2$ aRR 1.00/year$^2$ (1.00-1.00) p=0.783).

*Other predictors* Ethnicity, socioeconomic status and practice size showed no evidence of association with risk of harm in the final model (all p≥0.160).

![Figure 10.10 Associations between age and adjusted risk of hospital harm (with 95% CIs) by location](image)
Figure 10.11 Associations between age and adjusted risk of hospital harm (with 95% CIs) by sex
Table 10.7 Patients with hospital admissions resulting in harm, compared to patients with hospital admissions that did not result in harm, by age, sex, ethnicity, NZDep13 quintile and practice size

<table>
<thead>
<tr>
<th></th>
<th>Total patients with hospital admissions n=1561</th>
<th>Patients with hospital admissions with harm n=172</th>
<th>Patients with hospital admissions with no harm n=1389</th>
<th>Unadjusted Risk ratio (95% CI)</th>
<th>p value</th>
<th>Adjusted Risk ratio (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>% (95% CI)</td>
<td>count</td>
<td>% (95% CI)</td>
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<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
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<tr>
<td>Urban</td>
<td>752</td>
<td>79</td>
<td>673</td>
<td>89.5 (87.1-91.6)</td>
<td>reference</td>
<td>0.410</td>
<td>reference</td>
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<tr>
<td>Rural</td>
<td>809</td>
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<td>1.01 (0.97-1.05)</td>
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<td><strong>Location-age (per year) interaction</strong></td>
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</tr>
<tr>
<td><strong>Practice Size</strong></td>
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</tr>
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<td>60</td>
<td>447</td>
<td>88.2 (85.0-90.8)</td>
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<td>reference</td>
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<td>499</td>
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<td>0.94 (0.58-1.51)</td>
<td>0.73 (0.50-1.09)</td>
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<td>0.97 (0.66-1.43)</td>
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<td>235</td>
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<td>247</td>
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<td>0.93 (0.51-1.67)</td>
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<td></td>
<td>Total patients with hospital admissions n=1561</td>
<td>Patients with hospital admissions with harm n=172</td>
<td>Patients with hospital admissions with no harm n=1389</td>
<td>Unadjusted Risk ratio (95% CI)</td>
<td>p value</td>
<td>Adjusted Risk ratio (95% CI)</td>
<td>p value</td>
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<td>count</td>
<td>% (95% CI)</td>
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<td>11.2 (7.3-16.2)</td>
<td>191</td>
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<td>86.9 (82.0-90.9)</td>
<td>1.23 (0.71-2.15)</td>
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<td>1.15 (0.71-1.45)</td>
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<td>9.3 (6.2-13.4)</td>
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<td>90.7 (86.6-93.8)</td>
<td>0.88 (0.57-1.37)</td>
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<td>Sex</td>
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<td>11.6 (9.3-14.1)</td>
<td>635</td>
<td>88.4 (85.9-90.7)</td>
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<tr>
<td></td>
<td>Female</td>
<td>843</td>
<td>10.4 (8.6-12.8)</td>
<td>754</td>
<td>89.4 (87.2-91.4)</td>
<td>1.08 (0.76-1.54)</td>
<td></td>
</tr>
<tr>
<td>Sex-age (per year) interaction</td>
<td>843</td>
<td>89</td>
<td>10.4 (8.6-12.8)</td>
<td>754</td>
<td>89.4 (87.2-91.4)</td>
<td>1.08 (0.76-1.54)</td>
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<tr>
<td>Sex-age² (per year²) interaction</td>
<td>53.4 (24.6)</td>
<td>60.4 (19.9)</td>
<td>52.6 (25.0)</td>
<td>1.02 (1.01-1.02)</td>
<td>&lt;0.001</td>
<td>1.02 (0.98-1.07)</td>
<td>0.322</td>
</tr>
</tbody>
</table>

<p>| Mean (SD) | 53.4 (24.6) | 60.4 (19.9) | 52.6 (25.0) | 1.02 (1.01-1.02) | &lt;0.001 | 1.02 (0.98-1.07) | 0.322 |</p>
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<thead>
<tr>
<th>Age in years (per year)</th>
<th>Total patients with hospital admissions n=1561</th>
<th>Patients with hospital admissions with harm n=172</th>
<th>Patients with hospital admissions with no harm n=1389</th>
<th>Unadjusted Risk ratio (95% CI)</th>
<th>p value</th>
<th>Adjusted Risk ratio (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (per year)</td>
<td>Total patients with hospital admissions n=1561</td>
<td>Patients with hospital admissions with harm n=172</td>
<td>Patients with hospital admissions with no harm n=1389</td>
<td>Unadjusted Risk ratio (95% CI)</td>
<td>p value</td>
<td>Adjusted Risk ratio (95% CI)</td>
<td>p value</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>57 (36)</td>
<td>64 (26)</td>
<td>56 (37)</td>
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<tr>
<td>Age^2 (per year^2)</td>
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<td>Age group in years</td>
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<td>8 (4.0 (1.8-7.8))</td>
<td>190 (96.0 (92.2-98.2))</td>
<td>reference</td>
<td>&lt;0.001</td>
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<td>20-39</td>
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<td>204 (91.5 (87.0-94.8))</td>
<td>1.68 (0.43-6.70)</td>
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<td>40-59</td>
<td>42 (10.1 (7.4-13.4))</td>
<td>375 (89.9 (86.6-92.6))</td>
<td>2.23 (1.06-4.69)</td>
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</tr>
<tr>
<td></td>
<td>60-79</td>
<td>77 (15.5 (12.4-18.9))</td>
<td>421 (84.5 (81.1-87.6))</td>
<td>3.92 (1.80-8.54)</td>
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<td>80+</td>
<td>26 (11.6 (7.9-16.5))</td>
<td>199 (90.0 (83.5-92.3))</td>
<td>2.84 (1.03-7.84)</td>
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<td>140 (11.4 (9.7-13.3))</td>
<td>1090 (88.6 (86.7-90.3))</td>
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<td>0.737</td>
<td>reference</td>
<td>0.853</td>
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<td>Māori</td>
<td>18 (8.6 (5.2-13.3))</td>
<td>191 (91.4 (86.7-94.8))</td>
<td>0.71 (0.35-1.44)</td>
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<td>0.76 (0.37-1.57)</td>
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<td>Socio-economic status - NZDep</td>
<td>Total patients with hospital admissions n=1561</td>
<td>Patients with hospital admissions with harm n=172</td>
<td>Patients with hospital admissions with no harm n=1389</td>
<td>Unadjusted Risk ratio (95% CI)</td>
<td>p value</td>
<td>Adjusted Risk ratio (95% CI)</td>
<td>p value</td>
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<td>count</td>
<td>% (95% CI)</td>
<td>count</td>
<td>% (95% CI)</td>
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<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>61</td>
<td>7</td>
<td>11.5 (4.7-22.2)</td>
<td>54</td>
<td>88.5 (77.8-95.3)</td>
<td>0.69 (0.20-2.42)</td>
<td>0.75 (0.24-2.31)</td>
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<td>0.72 (0.21-2.47)</td>
<td>0.80 (0.26-2.46)</td>
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<td>Socio-economic status - NZDep</td>
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<td></td>
</tr>
<tr>
<td>Quintile 1</td>
<td>315</td>
<td>27</td>
<td>8.6 (5.7-12.2)</td>
<td>288</td>
<td>91.4 (87.7-94.3)</td>
<td>reference</td>
<td>0.244</td>
</tr>
<tr>
<td>Quintile 2</td>
<td>321</td>
<td>34</td>
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<td>287</td>
<td>89.4 (85.5-92.6)</td>
<td>1.12 (0.64-1.95)</td>
<td>1.16 (0.66-2.03)</td>
</tr>
<tr>
<td>Quintile 3</td>
<td>292</td>
<td>30</td>
<td>10.3 (7.0-14.3)</td>
<td>262</td>
<td>89.7 (85.6-93.0)</td>
<td>1.40 (0.74-2.64)</td>
<td>1.39 (0.68-2.85)</td>
</tr>
<tr>
<td>Quintile 4</td>
<td>251</td>
<td>26</td>
<td>10.4 (6.9-14.8)</td>
<td>225</td>
<td>89.6 (85.2-93.1)</td>
<td>1.58 (0.80-3/13)</td>
<td>1.77 (0.90-3.48)</td>
</tr>
<tr>
<td>Quintile 5</td>
<td>231</td>
<td>32</td>
<td>13.9 (9.7-19.0)</td>
<td>199</td>
<td>86.1 (81.0-90.3)</td>
<td>1.84 (0.97-3.51)</td>
<td>1.90 (1.07-3.36)</td>
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<td>151</td>
<td>23</td>
<td>15.2 (9.9-22.0)</td>
<td>128</td>
<td>84.8 (78.0-90.1)</td>
<td>2.24 (1.03-4.87)</td>
<td>2.47 (1.08-5.65)</td>
</tr>
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</table>

*Reported to 3 decimal places to show direction of effect*
The findings regarding the risk of hospital harm have been presented and no evidence of statistically significant association between location and hospital harm was found. Age showed a statistically significant unadjusted association with hospital harm, and the adjusted model showed interaction between age and sex and age and location. There was no evidence of association between adjusted age and risk of hospital harm but the interactions showed that older urban patients and older men had higher risk of hospital harm.

10.3.3 The rate ratio of hospital harm per admission

This section presents findings of the rate ratio of hospital harm per admission. It is calculated by considering the number of admissions resulting in harm as a proportion of the total number of admissions each patient experienced. The association between location and other demographic variables and the unadjusted rate ratios (uIRR) and adjusted rate ratios (aIRR) for hospital harm per admission are shown in Table 10.8 and described below.

10.3.3.1 Rate ratio of hospital harm per admission by location

There was no evidence of difference in the unadjusted rate ratio (uIRR 0.95 [0.62-1.46], p=0.822) or adjusted rate ratio (1.09 [0.83-1.43] p=0.524) for hospital harm per admission by location. Socioeconomic status and location showed evidence of interaction in the adjusted model.

10.3.3.2 Rate ratio of hospital harm per admission – other predictors and the unadjusted model

Ethnicity There was a significant association between unadjusted ethnicity and rate ratios for hospital harm per admission (p=0.001). Pacific patients had lower hospital harm per admission than Europeans (uIRR 0.71 [0.60-0.83] p<0.001) and Māori (uIRR 0.60 [0.42-0.88] p=0.010).

Socioeconomic status Socioeconomic status as represented by NZDep13 quintiles showed a significant overall association with rate ratios for hospital harm per admission (unadjusted p=0.002). There was a tendency towards lower rates of
hospital harm per admission for patients living in areas of increasing socioeconomic disadvantage. The pairwise comparisons showed statistically significant lower risk of hospital harm per admission for 4 out of the 10 pairings across the 5 quintiles (quintiles 3 vs 1, 5 vs 1, 3 vs 2, 5 vs 2).

Other predictors Age showed no evidence of higher rates of harm per admission, despite higher age being associated with higher risk of admission. Sex and practice size also showed no evidence of difference in the rate ratio of hospital harm per admission (all p≥0.207).

10.3.3.3 Rate ratio of hospital harm per admission event – other predictors and the adjusted model

Ethnicity The overall association between ethnicity and rate ratios for hospital harm per admission was just at the cut-off for significance in the adjusted model (p=0.050). Māori had a non-statistically significant higher adjusted rate of hospital harm per admission compared to Europeans (aRR 1.41 [0.98-2.03] p=0.064). There was evidence in pairwise comparison that Pacific patients had 38% lower adjusted rate of hospital harm per admission than Māori (aRR 0.62 [0.44-0.87] p=0.007), whereas Pacific patients had similar adjusted rate of hospital harm per admission as Europeans (0.88 [0.66-1.17] p=0.356), noting that only 7 Pacific patients in the study experienced hospital harm. No significant difference was seen between patients of ‘Other’ ethnicity and each of European, Māori and Pacific patients.

Socioeconomic status Socioeconomic status showed a significant overall association with rate ratios hospital harm per admission (p<0.001). There was a tendency towards lower rates hospital harm per admission with increasing socioeconomic disadvantage. The pairwise comparisons showed less risk of hospital harm per admission for any quintile that was of higher category than its comparator (e.g. quintile 3 compared to quintile 2) and this was statistically significant for 4 out of the 10 pairings across the 5 quintiles (quintiles 3 vs 1, 4 vs 1, 5 vs 1, 3 vs 2).
Location and socioeconomic status showed evidence of interaction (p=0.012) but there was no clear pattern across the quintiles were data was available, as shown in Figure 10.12. The only statistically significant interaction term was for the group with no NZ Dep13 data available, making it difficult to interpret these results.

Other predictors and interactions  Age, sex and practice size all showed no evidence of difference in the rate ratio of admissions resulting in harm in the adjusted model (all p≥0.630). There was no evidence of a nonlinear association between admissions resulting in harm and age, or of interactions between age and sex, or location and each of age, sex, ethnicity, and practice size ( all p≥0.239).

Figure 10.12 Interaction between location and socioeconomic status and adjusted rate ratios of hospital admissions resulting in harm (with 95% CIs) where NZDep13 data recorded
<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted Rate Ratio of admissions resulting in harm (95%CI)</th>
<th>p-value</th>
<th>Adjusted Rate Ratio of admissions resulting in harm (95%CI)</th>
<th>p-value</th>
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<td>0.822</td>
<td>1.09 (0.83-1.43)</td>
<td>0.524</td>
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<tr>
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<td>1.08 (0.78-1.49)</td>
<td>0.630</td>
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<td>0.050</td>
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<td>1.41 (0.98-2.03)</td>
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<tr>
<td>Pacific</td>
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<td>0.88 (0.66-1.17)</td>
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<tr>
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<td>0.98 (0.65-1.49)</td>
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<tr>
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</tr>
<tr>
<td>Rural Quintile 5</td>
<td></td>
<td></td>
<td>1.02 (0.62-1.67)</td>
<td></td>
</tr>
<tr>
<td>Rural no data</td>
<td></td>
<td></td>
<td>0.30 (0.11-0.79)</td>
<td></td>
</tr>
<tr>
<td><strong>Practice size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>reference</td>
<td>0.207</td>
<td>reference</td>
<td>0.665</td>
</tr>
<tr>
<td>Medium</td>
<td>1.02 (0.74-1.40)</td>
<td>0.99</td>
<td>0.79 (0.99-1.24)</td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>0.83 (0.64-1.08)</td>
<td>0.90</td>
<td>0.69 (0.69-1.16)</td>
<td></td>
</tr>
</tbody>
</table>

@ Effects presented are fixed for ‘urban’ location ®SES=Socioeconomic status.
The findings of the rate ratio of hospital harm per admission analysis show no statistically significant adjusted associations between variables and hospital harm per admission, except for socioeconomic status which indicated a tendency towards lower rates of harm with increasing socioeconomic disadvantage. The next section looks at hospital harm and inter-hospital transfer.

10.3.4 Patient inter-hospital transfer

This section reports findings related to interhospital transfer, location, and risk of hospital harm.

10.3.4.1 Patient inter-hospital transfer and location

Of the 1561 patients with any hospital admission, 1535 (98.3%) were treated within the same hospital during the admission. Of the 26 patients (1.7%) who experienced inter-hospital transfer, 22 experienced one transfer, two experienced two transfers and two experienced three transfers. No urban patients experienced inter-hospital transfer compared to 26 rural patients (0% vs 3.2%, p<0.001). Rural patients who experienced inter-hospital transfer were older than rural patients who were not transferred during any admission (median age 70.5 years, [IQR 36 years] vs 58 years, [IQR 33 years] MWU p=0.012).

10.3.4.2 Patient inter-hospital transfer and risk of harm

As all patients transferred were from rural locations, the data was also analysed exclusively for rural patients. Table 10.9 shows rural patients’ experience of hospital harm and inter-hospital transfer.

<table>
<thead>
<tr>
<th>Rural patients</th>
<th>No transfer*</th>
<th>Inter-hospital transfer*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No hospital harm</td>
<td>697 (97.3)</td>
<td>19 (2.65)</td>
<td>716 (88.5)</td>
</tr>
<tr>
<td>Hospital harm</td>
<td>86 (92.5)</td>
<td>7 (7.53)</td>
<td>93 (11.5)</td>
</tr>
<tr>
<td>Total</td>
<td>783 (96.8)</td>
<td>26 (3.21)</td>
<td>809</td>
</tr>
</tbody>
</table>

*Values are count (percentage); Fisher’s exact p=0.022
An unadjusted association between inter-hospital transfer and higher risk of hospital harm for rural patients was demonstrated (uRR 2.41 [1.54-3.77] p<0.001). The association persisted when adjusted in different models for age (age aRR 2.33 [1.37-3.98] p=0.003) and sex (sex aRR 2.41 [1.52-3.80] p=0.001). More detailed analysis was not possible given the small number (26) of patients who experienced transfers, according to Peduzzi’s rule requiring 10 events per variable.246

10.3.5 Site of hospital harm identification

This section briefly presents findings regarding where hospital harm was identified, noting that the type of harm experienced was not the focus of this research. For 172 patients who experienced hospital harm, 95 patients’ harm (55.2%) was recorded in the general practice clinical record as detected during the hospital admission or subsequent readmission. In the remaining 77 patients (44.8%) the hospital harm was detected only through encounters with the general practice team. There was no evidence of a difference in where hospital harms were identified by location, with the hospital harm of 40 rural patients (43.0%) and 37 urban patients (46.8%) detected outside of hospital (p=0.615).

10.3.6 The risk of any preventable harm

This section details findings regarding preventable hospital harm. Definitions relating to harm preventability are included in §9.3.4.3 (page 184).

Of the 172 patients with hospital harm, 86 patients experienced at least one episode of preventable hospital harm, and 86 experienced harm judged by the SHARP researchers as not preventable. There was no evidence of a difference in the risk of experiencing preventable hospital harm by location, either in unadjusted risk (uRR 1.15 [0.83-1.60] p=0.679) or risk adjusted for age, sex and ethnicity (aRR 1.12 [0.77-1.61] p=0.550). There was no evidence of a difference in preventable hospital harm risk by other sociodemographic variables (all p≥0.162), as shown in Table 10.10.
Table 10.10 Patients with any preventable compared to no preventable hospital harm, by location, practice type, age, sex, ethnicity and socioeconomic status.

<table>
<thead>
<tr>
<th></th>
<th>Total patients with hospital harm n=172</th>
<th>Patients with any preventable hospital harm n=86</th>
<th>Patients with no preventable hospital harm n=86</th>
<th>Unadjusted Risk ratio (95% CI)</th>
<th>p value</th>
<th>Adjusted Risk ratio (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>count</td>
<td>% (95% CI)</td>
<td>count</td>
<td>count</td>
<td>% (95% CI)</td>
<td>p value</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>79</td>
<td>35</td>
<td>44.3 (33.1-55.9)</td>
<td>44</td>
<td>55.7 (44.1-66.9)</td>
<td>reference</td>
<td>0.383</td>
</tr>
<tr>
<td>Rural</td>
<td>93</td>
<td>51</td>
<td>54.8 (44.2-65.2)</td>
<td>42</td>
<td>45.2 (34.8-55.9)</td>
<td>1.15 (0.83-1.60)</td>
<td>1.12 (0.77-1.61)</td>
</tr>
<tr>
<td><strong>Practice Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>60</td>
<td>29</td>
<td>48.3 (35.2-61.6)</td>
<td>31</td>
<td>51.7 (38.3-64.8)</td>
<td>reference</td>
<td>0.679</td>
</tr>
<tr>
<td>Medium</td>
<td>62</td>
<td>33</td>
<td>53.2 (40.1-66.0)</td>
<td>29</td>
<td>46.8 (34.0-59.9)</td>
<td>1.07 (0.71-1.62)</td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>50</td>
<td>24</td>
<td>48.0 (33.7-62.6)</td>
<td>26</td>
<td>52.0 (37.4-66.4)</td>
<td>0.90 (0.61-1.33)</td>
<td></td>
</tr>
<tr>
<td><strong>Size and location</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban large</td>
<td>28</td>
<td>13</td>
<td>46.4 (27.5-66.1)</td>
<td>15</td>
<td>53.6 (33.9-72.5)</td>
<td>reference</td>
<td>0.415</td>
</tr>
<tr>
<td>Urban med</td>
<td>27</td>
<td>13</td>
<td>48.1 (28.7-68.1)</td>
<td>14</td>
<td>51.9 (31.9-71.3)</td>
<td>1.04 (0.60-1.78)</td>
<td></td>
</tr>
<tr>
<td>Urban small</td>
<td>24</td>
<td>9</td>
<td>37.5 (18.8-59.4)</td>
<td>15</td>
<td>62.5 (40.6-81.2)</td>
<td>0.81 (0.50-1.30)</td>
<td></td>
</tr>
<tr>
<td>Rural large</td>
<td>32</td>
<td>16</td>
<td>50.0 (31.9-68.1)</td>
<td>16</td>
<td>50.0 (31.9-68.1)</td>
<td>1.08 (0.66-1.76)</td>
<td></td>
</tr>
<tr>
<td>Rural med</td>
<td>35</td>
<td>20</td>
<td>57.1 (39.4-73.7)</td>
<td>15</td>
<td>42.9 (26.3-60.6)</td>
<td>1.23 (0.82-1.84)</td>
<td></td>
</tr>
<tr>
<td>Age group in years</td>
<td>Total patients with hospital harm n=172</td>
<td>Patients with any preventable hospital harm n=86</td>
<td>Patients with no preventable hospital harm n=86</td>
<td>Unadjusted Risk ratio (95% CI)</td>
<td>p value</td>
<td>Adjusted Risk ratio (95% CI)</td>
<td>p value</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------</td>
<td>---------</td>
<td>-------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Rural small</td>
<td>count</td>
<td>count</td>
<td>% (95% CI)</td>
<td>count</td>
<td>% (95% CI)</td>
<td>0.81 (0.50-1.30)</td>
<td>0.354</td>
</tr>
<tr>
<td>Male</td>
<td>Sex</td>
<td>Male</td>
<td>83</td>
<td>43</td>
<td>51.8 (40.6-62.9)</td>
<td>40</td>
<td>48.2 (37.1-59.4)</td>
</tr>
<tr>
<td>Female</td>
<td>Female</td>
<td>89</td>
<td>43</td>
<td>48.3 (37.6-59.2)</td>
<td>46</td>
<td>51.7 (40.8-62.4)</td>
<td>0.83 (0.56-1.23)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>Age in years</td>
<td>60.4 (19.9)</td>
<td>61.6 (17.3)</td>
<td>59.2 (22.4)</td>
<td>1.00 (0.99-1.01)</td>
<td>0.956</td>
<td>1.00 (0.99-1.01)</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>Median (IQR)</td>
<td>64 (26)</td>
<td>64 (22)</td>
<td>64 (30)</td>
<td>(per year)</td>
<td>0.539</td>
<td>0.539</td>
</tr>
<tr>
<td>0-19</td>
<td>Age group in years</td>
<td>87</td>
<td>9</td>
<td>25.0 (3.3-65.1)</td>
<td>6</td>
<td>75.0 (34.9-96.8)</td>
<td>reference</td>
</tr>
<tr>
<td>20-39</td>
<td>25</td>
<td>8</td>
<td>42.1 (20.3-66.5)</td>
<td>11</td>
<td>57.9 (33.5-79.7)</td>
<td>0.93 (0.23-3.83)</td>
<td>0.539</td>
</tr>
<tr>
<td>40-59</td>
<td>42</td>
<td>24</td>
<td>57.1 (41.0-72.3)</td>
<td>18</td>
<td>42.9 (27.7-59.0)</td>
<td>1.55 (0.43-5.63)</td>
<td>0.539</td>
</tr>
<tr>
<td>60-79</td>
<td>77</td>
<td>42</td>
<td>54.5 (42.8-65.9)</td>
<td>35</td>
<td>45.5 (34.1-57.2)</td>
<td>1.12 (0.21-5.90)</td>
<td>0.539</td>
</tr>
<tr>
<td>80+</td>
<td>26</td>
<td>10</td>
<td>38.5 (20.2-59.4)</td>
<td>16</td>
<td>61.5 (40.6-79.8)</td>
<td>1.05 (0.25-4.40)</td>
<td>0.539</td>
</tr>
</tbody>
</table>

238
<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Total patients with hospital harm n=172</th>
<th>Patients with any preventable hospital harm n=86</th>
<th>Patients with no preventable hospital harm n=86</th>
<th>Unadjusted Risk ratio (95% CI)</th>
<th>p value</th>
<th>Adjusted Risk ratio (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>count</td>
<td>count % (95% CI)</td>
<td>count % (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>140</td>
<td>68 48.6 (40.0-57.2)</td>
<td>72 51.4 (42.8-60.0)</td>
<td>reference</td>
<td>0.162</td>
<td>reference</td>
<td>0.505</td>
</tr>
<tr>
<td>Māori</td>
<td>18</td>
<td>10 55.6 (30.8-78.5)</td>
<td>8 44.4 (21.5-69.2)</td>
<td>1.09 (0.82-1.47)</td>
<td>1.12 (0.89-1.42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>7</td>
<td>3 42.9 (9.9-81.6)</td>
<td>4 57.1 (18.4-90.1)</td>
<td>0.91 (0.72-1.16)</td>
<td>0.93 (0.73-1.19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>5 71.4 (29.0-96.3)</td>
<td>2 28.6 (3.7-71.0)</td>
<td>1.03 (0.33-3.23)</td>
<td>1.06 (0.38-2.97)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio-economic status – NZDep13</td>
<td>Quintile 1</td>
<td>27</td>
<td>14 51.9 (31.9-71.3)</td>
<td>13 48.1 (28.7-68.1)</td>
<td>reference</td>
<td>0.699</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 2</td>
<td>34</td>
<td>13 38.2 (22.2-56.4)</td>
<td>21 61.8 (43.6-77.8)</td>
<td>0.58 (0.27-1.26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 3</td>
<td>30</td>
<td>14 46.7 (28.3-65.7)</td>
<td>16 53.3 (34.3-71.7)</td>
<td>0.77 (0.30-1.97)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 4</td>
<td>26</td>
<td>12 46.2 (26.6-66.7)</td>
<td>14 53.8 (33.4-73.4)</td>
<td>0.68 (0.26-1.76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 5</td>
<td>32</td>
<td>17 53.1 (34.7-70.9)</td>
<td>15 46.9 (29.1-65.3)</td>
<td>0.96 (0.41-2.26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No data</td>
<td>23</td>
<td>16 69.6 (47.1-86.8)</td>
<td>7 30.4 (13.2-52.9)</td>
<td>0.81 (0.34-1.95)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10.3.7 Harm severity

The previous section showed no evidence of association between preventable harm and location, or other variables. This section outlines findings related to harm severity. Definitions relating to harm severity are described in §9.3.4.3 (page 184).

Table 10.11 shows the highest harm severity code given to patients with hospital harms by rural and urban location.

<table>
<thead>
<tr>
<th></th>
<th>Mild harm* n=72</th>
<th>Moderate harm* n=62</th>
<th>Severe harm and death* n=38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>41 (44.1)</td>
<td>34 (36.6)</td>
<td>18 (19.4)</td>
</tr>
<tr>
<td>Urban</td>
<td>31 (39.2)</td>
<td>28 (35.4)</td>
<td>20 (25.3)</td>
</tr>
</tbody>
</table>

*Values are count (percentage)

There was no evidence of difference in odds of being in a higher severity category for rural patients compared to urban patients in the unadjusted ordinal logistic regression model (unadjusted odds ratio (OR) 0.76 [0.28-2.10] p=0.597) or in the ordinal logistic regression model adjusted for location, sex and age (aOR 0.76 [0.28-2.03] p=0.583). In the adjusted model, females had a 44% lower odds of being in a higher severity category compared to males (adjusted odds ratio 0.56 [0.34-0.95] p=0.030).

Thus far, the findings for the whole group of 1561 patients with hospital admissions have been presented. The next section focuses on patients who had complete information regarding hospital length of stay.

10.4 Patients with complete length of hospital stay data

This section looks in detail at the group of patients where there was full information about the duration of their hospital admissions (length of stay) and
explores their patient characteristics, hospital usage and association with hospital harm.

10.4.1 Characteristics of patients with complete length of stay data compared to all patients with admissions

Of the 1561 patients with identifiable hospital admissions, 753 patients’ records (48.2%) contained complete information about length of stay (LOS) for all admissions and 808 patients (51.8%) had incomplete LOS information captured. As noted in the §9.3.1.4, page 177, the computer system used by the hospital dictated whether data regarding LOS was accessible in the data gathering process.

Table 10.12 describes the demographics of four patient groups, being all patients with hospital admissions, all patients with complete LOS data, and patients with complete LOS data by rural and urban location. No difference in proportion of patients experiencing hospital harm was seen across the groups.

Comparing patients with and without complete LOS data showed no evidence of difference in age distribution for the two groups (MWU p=0.719) but differences were seen in age bands (more patients aged 0-19 years old, fewer patients aged 40-59 and more patients aged 80 years and over had complete LOS data) and practice size and location (more patients with complete LOS data attended large rural and small urban practices and fewer patients attended small rural and large urban practices), with no difference in other characteristics.

For patients with complete LOS data, more rural patients were male, were aged 40-59 years and had no NZDep13 data recorded compared to urban patients. Rural patients with complete length of stay data had were younger (MWU p=0.025). Fewer rural patients were female, were aged 80 years and over, were Pacific, and lived in quintile 4 areas, with no difference in other characteristics.
Table 10.12 The demographics of all patients with hospital admissions, those with full data on hospital admission length of stay, and those with complete length of stay data by rural and urban location.

<table>
<thead>
<tr>
<th></th>
<th>Total hospital admissions n=1561 (count)</th>
<th>Complete LOS data n=753*</th>
<th>Urban patients, complete LOS data n=355†</th>
<th></th>
<th>Rural patients, complete LOS data n=398‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>752</td>
<td>355 (47.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>809</td>
<td>398 (49.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Practice Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>507</td>
<td>244 (48.1)</td>
<td>109 (30.7)</td>
<td>135 (33.9)</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>561</td>
<td>280 (49.9)</td>
<td>128 (36.1)</td>
<td>152 (38.2)</td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>493</td>
<td>229 (46.4)</td>
<td>118 (33.2)</td>
<td>111 (27.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Size and location</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural large</td>
<td>244</td>
<td>135 (55.3)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural med</td>
<td>287</td>
<td>152 (53.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural small</td>
<td>278</td>
<td>111 (39.9)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban large</td>
<td>263</td>
<td>109 (41.4)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban med</td>
<td>274</td>
<td>128 (46.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban small</td>
<td>215</td>
<td>118 (54.9)†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>718</td>
<td>375 (47.8)</td>
<td>148 (41.7)</td>
<td>195 (49.0)*</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>843</td>
<td>410 (48.6)</td>
<td>207 (58.3)</td>
<td>203 (51.0)*</td>
<td></td>
</tr>
<tr>
<td><strong>Age in years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>53.4 (24.6)</td>
<td>52.7 (26.6)</td>
<td>54.5 (28.1)*</td>
<td>51.0 (25.1)*</td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>57 (36)</td>
<td>57 (43)</td>
<td>62 (42)</td>
<td>55 (40)</td>
<td></td>
</tr>
<tr>
<td><strong>Age group in years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-19</td>
<td>198</td>
<td>123 (62.1)**</td>
<td>62 (17.5)</td>
<td>61 (15.3)</td>
<td></td>
</tr>
<tr>
<td>20-39</td>
<td>223</td>
<td>97 (43.5)</td>
<td>39 (11.0)</td>
<td>58 (14.6)</td>
<td></td>
</tr>
<tr>
<td>40-59</td>
<td>417</td>
<td>181 (43.3)*</td>
<td>72 (20.3)</td>
<td>109 (27.4)*</td>
<td></td>
</tr>
<tr>
<td>60-79</td>
<td>498</td>
<td>228 (45.8)</td>
<td>109 (30.7)</td>
<td>119 (29.9)</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td>225</td>
<td>124 (55.1)*</td>
<td>73 (20.6)</td>
<td>51 (12.8)*</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>1230</td>
<td>601 (48.9)</td>
<td>282 (79.4)</td>
<td>319 (80.2)</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Total hospital admissions n=1561 (count)</td>
<td>Complete LOS data n=753*</td>
<td>Urban patients, complete LOS data n=355**</td>
<td>Rural patients, complete LOS data n=398***</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------</td>
<td>--------------------------</td>
<td>-------------------------------------------</td>
<td>-------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>209</td>
<td>93 (44.5)</td>
<td>38 (10.7)</td>
<td>55 (13.8)</td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>61</td>
<td>24 (39.3)</td>
<td>20 (5.6)</td>
<td>4 (1.0)***</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>61</td>
<td>35 (57.4)</td>
<td>15 (4.2)</td>
<td>20 (5.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Socio-economic status – NZDep13</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quintile 1</td>
<td>315</td>
<td>149 (41.7)</td>
<td>72 (20.3)</td>
<td>77 (19.4)</td>
<td></td>
</tr>
<tr>
<td>Quintile 2</td>
<td>321</td>
<td>167 (52.0)</td>
<td>88 (24.8)</td>
<td>79 (19.9)</td>
<td></td>
</tr>
<tr>
<td>Quintile 3</td>
<td>292</td>
<td>140 (47.9)</td>
<td>72 (20.3)</td>
<td>68 (17.1)</td>
<td></td>
</tr>
<tr>
<td>Quintile 4</td>
<td>251</td>
<td>117 (46.6)</td>
<td>67 (18.9)</td>
<td>50 (12.6)*</td>
<td></td>
</tr>
<tr>
<td>Quintile 5</td>
<td>231</td>
<td>114 (49.3)</td>
<td>66 (13.5)</td>
<td>48 (16.6)</td>
<td></td>
</tr>
<tr>
<td>No data</td>
<td>151</td>
<td>66 (43.7)</td>
<td>8 (2.3)</td>
<td>58 (14.6)***</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital Harm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No hospital harm</td>
<td>1389</td>
<td>668 (48.1)</td>
<td>322 (90.7)</td>
<td>346 (86.9)</td>
<td></td>
</tr>
<tr>
<td>Hospital harm</td>
<td>172</td>
<td>85 (49.4)</td>
<td>33 (9.3)</td>
<td>52 (13.1)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1561</td>
<td>753 (48.2)</td>
<td>355 (47.1)</td>
<td>398 (52.9)</td>
<td></td>
</tr>
</tbody>
</table>

*Values are count (percentage) unless otherwise indicated. Within both of complete LOS compared to incomplete LOS, and urban compared to rural patients statistically significant differences noted using *p<0.05  **p<0.01  ***p<0.001  @row percentages  @@column percentages

10.4.2 Information on hospital admissions and lengths of stay.

The previous section has presented demographic data regarding patients with and without complete LOS data, and compared rural to urban patients with complete LOS data. This section explores patterns of hospital admissions for those with complete LOS data, by location.
Of the 753 patient records with full length of stay data, 121 patients (16.1%) only had day stay admissions, 559 patients (74.2%) only had overnight admissions, and 73 patients (9.7%) had both day stay and overnight admissions.

Of the 753 patients, 194 patients (25.8%) had one or more day stay admissions. Most patients had just one day stay admissions (167/194, 86.1%) and 23 patients had 2 days stay admissions (11.9%). One patient had 13 day stay admissions. In addition, 632 patients (83.9%) had at least one overnight hospital admission. Most had one (433 patients, 68.5%) or two (111, 17.6%) overnight hospital admissions, with a maximum of 12 in the three-year study period. The mean LOS was 4.25 days, with a median of 2 days, and a maximum LOS of 61 days. The mean number of total occupied bed days for patients was 7.08 days, with a median of 2 days, and a maximum of 89 bed days (see Table 10.13). The unadjusted incidence rate ratios for rates of overnight admissions, day-stay admissions, mean LOS and total occupied bed days (OBD) for rural and urban patients over the three year study period are shown in Table 10.13. No evidence of a difference in these measures is seen for rural and urban patients.

10.4.3 Associations between hospital harm and hospital occupancy

The previous section found that there was no difference in pattern of admission for rural and urban patients with complete LOS data. This section explores associations between hospital harm and hospital occupancy.

10.4.3.1 Hospital admissions and total occupied bed days and harm

Comparisons of the number of admissions, length of admissions and total occupied bed days for patients who experienced hospital harm and those who did not are shown in Table 10.14. For those patients with complete data on length of stay, experiencing hospital harm during a hospital admission was associated with an unadjusted 73% increase in the mean number of admissions per patient compared to those patients who did not experience hospital harm (uIRR 1.73 (1.22-2.46) p=0.003). It was also associated with an 85% increase in mean length of stay for
hospital admissions, (uIRR 1.85 (1.33-2.56) p<0.001) and a 140% increase in total hospital bed day usage (uIRR 2.40 (1.47-3.91) p<0.001).

Table 10.13 Comparison between rural and urban location and inpatient hospital usage over three year period, where complete LOS data available

<table>
<thead>
<tr>
<th></th>
<th>Total n=753</th>
<th>Rural n=398</th>
<th>Urban n=355</th>
<th>uIRR (rural compared to urban)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean no.* of admissions@ per patient, (SD) min-max</td>
<td>1.63 (1.45) 1-23</td>
<td>1.65 (1.67) 1-23</td>
<td>1.60 (1.15) 1-8</td>
<td>1.08 (0.90-1.29) †</td>
<td>0.407</td>
</tr>
<tr>
<td>Mean no. # of overnight admissions per patient,* (SD) min-max</td>
<td>1.47 (0.96) (1-8)</td>
<td>1.39 (0.78) (1-6)</td>
<td>1.56 (1.12) (1-8)</td>
<td>0.93 (0.79-1.10)</td>
<td>0.401</td>
</tr>
<tr>
<td>Mean no. # of day-stay admissions per patient, (SD) min-max</td>
<td>0.31 (0.72) 0-13</td>
<td>0.33 (0.85) 0-13</td>
<td>0.29 (0.54) 0-3</td>
<td>0.92 (0.60-1.43) †</td>
<td>0.710</td>
</tr>
<tr>
<td>Mean LOS* (SD) min-max</td>
<td>4.25 (6.79) 0-61</td>
<td>3.90 (6.64) 0-59</td>
<td>4.65 (6.94) 0-61</td>
<td>0.90 (0.65-1.26) †</td>
<td>0.542</td>
</tr>
<tr>
<td>Mean total OBD* (SD) min-max</td>
<td>7.08 (12.12) 0-89</td>
<td>6.45 (11.44) 0-89</td>
<td>7.78 (12.82) 0-87</td>
<td>0.94 (0.64-1.38) †</td>
<td>0.741</td>
</tr>
</tbody>
</table>

*no. = number; @ day stay and overnight admissions; † Only overnight admissions † negative binomial regression due to evidence of overdispersion

10.4.3.2 Hospital harm and total occupied bed days

The association between number of admissions, LOS and OBD and hospital harm shown in Table 10.14 below was investigated further through modelling the association between OBD and hospital harm, as well as location and other demographic characteristics, and presented in Table 10.15 and described below.

10.4.3.2.1 Hospital occupancy by location

There was no evidence of a difference in total OBD usage between rural and urban patients in the unadjusted model (uIRR 0.94 [0.64-1.38] p=0.741) and when adjusted for hospital harm age and socioeconomic status (aIRR 1.00 [0.75-1.35] p=0.983).
Table 10.14 Association between those with and without hospital harm in patients with complete hospital occupancy data

<table>
<thead>
<tr>
<th></th>
<th>Total n=753</th>
<th>Hospital harm n=85</th>
<th>No hospital harm n=668</th>
<th>uIRR (95%CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean number of admissions per patient (SD)</strong></td>
<td>1.63 (1.45)</td>
<td>2.61 (3.06)</td>
<td>1.50 (1.02)</td>
<td>1.73 (1.22-2.46)</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Mean LOS per admission episode (SD)</strong></td>
<td>4.25 (6.79)</td>
<td>7.03 (8.31)</td>
<td>3.90 (6.50)</td>
<td>1.85 (1.33-2.56)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Mean total occupied bed days (SD)</strong></td>
<td>7.08 (12.12)</td>
<td>14.95 (16.75)</td>
<td>6.08 (11.02)</td>
<td>2.40 (1.47-3.91)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

* Negative binomial regression due to evidence of overdispersion

10.4.3.2.2 Hospital occupancy by harm

The unadjusted association between patients who experienced any hospital harm and mean number of total OBD (uIRR 2.40 [1.47-3.91] p=0.001) persisted in the model adjusted for location, age and socioeconomic status (aIRR 2.16 (1.39-3.35) p=0.001).

10.4.3.2.3 Hospital occupancy – other predictors and the unadjusted model

**Age** In the unadjusted analysis, age showed a linear association with OBD, with a 2% increase per year of age (uIRR 1.02 (1.02-1.03) p<0.001).

**Ethnicity** Unadjusted ethnicity indicated an association with total OBD (Wald p=0.039). Pairwise comparison of ethnicity showed evidence of a significant association between Māori and European patients, where Māori had lower mean total occupied bed days compared to European (uIRR 0.61 (0.44-0.86) p=0.006). No other combinations of ethnicities showed statistical association.

**Socioeconomic status** Unadjusted socioeconomic status showed evidence of an overall significant association with total OBD (Wald p=0.004), but there was no
clear tendency of higher or lower risk of higher total occupied bed days with increasing deprivation. Pairwise comparison within quintiles showed a significant difference between only two of the 10 pairings possible, being Quintile 3 vs Quintile 2 (uIRR 1.43 (1.06-1.92) p=0.019) and Quintile 5 vs Quintile 2 (uIRR 2.00 (1.14-3.49) p=0.016). Patients with no data recorded showed a significant difference in one out of five possible pairings.

Practice size and sex showed no evidence of association with total OBD (both p≥0.224).

10.4.3.2.4 Hospital occupancy – other predictors and the adjusted model

The total number of events of hospital harm was 85, so in constructing the final adjusted model, a maximum of 8 variables was possible. Hospital harm (p=0.001) and age (p<0.001) showed strong association with total occupied bed days in the unadjusted model and were included in the final model. Location was included as a key variable of interest. Socioeconomic status was retained in the final model as it had the greater level of significant association statistically in the unadjusted model than ethnicity. In the final model, adjusted for age, location and socioeconomic status, the association between hospital harm and total OBD persisted (age, location, socioeconomic status adjusted IRR 2.15 [1.39-3.35] p=0.001) as shown in Table 10.15.

**Age** With every year increase in age, a 2% increase in total occupied bed days was seen (aIRR 1.02 (1.02-1.03) p<0.001).

**Socioeconomic status** Socioeconomic status did not show a significant association with occupied bed days in the adjusted model (p=0.170). There were no significant interactions between variables seen in the final model (all p≥0.209).

**Ethnicity** A separate model was constructed, adjusted for hospital harm, age, location and ethnicity. With this model, the association between hospital harm and
total OBD persisted (age, location, ethnicity adjusted IRR 2.22 [1.41-3.51] p=0.001) but patient ethnicity was not statistically significant (Wald p=0.426).

Table 10.15 The associations between both hospital harm and demographic variables and total occupied bed days (OBD) for 753 patients with complete LOS data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted IRR Ratio for total OBD (95%CI)</th>
<th>p value</th>
<th>Adjusted IRR Ratio for total OBD (95%CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>reference</td>
<td>0.741</td>
<td>reference</td>
<td>0.983</td>
</tr>
<tr>
<td>Rural</td>
<td>0.94 (0.64-1.38)</td>
<td></td>
<td>1.00 (0.75-1.35)</td>
<td></td>
</tr>
<tr>
<td>Hospital harm status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No hospital harm</td>
<td>reference</td>
<td>0.001</td>
<td>reference</td>
<td>0.001</td>
</tr>
<tr>
<td>Hospital harm</td>
<td>2.40 (1.47-3.91)</td>
<td></td>
<td>2.16 (1.39-3.35)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Per year increment</td>
<td>1.02 (1.02-1.03)</td>
<td></td>
<td>1.02 (1.02-1.03)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>reference</td>
<td>0.672</td>
<td>Not in final model</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.09 (0.73-1.62)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>reference</td>
<td>0.039</td>
<td>Not in final model</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>0.61 (0.44-0.86)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>0.72 (0.22-2.39)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.94 (0.58-1.53)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quintile 1</td>
<td>reference</td>
<td>0.004</td>
<td>reference</td>
<td>0.170</td>
</tr>
<tr>
<td>Quintile 2</td>
<td>0.64 (0.30-1.35)</td>
<td></td>
<td>0.67 (0.34-1.33)</td>
<td></td>
</tr>
<tr>
<td>Quintile 3</td>
<td>0.92 (0.44-1.90)</td>
<td></td>
<td>0.78 (0.44-1.38)</td>
<td></td>
</tr>
<tr>
<td>Quintile 4</td>
<td>0.84 (0.40-1.77)</td>
<td></td>
<td>0.91 (0.48-1.74)</td>
<td></td>
</tr>
<tr>
<td>Quintile 5</td>
<td>1.28 (0.56-2.93)</td>
<td></td>
<td>0.94 (0.48-1.83)</td>
<td></td>
</tr>
<tr>
<td>No data</td>
<td>1.15 (0.57-2.33)</td>
<td></td>
<td>1.12 (0.61-2.08)</td>
<td></td>
</tr>
<tr>
<td>Practice size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>reference</td>
<td>0.224</td>
<td>Not in final model</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>1.53 (0.91-2.59)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>1.39 (0.85-2.27)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Negative binomial regression used in this table due to evidence of overdispersion.

This section has presented findings for patients with complete LOS data, and identified statistically significant associations between hospital harm and hospital bed-day use. The next section returns to the whole patient group with hospital admission and tests the impact of alternative rurality definitions of study findings.
10.5 Exploratory Analysis – alternative rural definitions

The results presented thus far have used the original SHARP Study’s definition of rural and urban location as outlined in §9.2, page 171, above. This section investigates whether applying alternative rural definitions altered the risk of hospital admission and harm.

10.5.1 Alternative rural definitions

The different rural definitions relate to parameters of the 44 participating practices from which patient records were selected, as described in §9.3.9, page 187. Table 10.16 describes the number of patients in the study group, with hospital admissions and with hospital harm according to the different rurality definitions. The smallest sub-group created from the alternative rurality definitions was just under 20% of the study group (Scenario 4, rural > 30km, containing 19.8% of ‘distance to nearest hospital by location’). In Scenario 1 and 2, three of the ‘rural’ practices did not meet the RRS definition with RRS score of 0, 20 and 30 points. The highest RRS score for a practice was 95. For Scenario 3, the furthest practice was 190 km from the nearest urban hospital. In scenario 4, the furthest practice from the nearest hospital was 66 km away. In Scenario 5, the longest drive time from a practice to the nearest hospital was 51 minutes.

Numerically speaking, no clear pattern was observed when comparing the percentage of all patients in the study group to patients with hospital admissions and to patients with hospital harm across the different rurality definitions. For the base case Location definition and the Scenarios 1 and 2 (the two RRS definitions), there were increases in the percentage of patients with hospital admissions and hospital harm in the rural or most rural category. For Scenario 3 (the nearest urban hospital definition), the percentage of patients with hospital admissions was unchanged but the percentage with hospital harm increased for the most rural category. For Scenarios 4 (the distance to nearest hospital definition) and 5, (drive time to nearest hospital definition), there were decreases in the percentage of patients with hospital admissions and hospital harm for the most rural category (see Table 10.16).
### Table 10.16 Different rurality definitions and size of categories for the study group, and patients with hospital admissions and hospital harm

<table>
<thead>
<tr>
<th>Rurality definition</th>
<th>Subset</th>
<th>Total n=9076</th>
<th>Hospital admission n=1561</th>
<th>Hospital harm n=172</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case: Location</td>
<td>Urban (20 practices)</td>
<td>4,544 (50.1)</td>
<td>752 (48.2)</td>
<td>79 (45.9)</td>
</tr>
<tr>
<td></td>
<td>Rural (24 practices)</td>
<td>4,532 (49.9)</td>
<td>809 (51.8)</td>
<td>93 (54.1)</td>
</tr>
<tr>
<td>1. Rural ranking scale (binary)</td>
<td>Urban: score&lt;35 (23 practices)</td>
<td>5,000 (55.1)</td>
<td>841 (53.9)</td>
<td>90 (52.3)</td>
</tr>
<tr>
<td></td>
<td>Rural: score≥35 (21 practices)</td>
<td>4,076 (44.9)</td>
<td>720 (46.1)</td>
<td>82 (47.7)</td>
</tr>
<tr>
<td>2. Rural ranking scale (3 part)</td>
<td>Urban: score&lt;35 (23 practices)</td>
<td>5,000 (55.1)</td>
<td>841 (53.9)</td>
<td>90 (52.3)</td>
</tr>
<tr>
<td></td>
<td>Mid rural: score 35-49 (10 practices)</td>
<td>2,012 (22.2)</td>
<td>350 (22.4)</td>
<td>36 (20.9)</td>
</tr>
<tr>
<td></td>
<td>Most rural: RRS score 50+ (11 practices)</td>
<td>2,064 (22.7)</td>
<td>370 (23.7)</td>
<td>46 (26.7)</td>
</tr>
<tr>
<td>3. Nearest urban Hospital</td>
<td>Close (≤20 km) (19 practices)</td>
<td>4,320 (47.6)</td>
<td>729 (46.7)</td>
<td>74 (43.0)</td>
</tr>
<tr>
<td></td>
<td>Intermediate (21-50 km) (13 practices)</td>
<td>2,274 (25.1)</td>
<td>406 (26.0)</td>
<td>43 (25.0)</td>
</tr>
<tr>
<td></td>
<td>Far (&gt;50 km) (12 practices)</td>
<td>2,482 (27.3)</td>
<td>426 (27.3)</td>
<td>55 (32.0)</td>
</tr>
<tr>
<td>4. Distance to nearest hospital by location</td>
<td>Urban (all 31 km or less, 20 practices)</td>
<td>4544 (50.1)</td>
<td>752 (48.2)</td>
<td>79 (45.9)</td>
</tr>
<tr>
<td></td>
<td>Rural,&lt;30 km (14 practices)</td>
<td>2734 (30.1)</td>
<td>509 (32.6)</td>
<td>67 (39.0)</td>
</tr>
<tr>
<td></td>
<td>Rural,≥30 km (10 practices)</td>
<td>1798 (19.8)</td>
<td>300 (19.2)</td>
<td>26 (15.1)</td>
</tr>
<tr>
<td>5. Drive time to nearest hospital</td>
<td>15 minutes or less (18 practices)</td>
<td>3978 (43.8)</td>
<td>684 (43.8)</td>
<td>84 (48.8)</td>
</tr>
<tr>
<td></td>
<td>16 to 30 minutes (14 practices)</td>
<td>3019 (33.3)</td>
<td>522 (33.4)</td>
<td>52 (30.2)</td>
</tr>
<tr>
<td></td>
<td>More than 30 minutes (12 practices)</td>
<td>2079 (22.9)</td>
<td>355 (22.7)</td>
<td>36 (20.9)</td>
</tr>
</tbody>
</table>

*Values are count (percentage)
10.5.2 The effect of different definitions of rurality on risk of hospital admission, hospital harm, and the rate of hospital events resulting in harm.

The previous section described the application of the alternative rurality definitions to the study group. This section describes the effect of testing alternative rurality definitions against the data.

The alternative rurality definitions were substituted for the base case ‘location’ variable in the final adjusted models for risk of hospital admission, risk of hospital admission causing harm, and rate ratio of hospital harm per admission. The interactions between the location variable and age for risk of hospital harm, and location variable and socioeconomic status for rate ratio of hospital harm per admission were accounted for. The results are shown in Table 10.17, and the salient findings are outlined below.

10.5.2.1 Risk of hospital admission and alternative rurality definitions

None of the models using the different definitions of rurality showed evidence of an association between rural location and risk of hospital admission during the three-year period, as shown in Table 10.17.

10.5.2.2 Risk of hospital harm and alternative rurality definitions

None of the models using the different definitions of rurality showed evidence of an association between rural location and risk of hospital harm during admission during the three-year period, as shown in Table 10.17.

When the alternative rurality measures were applied to the final model for risk of preventable hospital harm, no significant association between preventable hospital harm and rurality was seen (Wald p ≥ 0.056).
10.5.2.3 Rate ratio of hospital harm per admission and alternative rurality definitions

Two out of five alternative rurality definitions showed evidence of statistically significant associations with the rate of hospital harm per admission.

The ‘distance to the nearest hospital’ rurality definition showed a highly significant association with the rate ratio of hospital harm per admission (p<0.001). The pairwise comparisons showed that patients living far (more than 30 km) from any hospital had a higher rate of hospital harm per admission than both urban patients living near (urban) hospitals (aIRR 2.37 (1.87-3.04) p<0.001) and rural patients living near (rural) hospitals (aIRR 2.28 (1.78-2.91) p<0.001). There was a significant interaction between this rurality definition and socioeconomic status (p<0.001) as shown graphically in Figure 10.13. Rural patients living in quintiles 3 (p<0.001) and 5 (p<0.001) areas and living far from any hospital had higher rates of harm per admission than patients living near either urban or rural hospitals.

![Effect of SES and hospital distance on rate of hospital admissions causing harm](image_url)

**Figure 10.13** Impact of socioeconomic status on rate ratio of hospital admissions causing harm (with 95% CIs), by distance from nearest hospital and rural/urban location
Drive time to nearest hospital showed a statistically significant association with rate of hospital harm per admission ($p=0.037$), as shown in Table 10.17. Pairwise comparison showed that while there was no statistically significant association between patients attending general practices located either 16-30 minutes (aIRR 1.25 [0.98-1.61] $p=0.073$) or more than 30 minutes (aIRR 0.96 [0.77-1.19] $p=0.676$) compared to those less than 15 minutes drive to the nearest hospital, patients living more than 30 minutes showed evidence of a reduced rate of hospital harm per admission than those living 16-30 minutes drive away from the nearest hospital (aIRR 0.76 [0.62-0.94] $p=0.013$).

The alternative rurality definitions of the binary and three-part rural ranking scales, and the proximity of the nearest urban hospital did not show any association with the rate of hospital harm per admission, as shown in Table 10.17.
### Effect of applying alternative rurality definitions in adjusted models to estimate risk of hospital admission, hospital related harm and rate of hospital harm per admission

<table>
<thead>
<tr>
<th>Rurality definition</th>
<th>Subset</th>
<th>Adjusted risk ratio of hospital admission (95% CI)</th>
<th>p value</th>
<th>Adjusted risk ratio of hospital harm (95% CI)</th>
<th>p value</th>
<th>Adjusted rate ratio of hospital events resulting in harm per hospital admission (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case: Location</td>
<td>Rural</td>
<td>reference (0.83-1.17)</td>
<td>0.844</td>
<td>reference (0.97-1.05)</td>
<td>0.587</td>
<td>reference (0.83-1.43)</td>
<td>0.524</td>
</tr>
<tr>
<td>1. Rural ranking scale (binary)</td>
<td>Urban&lt;35</td>
<td>reference (0.80-1.14)</td>
<td>0.608</td>
<td>reference (0.97-1.05)</td>
<td>0.590</td>
<td>reference (0.79-1.35)</td>
<td>0.794</td>
</tr>
<tr>
<td>2. Rural ranking scale (3 part)</td>
<td>Urban&lt;35</td>
<td>reference (0.75-1.25)</td>
<td>0.791</td>
<td>reference (0.97-1.07)</td>
<td>0.155</td>
<td>reference (0.79-1.52)</td>
<td>0.390</td>
</tr>
<tr>
<td>3. Nearest Urban Hospital</td>
<td>Close (≤20 km)</td>
<td>reference (0.71-1.19)</td>
<td>0.503</td>
<td>reference (0.97-1.07)</td>
<td>0.056</td>
<td>reference (0.78-1.31)</td>
<td>0.263</td>
</tr>
<tr>
<td>4. Distance to nearest hospital by location</td>
<td>Rural (all 31 km or less)</td>
<td>reference (0.83-1.25)</td>
<td>0.844</td>
<td>reference (0.99-1.08)</td>
<td>0.101</td>
<td>reference (0.82-1.35)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>5. Drive time to nearest hospital</td>
<td>15 minutes or less</td>
<td>reference (0.86-1.14)</td>
<td>0.591</td>
<td>reference (0.97-1.02)</td>
<td>0.410</td>
<td>reference (0.98-1.61)</td>
<td>0.037</td>
</tr>
</tbody>
</table>
This section has explored the effect of alternative rurality definitions and found that different definitions were not associated with risk of hospital admission or risk of hospital harm. ‘Distance to nearest hospital’ was strongly associated with a higher rate of harm per admission for those living more than 30 km from either urban or rural hospitals (p<0.001). Drive time to nearest hospital was associated with rate ratio of harm per admission (p=0.037) with lower rates of harm per admission for those living more than 30 minutes drive from hospital compared to those living 16-30 minutes from hospital, whereas the other rurality definitions did not show evidence of difference.

10.6 Summary

This chapter has presented the results of the Hospital Harms Study. First the study group was described then associations between location and other demographic variables and hospital admission and hospital harm were reported. Patient rurality showed no evidence of significant association with the risk of hospital admission, hospital harm, preventable harm, greater harm severity, having hospital harm only detected in general practice settings, the rate ratio of hospital harm per admission and the number of total occupied hospital bed days. Only rural patients experienced inter-hospital transfer, and interhospital transfer was associated with a more than doubled risk of hospital harm. Experiencing hospital harm was associated with a more than doubled total occupied bed-day usage. Alternative rurality definitions did not impact on the risk of hospital admission or risk of hospital harm seen. Two alternative rurality definitions were associated with higher rates of harm per admission. The next chapter discusses the study’s findings, with an overview of key study results, a discussion of findings with reference to existing literature and a review of the study's strengths and limitations.
11 Hospital Harms Study discussion

The previous two chapters have outlined the methods and results of the Hospital Harms Study undertaken as part of this thesis. This discussion chapter starts by presenting the study’s main findings of association between hospital admissions, hospital harm and rurality, followed by associations between hospital admissions and hospital harm, and practice size and demographic variables. Key findings are then discussed within the context of other relevant literature. Finally, the strengths and limitations of the study design of the Hospital Harms Study are outlined.

11.1 Summary of findings

The main findings of the Hospital Harm study are summarised here. Positive and significant negative findings are reported, including non-statistically significant tendencies, (0.100 > p ≥ 0.050) that suggest patterns in the risk of harm that warrant further exploration. Patients’ urban-rural location for the main analysis was defined by whether the general practices attended were in rural centres or independent urban areas, as defined by Stats NZ. The five alternative rurality definitions tested were based on RRS and distances from patients’ general practices to hospitals.

11.1.1 The Hospital Harms Study group and rural and urban comparisons

The study group The study group of 9076 patients represented through three years of their general practice clinical records was evenly distributed across rural and urban general practices, and small, medium and large practices (by design) and contained similar numbers of males and females, with a median age of 43 years. More patients of European ethnicity (75.9% versus 70.0%) and less Pacific patients (3.5% versus 7.0%) were in the study group compared to the NZ population. The socioeconomic status of the study group differed to the NZ population, with a slight overrepresentation in patients living in quintile 1 (21.7% even with patients with missing values retained in the denominator) and increasing underrepresentation by patients living in quintile 3
through to 5 areas (18.7%, 14.9% and 14.3% respectively). Nearly one in 10 patient records (9.9%) had no socioeconomic data recorded.

*Rural and urban demographic comparisons* There were similar proportions of female (50.9%) and male (49.1%) patients from rural practices, but more urban patients were female (54.3%) than male (45.7%, p=0.001). There was a lower percentage of rural patients aged 20-39 (19.9% vs 22.5%, p=0.003), and a higher percentage aged 60-79 (21.6% vs 18.8%, p=0.001) compared to urban patients. A higher percentage of Māori (16.8% vs 11.7%, p<0.001) and European patients (77.2% vs 74.6%, p<0.01) and a lower percentage of Pacific patients (1.4% vs 5.6%, p<0.001) in the study group were living in rural compared to urban settings. Fewer rural patients lived in Quintile 1 areas than urban patients (20.4% vs 22.9%, p=0.005). Nearly twice the number of rural compared to urban patients had no data on socioeconomic status (12.9% vs 6.8%, p<0.001).

### 11.1.2 Hospital admissions and rurality

Of the study group, 1561 patients (17.2%) had at least one hospital admission identified during the three-year study period, of whom 172 patients (11.0%) experienced hospital harm. Rural patients represented 49.9% of the study group, 51.8% of those with hospital admissions, and 54.1% of patients with admissions resulting in harm.

Most patients who experienced hospital admissions had one (1052/1561 patients, 67.4%) or two (286/1561 patients, 18.3%) admissions over the three-year study period with no evidence of a difference by location. There was no evidence of a difference in the unadjusted or adjusted risk of hospital admission for rural and urban patients, using the original urban-rural definition of the study, (uRR 1.00 [95% CI 0.84-1.19] p=0.980; aRR 0.98 [0.83-1.17] p=0.844), or the five alternative rural definitions tested.
11.1.3 Hospital harm and rurality

There was no evidence of a significant difference in the risk of hospital harm in patients with hospital admissions for rural patients compared to urban patients using the study’s original urban-rural definition (uRR 1.17 [0.80-1.70] p=0.410; aRR 1.01 [0.97-1.05] p=0.587), or the five alternative rural definitions tested.

The rate ratio of hospital harm per admission took into account the number of admissions patients had over the study period and their exposure to hospital harm per admission. There was no evidence to support a significant difference in the rate ratio of hospital harm per admission between rural and urban patients, using the study’s original definition of rurality (uIRR 0.95 [0.62-1.46], p=0.822, aIRR 1.09 [0.83-1.43] p=0.524) and the alternative rurality definitions relating to the Rural Ranking Scale and proximity to the nearest urban hospital.

The ‘distance to the nearest (rural or urban) hospital’ showed a highly significant association with the rate of hospital harm per admission (p<0.001). Patients living more than 30 km from a hospital had higher rates of hospital harm per admission than both urban patients living near (urban) hospitals (aIRR 2.37 (1.87-3.04) p<0.001) and rural patients living near (rural) hospitals (aIRR 2.28 (1.78-2.91) p<0.001). Drive time to nearest hospital showed a statistically significant association with rate of hospital harm per admission (p=0.037). Between the three categories of this rurality definition, the only significant association was that patients living far (> 30 minutes’ drive) from hospital had a reduced rate of hospital harm per admission compared to those living 16-30 minutes’ drive time away from the nearest hospital (aIRR 0.76 [0.62-0.94] p=0.013).

Just under half of all hospital harm identified (44.8%) was evident only in the general practice setting, with no evidence for a difference between rural and urban locations seen. There was no evidence of a difference in the risk of experiencing any preventable hospital harm for rural patients compared to urban patients (uRR 1.15 [0.83-1.60])
p=0.679, adjusted for age, sex and ethnicity aRR 1.12 [0.77-1.61] p=0.550, nor with alternative rurality definitions. There was no evidence of difference in odds of being in a higher severity category for rural patients compared to urban patients (uOR 0.76 [0.28-2.10] p=0.597, adjusted for location, age and sex aOR 0.76 [0.28-2.03] p=0.583).

Twenty-six rural patients (26/809, 3.2% of rural patients with admissions) experienced inter-hospital transfer in the study period. No inter-hospital transfers occurred for urban patients. There was a significant association between inter-hospital patient transfer and risk of hospital harm (rural patients adjusted for age only, aRR 2.33 [1.37-3.98] p=0.003 and for sex only, aRR 2.41 [1.52-3.80] p=0.001).

11.1.4 Association of general practice size with findings

When patients' location, age, ethnicity and socioeconomic status were adjusted for, patients attending small practices had 24% lower risk of hospital admission over the 3 year period, compared to large practices (aRR 0.76 [0.62-0.92], p=0.006).

11.1.5 Association of sex with findings

Men aged 70 to 95, had higher adjusted risk of admission than women of the same age. Men aged 85 and older had higher adjusted risks of hospital harm than women in this age group, but otherwise there was not association between age and risk of harm, harm per admission, or preventable harm.

11.1.6 Association of age with findings

Patients who had hospital admissions were older than those without admissions (median 57 years vs 40 years) and patients experiencing hospital related harm were older again (median 64 vs 56 years). The risk of hospital admission was higher with older age (p<0.001). Older age was associated with higher unadjusted risk of hospital harm but not when other variables and age-sex and age-location interactions were adjusted for.
11.1.7 Association of ethnicity with findings

An association between ethnicity and admission risk was seen (p=0.010). There was a non-statistically significant tendency for higher adjusted risk of admission for Māori compared to European patients (aRR 1.13 [0.99-1.28] p=0.073). There was no evidence of a difference in risk of harm by ethnicity. There was a tendency towards an association between ethnicity and rate of admissions resulting in harm, at the cut-off point of p=0.050, with Pacific patients having significantly lower rates than either Māori or European patients. Given the under-representation of Pacific patients in the study group, these findings should be treated with caution as the Pacific patients included in the study might differ from the broader population. Māori patients showed a non-statistically significant tendency towards higher rates of hospital harm per admission than European patients (aRR 1.41 [0.98-2.03] p=0.064). Noting that the study was not powered to detect a difference between ethnic groups, these findings may be interpreted as suggesting a tendency towards higher risk of admission and higher rate of hospital harm per admission for Māori compared to European patients when urban-rural location and socioeconomic status, age, sex and practice size were controlled for. Conversely these findings could represent falsely positive results, given the attendant p-values.

11.1.8 Association of socioeconomic status with findings

Socioeconomic status showed no association with risk of hospital admission or hospital harm. Socioeconomic status showed a significant overall association with rate of hospital harm per admission (p<0.001) with lower rates of hospital harm per admission with increasing socioeconomic disadvantage, and an interaction between socioeconomic status and location, but no clear pattern of difference between rural and urban patients. When applying the alternative rurality definitions, the ‘distance to nearest (rural or urban) hospital’ definition showed an interaction with rate ratio of hospital harm per admission, with higher rates of hospital harm per admission for the ‘most rural’ patients living in the disadvantaged areas. Given that data quality issues
with socioeconomic data noted in §10.2.3, page 209, these results should be treated with caution.

11.1.9 Hospital bed-day use and hospital harm

Nearly half of patients with admissions (48.2%) had complete information about length of stay for all admissions. Rural or urban location was not associated with a difference in total occupied bed days (aIRR 1.00 [0.75-1.35] p=0.983). Every year increase in age was associated with a 2% higher mean number of total occupied bed days (aIRR 1.02 [1.02-1.03] p<0.001). Experiencing hospital harm during admission was associated with greater mean number of admissions per patient (uIRR 1.73 [1.22-2.46] p=0.003), longer mean length of stay for hospital admissions, (uIRR 1.85 [1.33-2.56] p<0.001) and a more than doubled mean total occupied bed day usage over the study period for both the unadjusted and adjusted rates (uIRR 2.40 [1.47-3.91] p<0.001, aIRR 2.16 [1.39-3.35] p=0.001).

This section has presented an overview of the main findings of the Hospital Harms Study. Figure 11.1 presents a diagrammatic summary of the study's key findings. The following section discusses these findings with reference to relevant existing literature.
Hospital Harms Study summary of results

**Rural-urban location:**
- Associated with hospital admissions? No Table 10.6
- Associated with hospital harm? No Table 10.7, 10.8
- Associated with preventable harm? No Table 10.10
- Effect of different rural definitions? Yes, higher rate of harm per admission with greater distance from nearest hospital Table 10.17

**Inter-hospital transfer**
- Associated with rural location? Yes, only rural patients transferred Section 10.3.4.1
- Associated with harm? Yes, more than doubled risk of harm associated with transfer Section 10.3.4.20

**Total occupied bed days:**
- Associated with rural-urban location? No Table 10.15
- Associated with hospital harm? Yes, doubled with hospital harm Table 10.15
- Associated with age? Yes, higher with older age Table 10.15

**Age:**
- Associated with hospital admissions? Yes, higher risk with older age Fig. 10.7; men 70+ yrs old higher risk of admission Fig. 10.8
- Associated with hospital harm? No, but interactions show higher risk of harm for > 85 yr old male Fig. 10.11 and urban patients Fig. 10.11

**Ethnicity:**
- Associated with hospital admissions? Yes Table 10.6
- Associated with hospital harm? No* Table 10.7, 10.8

**Socioeconomic status:** (data quality issues)
- Associated with hospital admissions? No Table 10.6
- Associated with hospital harm? Yes, lower risk with increasing disadvantage Table 10.7, 10.8

**Practice size:**
- Associated with hospital admissions? Yes, lower risk with small practices Fig. 10.6
- Associated with hospital harm? No Table 10.7, 10.8

**Sex:**
- Associated with hospital admissions? No Table 10.6
- Associated with hospital harm? No Table 10.7, 10.8

- * Harm per admission overall p=0.050
- # higher tendency towards admission risk and harm per admission rate for Māori compared to European (0.1<p<0.05)

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*Figure 11.1 Schema of findings of Hospital Harms Study*
11.2 The Hospital Harms Study findings in context of other research

11.2.1 Hospital admissions

During the study’s three-year period, 17.2% (1561/9076) of patients had at least one identified hospital admission, with most patients having one or two admissions (1338/1561, 85.7%), and no evidence for a difference in rate of admission to hospital between rural and urban patients. The study detected 88.2% of all admissions where harm was detected and was likely to under-represent private hospital admissions, mental health admissions and uncomplicated birthing admissions. Published data on people’s hospital use in NZ is limited. One study from the early 1990s showed 13.3% of patients had a hospital admission in one year in a single urban general practice of 3611 patients. An analysis of the 2002/03 NZ Health Survey by The Public Health Intelligence Unit compared survey respondents’ hospital use information. This report used the original Statistics NZ rural and urban definitions, in which independent urban areas were classified as urban, so that both rural and urban hospitals would be situated in the towns and cities considered urban by this data. The results were not adjusted for ethnicity. The report found no evidence for a difference in public hospital usage (“used or been admitted to hospital”) in the year sampled by people living in rural and urban locations for either sex. Increasing deprivation was associated with increased hospital use generally. The use of private hospitals decreased with increasing deprivation for both rural and urban areas but there was no evidence for a difference between rural and urban areas for males or females of the same deprivation level.

11.2.2 Hospital harm

In the Hospital Harms Study, 11.0% of patients with hospital admissions experienced hospital harm (172/1561). The hospital patient safety studies published have all undertaken retrospective hospital patient records reviews focused on adverse events detected during admission or subsequent readmission, and so are not directly comparable with the rates of hospital harm identified in this study, which are derived from general practice records review. Adverse events were defined as “an unintended injury resulting in disability and caused by healthcare management rather than the
underlying disease process.” In contrast the Hospital Harm Study considered at patient hospital harm, defined as “physical, emotional, or financial negative consequences to patients directly arising from health care, beyond the usual consequences of care and not attributable to patients’ health condition” as the result of hospital admission. The hospital harms identified in the Hospital Harms Study would be less likely to detect minor patient harm experienced during hospital admission, as minor harms with minimal impact would be less likely to be recorded in the discharge summary than harms with a major impact on patients’ hospital stay. The Hospital Harms Study would also include hospital harms that did not appear until after discharge, and did not trigger re-admission, such as post-operative infections treated in general practice. These harms only detected out of hospital would not be detected in hospital records review study methodology. In this study, 48% of (77/172) patients’ hospital harm was detected only in the out-of-hospital patient clinical record.

A systematic review of NZ, US, UK, Australia and Canadian retrospective hospital patient record review studies to identify hospital related adverse events showed that approximately 9% of all patients admitted to hospital experience adverse events, noting differences in the data collection process between countries. Davis and colleagues’ major NZ study looking at adverse events in hospitals of 6579 hospital records drawn from 13 NZ general hospitals with over 100 beds in 1998 reported an adverse event rate of 12.9% of admissions, with 80.4% of these resulting from the hospital admission. This indicates a rate of 10.4% of admissions causing adverse events detectable during hospital admission or subsequent readmission. While noting that the data are not directly comparable, the rates of identifiable hospital harm in this study are similar to adverse event rates reported in existing literature.

11.2.3 Inter-hospital transfer
All inter-hospital transfers in the study data occurred in rural patients. The only relevant NZ study identified indicated that 60% of rural patients from three NZ rural hospitals were transferred to urban hospitals, using national level hospital discharge data, whereas 3.2% (26/809) of rural patients admitted to hospital required inter-
hospital transfer in this clinical record based review study. As well as a difference in data collection methods, clinical practice may have changed since Williamson’s research\textsuperscript{24} with the advent of rural hospital medicine specialists in the workforce. Inter-hospital patient transfer was statistically significantly associated with a more than doubled risk of hospital harm (rural patients adjusted for age only, aRR 2.33 [1.37-3.98] \( p=0.003 \) and for sex only, aRR 2.41 [1.52-3.80] \( p=0.001 \)). There were no relevant NZ studies to compare these results with. However, these findings were consistent with international literature which shows that rural patients have higher rates of transfer than urban patients,\textsuperscript{141} and that patient transfer is associated with higher rates of adverse outcomes.\textsuperscript{140-143} Some studies show this excess in adverse outcomes persisted when patient characteristics and underlying illnesses were controlled for.\textsuperscript{142,143} Poorer outcomes for transferred patients has been noted as a combination of patient factors, as patients requiring transfer will be vulnerable to adverse outcomes due to the complex and unstable medical problems necessitating transfer; and system factors relating to poor communication and handover between referring, transferring and receiving clinical teams, and limited resources and space during transfers to monitor and address evolving changes in health status.\textsuperscript{142,144} Insufficient data was collected during the Hospital Harms Study to further explore the association demonstrated between inter-hospital transfer and higher patient harm, and the exploratory results presented here warrant further research.

11.2.4 Harm preventability and severity

Using the SHARP study researchers’ determinations of harm preventability and severity, there was no evidence of a difference in the risk of experiencing any preventable hospital harm or increased odds of experiencing harm of higher severity for rural patients compared to urban patients. No existing published data that explored preventability or severity of hospital harms related to where patients resided was found.
11.2.5 Rurality and hospital harm

The international published literature on difference in quality outcomes compares rural and urban hospitals, rather than where patients reside. Vartak and colleagues found the quality of care provided in small rural hospitals was the same as in small urban hospitals in 292 American hospitals with less than 100 beds. Coburn and colleagues’ paper which included a review of existing literature noted that adverse patient events may be less likely in rural compared to urban hospitals. No published studies consider the location of patients when investigating hospital harm, as explored in this study.

The HHS showed no evidence of a difference in the risk of hospital harm or rate of hospital harm per admission between patients living in rural and urban settings using Stats NZ’s rural centres and IUAs to define rurality. The alternative rurality definitions were developed to test different views of being rural that may be more relevant in the health context. The Rural Ranking Scale definitions (see Appendix 2) measures local isolation from a wide range of health services. The ‘distance to nearest (urban or rural) hospital’ definition measures isolation from any hospital, whereas the ‘distance to urban hospital’ definition measures isolation from large specialised hospitals. The ‘drive time to nearest hospital’ definition only measures time to drive to the nearest hospital, whether driving through a city or on rural roads and does consider other services available, such as public transport and ambulance services. The only strongly statistically significant association with hospital harm was seen between the rate of harm per hospital admission and being far (> 30 km) from any hospital (p<0.001). Even if a higher cut off for statistical significance was applied due to undertaking the multiple tests as shown in Table 10.17, this result would still be significant. One could hypothesise that this could be related to poorer access to hospital causing delay in admission. This could result in patients being in poorer condition when they were eventually admitted, and therefore less resilient to adverse events. Patient co-morbidity may well be a confounder in these findings. This is an area for further research.
11.2.6 Practice size

Patients enrolled in small practices (1420 mean enrolled patients/practice) in the Hospital Harms Study had a 24% lower adjusted risk of hospital admission over the three year period compared to patients enrolled in large practices (7893 mean enrolled patients/practice). In the 29 practices in original SHARP study that provided complete data, large practices had significantly higher number of patients enrolled per full-time-equivalent (FTE) GP (mean 1827 patients per FTE GP) compared to medium sized practices (mean 1457 patients/FTE GP) and small practices (mean 1120 patients/FTE GP) but similar practice nurse workloads in the overall study.\textsuperscript{38} It is not clear whether an overall lower risk of hospital admission reflects better access to primary care services, leading to less unplanned potentially preventable hospital admissions, or poorer access to primary care services with appropriate referral to planned hospital services such as elective surgery. International literature on the linkage between the effect of practice size, patient caseload for the general practice team and quality and continuity of primary care is mixed. A systematic review of the effect of practice size on quality of primary care found that there was limited evidence to support a link between the size and quality, with different attributes of quality favouring larger or smaller practices.\textsuperscript{252} Another systematic review showed the greater continuity of care by generalist (and specialist) doctors was associated with reduced mortality rates.\textsuperscript{253} A cross-sectional study in England\textsuperscript{254} of over 230,000 patients showed that better continuity of care with one's own GP was associated with reduced rates of preventable hospital admissions and that larger practices (> 7 FTE GPs) had lower levels of continuity than smaller practices (1 to 3 FTE GPs).\textsuperscript{254} One could postulate that smaller practices with lower patient to GP ratios in the Hospital Harms Study may have provided greater continuity of care which may have prevented unnecessary patient admissions, but the type of hospital admission (planned or unplanned) is not captured in the data set here, and the literature to support such a theory is inconclusive.
11.2.7 Age

Older age was associated with higher risk of hospital admission. In the adjusted models, age showed no evidence of increased risk or rates of hospital harm per admission, despite age being associated with increasing risk of admission. This suggests that older patients in the Hospital Harms Study were more likely to be admitted, but there was no evidence that they were more likely to be harmed *per se*. This was in contrast to existing NZ and international literature that indicated older people were at increased risk of adverse events during hospital admissions,\(^{25,138,139}\) and experienced greater impact from adverse events.\(^{137}\)

11.2.8 Ethnicity

A non-statistically significant tendency for higher adjusted risk of admission (aRR 1.13 [0.99-1.28] \(p=0.073\)) for Māori compared to European patients was found. The *Tatau Kahukura: Māori Health Chart Book 2015* MOH report\(^{255}\) showed that for ambulatory sensitive hospital admission rates across NZ in 2012-14, Māori had rates more than one-and-a-half times higher than non-Māori (RR 1.64, CI 1.63–1.66). The MOH’s *Mātātuhi Tuawhenua: Rural hospitalisations 2007 to 2011* report\(^{256}\) examined age-standardised hospital rates for a range of health conditions for Māori and non-Māori living in rural centres and reported that for virtually all conditions, rural Māori had significantly higher admission rates than rural non-Māori.

Māori in the Hospital Harms Study also had a non-statistically significant tendency for higher adjusted rates of hospital harm per admission (aRR 1.41 [0.98-2.03] \(p=0.064\)) compared to European patients, but no evidence of a difference in risk of harm by ethnicity. Given that the Hospital Harm Study was not powered to detect differences by ethnicity and the wide confidence intervals of these results, this supports the findings of Davis and colleagues’ analysis of adverse events in their study by ethnicity,\(^{147}\) which showed an age-standardised in-hospital adverse event rate for Māori of 12.5% of admissions, compared with 9.0% for non-Māori/non-Pacific patients (\(p=0.002\)), although these data were not adjusted for socioeconomic status.
11.2.9 Resource use

Hospital harm was associated with higher resource use, with a more than doubled mean total occupied bed day usage over the three year period for those patients experiencing hospital harm (aIRR 2.16 [1.39-3.35] p=0.001), with no evidence for a urban-rural difference. This supports the findings of two NZ studies that showed in-hospital adverse events was associated with hospital resource use.25,139

This section has discussed the Hospital Harms Study findings as they relate to existing literature. The final section of this chapter discussed the strengths and limitations of the Hospital Harms Study.

11.3 Strengths and limitations of the Hospital Harms Study

This section discusses the strengths and limitations of the retrospective record review study undertaken. The internal validity of the study design, in terms of potential biases, including confounders, and the role of chance in the findings are discussed. The generalisability of the study findings and the secondary analysis approach will then be considered.

11.3.1 Retrospective patient record review study

In context of the overall research aim to investigate differences in health care quality experienced by rural and urban NZers, this study was only focused on one aspect of patient safety, namely patient harm, with patient safety being only one aspect of quality. Noting that limitation, this study was the first large-scale patient record review study to my knowledge to investigate the association of rural and urban location on hospital harm in NZ. It analysed data on hospital admissions for a large sample (9076 patients) from the NZ population and included private and public hospital admissions linked to patient level demographics. The study design that randomly selected similar numbers of patients from rural and urban practices maximised the study’s power to detect differences between the two groups at the cost of making NZ population-level estimates
less precise. The detailed demographic data collected on the participating practices in the original SHARP study allowed the impact of different rurality definitions on hospital admissions and harm outcomes to be tested.

A weakness of the retrospective records review study was inconsistent data quality with attendant limitations around the accuracy of admission detection. The lack of a standardised method to record hospital admissions across the 44 contributing practices’ clinical records meant that detection of hospital admissions varied, depending on the different patient information systems used in hospitals and individual practice procedures.

The technique used in this study to identify hospital harm was through interrogation of the general practice clinical record. Other hospital harm studies interrogated the hospital clinical record.25,135 Minor harms occurring during hospital admissions were unlikely to be noted on hospital discharge summaries or detected through the general practice record. Nearly half of all hospital harm identified originated during hospital admissions but only became evident after hospital discharge, requiring a visit to the general practice but not hospital readmission, and so would not be identified through hospital clinical record review. This study’s findings provide a novel perspective on hospital harms that affected patients, whether the harm was identified as an inpatient or after discharge. However, the difference in methods used reduces comparability of findings from this study with studies of adverse events identified through the traditional hospital clinical record review process.

The retrospective nature of the study design and the limitation of working with data already collected, or able to be extracted from data collected, from the original SHARP study, meant the Hospital Harms Study was only able to investigate associations between predictors and outcomes without being able to fully account for all potential confounding variables. No formal causal modelling was undertaken, such as constructing a directed acyclic graph (DAG)257 to identify the minimal set of confounders necessary for stronger claims around causality, and to ensure that
variables on the causal pathway and colliders were not included in the adjustment set. Appropriate caution has been used throughout the thesis in terms of noting associations rather than making causal claims. Areas for further research aimed at understanding potentially important associations were able to be proposed.

The findings in relation to the three threats to the internal validity of an observational study will now be discussed: bias, confounding and chance.

### 11.3.2 Bias

A bias is “any error that results in a systematic deviation from the estimation of the association between exposure and outcome”.¹⁸⁹ There are various sources of bias in this study, including selection bias, information bias, conceptual bias and confounding. These biases and approaches to their mitigation are discussed below.

#### 11.3.2.1 Selection bias

The original SHARP study aimed to control for selection bias through random selection of participants, at general practice and then patient level within each practice. Twelve practices were randomly selected from each of the six general practice groups (large, medium and small, rural and urban practices).³⁸ A small number of practices (29/989, 2.9%) were excluded from the sampling frame due to being considered not typical general practices, for example sports medicine, men’s health, university or polytechnic based practices. Practices needed to use the MedTech32 computerised patient management system (PMS) to be eligible to participate. The reasons behind practices’ choice of PMS are historical and varied, and unlikely to show a systematic difference. The SHARP researchers estimated that 80% of practices used MedTech32 and oversampled to achieve the aim of 10 practices in each group.¹⁹⁵ Of practices randomly selected for invitation to participate, 83.3% (62/72 practices) were eligible with equal numbers of rural and urban practices ineligible (5 each). In addition, five large urban, two medium urban, three small urban, (10 urban) and no large rural, 2 medium rural and 5 small rural (seven rural) practices declined to participate.³⁸ The reasons behind
why these 17 practices declined to participate may include the perceived level of effort involved in participating, administrative staff workload, absences of key staff at the time or practices being uncomfortable with giving access to patient level information to the researchers, despite ethical approval for the study. The varied potential reasons are unlikely to show a systematic difference although this cannot be ruled out. The SHARP researchers reported that the practices in the whole NZ population, those randomly selected and those participating were similar in enrolled patient population and rural/urban location. All Individual patient records randomly selected from each participating general practice were included in the study group as no individual patient consent was required.

Patients included in the study and with valid data might differ from those not included in the analyses. Pacific patients were underrepresented in the study group (3.5%) compared to the NZ population (7.0%). Results for Pacific patients need to be interpreted with caution as a result. The low inclusion of Pacific patients was likely related to the study protocol stratifying practice selection by size and location, with NZ’s Pacific population being largely based in large cities where large practices are dominant (personal communication, Professor Nicolette Sheridan). The ‘Other’ category was heterogeneous and included all patients not identified as Māori, Pacific, European (including patients with no ethnicity data recorded). Patient numbers in individual ethnic groups included this category were small, and the decision was taken to combine these into one category with patients with no ethnicity data to allow for developing models complex enough to analyse the data that adhered to Peduzzi and colleagues’ guidelines around events per variable.

Data on socioeconomic status was missing for 9.9% of the study group, with about twice the number of rural compared to urban patients having no data on socioeconomic status (12.9% vs 6.8%, p<0.001), possibly due to difficulties assigning geo-codes to rural addresses along with NZ deprivation data not being provided for some meshblocks where this could risk the identification of individual households. Results involving socioeconomic status need to be interpreted with caution given the large
amount of missing data and discrepancy of missing data between rural and urban locations.

11.3.2.2 Information bias

Information biases might have affected the values included in the SHARP data set and my own measures.

The method used to identify hospital admissions was an underestimate of the total number of hospital admissions experienced by patients in the study. Public and private hospitals sent their hospital discharge information electronically to general practices in a variety of formats that were variably identifiable. I was able to estimate the accuracy of the admission detection method used as identifying 88.2% of admissions and analyse the differences between those with and without admissions identified in whom hospital harm had been detected (see Section 9.3.3, page 179 for more details). While patients with undetected admissions were younger (median age 47 vs 64 years old, p=0.005) and more likely to be female (73.9% vs 45.6%, p=0.045), there was no evidence of difference in rural or urban status, ethnicity, sociodemographic status or practice size.

The SHARP Study defined patients’ location by the general practice they were enrolled in. The assumption underpinning the application of the base case and alternative rural definitions was that people attended general practices of the same urban or rural status as where they lived. Very few NZ general practices would be located in towns of less than 1000 (i.e. ‘rural’ communities by Statistics NZ definition) and the majority (21/24, 87.5%) of participating ‘rural’ practices were located in independent urban areas (small towns). Patients living in open countryside or rural communities with no local general practice services would need to choose where to travel to, to receive general practice services. If these true rural patients lived midway between a city and a small town, they may choose to drive to the city for general practice services and thus would be classified as urban. This would lead to classification bias and potential under-estimation of the effect of rurality on the reported findings.
11.3.2.3 Confounding

Confounders are variables that influence relationships, here between urban-rural status and hospital admission and hospital harm outcomes, and need to be identified and controlled for so as to not distort the estimates for the underlying associations.\textsuperscript{206} The original SHARP study group was stratified by urban-rural location and general practice size. Known confounders of age, ethnicity, and socioeconomic status\textsuperscript{63} were collected and adjusted for in statistical modelling (although the data on socioeconomic status was not complete and this could cause residual confounding). The different rurality definitions were attempting to address poorer service availability and transport factors.\textsuperscript{63} Data on potentially major confounders of patient health or illness status were not collected and are likely to be residual confounders to results seen. For example rural people may migrate to urban settings as they became more unwell, noting that frail elderly with multiple co-morbidities were more likely to experience hospital harm.\textsuperscript{138} Rural patients may delay seeking care\textsuperscript{123} and may be more unwell when admitted to hospital which could reduce their physical reserve, making them more susceptible to harm. Factors regarding other known potential confounders of hazardous environments and occupations\textsuperscript{63} were not collected. Residual confounding is also possible through the use of overly broad categories (such as socioeconomic status being collected from the general practice clinical records as 5 NZDep13 quintiles, rather than 10 deciles from which it was aggregated or the NZDep13 continuous score from which the ordinal scale was derived).\textsuperscript{220}

11.3.3 Chance (random error)

The SHARP Study design stratified the randomly selected patient records to provide equal numbers of patients in each of the six categories (large, medium and small, rural and urban practices). This was in order to maximise the study’s explanatory power when examining differences between these six combinations. The patient records available for the harms analysis in the Hospital Harms Study was determined by the SHARP Study group size, the hospital admission rate within the study group and the ability of the Hospital Harms Study to detect hospital admissions determined. Comparing patients who experienced hospital admissions to the whole study group (see
similar proportions of rural and urban patients, and patients attending large, medium and small practices experienced hospital admissions as in the study group, but a lower number of patients attending small urban practices experienced hospital admissions compared to the other five categories.

The SHARP study’s sample size calculation applied to the study group of 9076 patients (see §9.4.3.6.1.1, page 194) but not for the sub-group of 1561 patients with hospital admissions. While the 172 patients who experienced hospital-related harm allowed for regression models with up to 17 variables to be constructed, there was no formal sample size calculation for this thesis and the retrospective power of the analysis as performed was communicated through the widths of the reported confidence intervals. Their width when reporting hospital harm risk and rate ratios indicated that the Hospital Harms Study’s power was not sufficient to robustly answer all of the questions posed.

The non-statistically significant tendency for greater risk of admission and rate of hospital harm per admission associated with Māori compared to European ethnicity may have represented a false negative (Type II) error, with no significant evidence of association seen when in fact an association existed, noting that the original SHARP Study was not powered to detect ethnicity differences. Conversely it could represent a spurious tendency attributable to chance, as if one performs enough tests with the alpha value of significance set at $p<0.05$, statistically significant findings will appear 1 in 20 times under the null hypothesis of no association and this risk is up to doubled for tendencies defined as $0.05<p<0.10$. The HHS study here was positioned as an exploratory and hypothesis generating study, and this potential association is worthy of further exploration.

The association between the alternative rurality definition ‘hospital drive time’ and rate of hospital harm per admission ($p=0.037$) was just within the declared level of statistical significance for the study, of $p>0.05$, and as one out of 18 different calculations in Table 10.17, does not stand strongly on its own. If one was to adjust for
multiplicity to ensure an overall Type I error rate of 0.05 for the set of alternative
rurality statistical analyses, the statistical association between living far from any
hospital and higher rates of hospital harm per admission \((p<0.001)\) would still be
significant. This significant association between rate of hospital harm per admission
and greater distance from any hospital is worthy of further investigation.

11.3.4 Generalisability

The external validity of the Hospital Harms Study relates to how generalisable the
study’s findings are to other populations. Forty-four general practices from all 989
general practices in NZ in 2014 were randomly selected and invited to participate in the
study. This sampling frame represented 96.5% of the estimated NZ population in 2013
\((4,092,647 \text{ patients}^{38} \text{ out of an estimated } 4,242,048 \text{ NZers}^{219})\). As noted in §10.2.2, page
203, Pacific patients were underrepresented by half (3.5% vs 7%) and ‘Other’ patients
by nearly one third (6.0% vs 8.9%) in the Hospital Harms Study group compared to the
general NZ population.\(^{219}\)

A small percentage of practices (2.9%) were excluded from selection as not being
typical, as noted above. Forty-four out of 72 (61.1%) randomly selected practices
participated in the study, and of eligible practices, 71% (44/62 practices) participated.
As consent was given at practice level, there was full participation of selected patients
through general practice clinical records. There may have been differences in how
practices that declined to participate were organised (for example if they were very
busier or did not use fully computerised clinical records) that could have affected how
hospital discharge summaries or harms in the general practice record were recorded.
Otherwise, there was no obvious reasons to suggest that patients attending practices
that were ineligible or declined to participate would have had a different experience of
hospital harms in rural and urban settings.

Applying the SHARP Study’s urban-rural definition, 789 practices (79.9%) in NZ in 2014
were urban, servicing 82.3% of all enrolled patients in NZ, while 199 rural practices

276
(20.1%) serviced 17.7% of all enrolled patients, as shown in Table 10.1 on page 202. As guided by the SHARP Study protocol, the randomly selected sample was stratified by practice size and rurality. Consequently, while one in two patients in NZ were enrolled in large urban general practices, and one in 40 patients were enrolled in small rural general practices, there were similar numbers of patient records from each group (1501 and 1493 patient records respectively) in the study. Nonetheless, the study did include 752 urban patients who experienced hospital admissions, as well as 809 rural patients. In addition, clustered robust standard errors were used to account for clustering within practices in statistical models, and patient weights were used (see §9.3.8, page 187) to increase the representativeness of the reported findings to the NZ population as a whole.

Taking these factors in to account, the Hospital Harms Study seems likely to be generalisable to the NZ European and Māori populations, but should be interpreted with greater caution for NZers of Pacific and Other ethnicities and to other countries with similar health systems.

11.3.5 Secondary analysis study design

Secondary analysis of a large retrospective patient record review study, where patient harm had already been identified, allowed access to a rich data set that would not have been available to an individual researcher, both from a financial and time perspective. The main limitations of this approach were missing information and interrater reliability, as outlined below.

11.3.5.1 Missing information

The SHARP study did not collect information on hospital admissions in their in-depth review of general practice patient records. The SHARP Study data was not linked to the National Health Index (NHI) number (unencrypted or encrypted) so could not be matched to other health data sets, such as the national data collections held by the Ministry of Health which record hospital admission information. My method of
screening patient records for hospital admissions detected hospital admissions in 88.2% of patient records where hospital harm had been detected by the original SHARP Study researchers (172/195 patient records). There was no evidence of a difference in hospital admission identified between rural (11/104, 12.3%) and urban (12/91, 10.7%) patients (p=0.573). The calculation of the accuracy of detecting all admissions assumed that the rate of ‘missed’ admissions for people who experienced harm was the same as for people who did not experience harm.

As mentioned above, the secondary analysis approach did not make it possible to collect data on the underlying health status of patients.

11.3.5.2 Inter-rater reliability

My analysis in the Hospital Harms Study used the identified harms from the SHARP study. As outlined in §9.3.4 page 182, inter-rater reliability reflects the consistency with which different raters reached the same conclusions when assessing clinical records. Blind double reviewing was undertaken for the records of 258 patients with identified hospital admissions. While there was moderate agreement between reviewers for the presence or absence of harm (kappa statistic for hospital harm detection (any harm or no harm) = 0.401 [95%CI 0.310-0.493]), the number of harms detected by pairs of reviewers showed slight agreement only (linearly weighted kappa statistic for number of harms=0.298 [0.152-0.292]). The eight GP researchers in the SHARP study were experienced clinicians with one day of training on coding and were geographically spread out around NZ but were in contact electronically. In a systematic review of inter-rater reliability studies, research groups with a maximum of five reviewers had significantly better inter-rater reliability, while training time and number of records reviewed was not significantly associated with better inter-rater reliability. Better communication between smaller research groups was suggested as an explanation for these findings.

The original intention to analyse the data by number of hospital harms was modified to become the presence or absence of hospital harm. Preliminary analysis of the number of
hospital harms indicated that over 80% of patients experienced one or two hospital harms, with no evidence of a difference between rural and urban patients, (chi-squared \( p=0.968 \)) so altering the outcome as described would be very likely to produce similar results.

This section has discussed the strengths and limitations of the Hospital Harms Study’s design. Secondary analysis of a large retrospective patient record review study, where patient harm had already been identified, has allowed access to a rich data set that would not have been available to me otherwise, and has allowed me to undertake what to my knowledge is the first large-scale patient record review study to investigate the association of rural and urban location on hospital harm in NZ or elsewhere. The nature of the study design meant that results would be exploratory rather than explanatory. The data gaps in socioeconomic status may bias relevant results and should be treated with caution. The potential for missing information on patient health status to confound results is acknowledged. The findings are likely to be generalizable to the wider NZ population, particularly for NZ European and Māori, and to people of Pacific and ‘Other’ ethnicities, and to other countries with some caution.

11.4 Summary

This chapter has outlined main findings of the Hospital Harms Study and discussed the study findings in the context of relevant published literature. The strengths and limitations of the Hospital Harms Study were outlined. The next and final chapter of this thesis combines the findings of the Hospital Harms Study presented over the last three chapters with the findings of the Interview Study described in Chapters 4 to 8 to present the overall findings of this thesis.
12 Discussion

The previous chapters in this thesis have presented the context, methods and findings of this research. This chapter reviews the study design and findings of both the Interview Study and Hospital Harms Study. The findings are then integrated to develop the overall findings of this thesis. The new knowledge that this thesis has contributed is outlined. The implications for policy and health service design are discussed, with suggestions for further areas of research. Finally, the overall conclusions of the research are presented to complete this thesis.

12.1 The component studies – study design and main findings

This section revisits the study designs and presents a summary of the main findings of the component studies to set the scene for the final discussion. This thesis aimed to understand what influences the quality of health care that people from rural communities receive when they require hospital level care, including whether there were measurable differences between rural and urban patients in patient safety, and to identify approaches that could be taken to improve hospital care quality for rural communities. Chapter 2 presented a narrative review of relevant literature. A pragmatic mixed methods methodology was used as outlined in Chapter 3.

12.1.1 The Interview Study

The Interview Study explored what contributed to high quality hospital services, and how service design did and could influence quality through semi-structured interviews with rural health providers and managers, and focus groups for Māori and community groups in four NZ rural communities during 2016. The methods used to gather and analyse interview data using thematic analysis are outlined in Chapter 4. Although focused on hospital care, many participants contributed views on the wider local health system, including primary and community care. The results were presented over the next three chapters, including a description of the participants, and the theme of the Rural Triple Aim, (Chapter 5) and seven themes describing key elements in providing
and improving high quality health services for rural communities, focused around hospital level services, developed from the data (Chapters 6 and 7). Chapter 8 discussed the findings in the context of existing literature and considered the strengths and limitations of the study design.

The Rural Triple Aim for NZ was developed, adapting NZ’s Triple Aim for Quality Improvement\textsuperscript{231} to be relevant for rural communities. The principles of quality identified as relevant to rural communities included considering people’s preferences for where treatment was provided, and providing services as close to home as could be done well. Explicit reference to team-based care over distance was made, and a focus on equity for Māori and the whole rural community. The importance of service sustainability and health service networks in the system was acknowledged, and that value in the rural setting was more than value for money and included improving patient flow across distance.

People living and working in the rural communities visited enjoyed the rural lifestyle and valued their local hospital and health services but transport and access were major concerns. The health care provided in their rural hospitals was seen as more holistic than that provided at large urban hospitals. These rural communities wanted health care to be provided as close to home as could be done safely. For this to happen reliably, attention needed to be given to the appropriateness and quality of services provided locally, and services provided at a distance, with appropriate access to both. Māori health needs required consideration and appropriate service delivery models were needed to be designed. People living in rural communities felt that they subsidised their health care in ways that people living in urban settings did not, due to greater need to travel, and at times no access to free urgent care, and the question was raised of whether rural communities were being treated fairly. A well-trained workforce that worked together over distance as a health service network was identified as important in providing high quality, sustainable services. Culture, leadership and consistent processes were seen as key to the success of the network. Information technology was seen to enable care over distance, but its full potential was yet to be fully realised.
Community involvement in service design, implementation and ongoing monitoring had great potential to improve services. A whole of system approach to funding the local health service network was needed. Quality measures appropriate for rural settings were important to monitor and improve quality. Seven themes of whole of system planning and resourcing, Māori focused service design, community participation, access ‘one service, many sites’ health service networks, capable workforce and rural-appropriate quality measures conveyed these concepts.

12.1.2 The Hospital Harms Study

One aspect of health care quality, namely patient harm, was investigated quantitatively through secondary analysis of a retrospective patient record review study of 9076 general practice clinical records that had previously been analysed for patient harm. The Hospital Harms Study investigated whether there were differences in hospital harm experienced when rural patients and urban patients were admitted to hospital. The methods used to identify hospital admissions and hospital harm, and analyse these records for differences in patterns of admission and hospital harm, by location and sociodemographic variables, are outlined in Chapter 9. Both univariable and multivariable analysis using regression models were undertaken. Patients were defined as rural for the main analysis if the general practices attended were in rural centres or independent urban areas, as defined by Stats NZ. Taking an exploratory and hypothesis generating approach, five alternative rural categorisations relating to the RRS and distance from hospital services were applied to investigate whether findings were sensitive to rurality definitions. The results were presented in Chapter 10. Chapter 11 discussed the findings with reference to existing literature and considered the strengths and limitations of the quantitative study design.

Of the study group, 1561 patients (17.2%) had at least one hospital admission identified during the three-year study period, of whom 172 patients (11.0%) experienced hospital harm. There was no evidence of a difference in the unadjusted or adjusted risk of hospital admission by rural location, using the original rural definition of the study, or the five alternative rural definitions tested.
There was no evidence of a difference in the unadjusted or adjusted risk of hospital harm or rate ratio of hospital harm per admission for rural compared to urban patients. There was no difference in the risk of hospital harm shown with the alternative rurality definitions. There was a strongly statistically significant association between greater distance from any hospital and rate of hospital harm per admission.

There was no evidence of a difference in the risk in preventable hospital harm or of increased odds of experiencing more severe harm for rural patients compared to urban patients. Nearly half of all patients who experienced hospital harm (48%) had that harm detected in the out-of-hospital (i.e. general practice) clinical record. A small number of rural patients with hospital admissions (26/809 patients, 3.2%) experienced inter-hospital transfer, with no urban patients transferred. Patients experiencing inter-hospital patient transfer had a more than doubled risk of hospital harm.

When patients’ location, age, ethnicity and socioeconomic status were adjusted for, patients attending small practices had a 24% lower risk of hospital admission compared to large practices. The risk of hospital admission was greater with increasing age (p<0.001) but age was not associated with adjusted risk of hospital harm or rate ratio of hospital harm per admission.

There was a non-statistically significant tendency for higher adjusted risk of admission for Māori compared to European patients (aRR 1.13 [0.99-1.28] p=0.073). Māori patients showed a non-statistically significant tendency towards higher adjusted rates of hospital harm per admission than European patients (aRR 1.41 [0.98-2.03] p=0.064). Taken together these results suggest a tendency towards higher risk of admission and harm for Māori compared to European patients when other factors were controlled for, but further research is needed to produce narrower confidence intervals to enable clearer interpretation.

The socioeconomic status of the study group differed from the NZ population, and nearly one in 10 patient records (9.9%) had no data recorded, with about twice the
number of rural compared to urban patients having no data on socioeconomic status (12.9% vs 6.8%, p<0.001). Socioeconomic status showed no evidence of association with risk of admission or harm by location, but a significant overall association with rate of hospital harm per admission (p<0.001) was found, with lower rates of hospital harm per admission with greater socioeconomic disadvantage. Given the data quality issues noted above, these results should be treated with caution.

Location was not associated with a difference in total occupied bed days. Patients experiencing hospital harm had an associated more than doubled mean total occupied bed day usage over the three-year period for both the unadjusted and adjusted rates.

12.2 Combining the two component studies

12.2.1 Common findings and themes

After initial analysis of both data sets, the results of the Hospital Harms Study regarding urban-rural differences in hospital harms were considered in the light of the results of the Interview Study, with reference to existing literature, to develop the final thesis findings, as outlined below.

The Hospital Harms Study found that the urban-rural definition used showed no difference in risk of hospital admission. The risk of hospital admission could be considered a marker of access to hospital inpatient services. Being admitted to hospital could be seen as a result of poor access to preventive health services in primary care resulting in the need for emergency care that could have been prevented by appropriate care (ambulatory sensitive hospital admissions). Conversely it could indicate good access resulting in planned admissions for inpatient services, such as for hip replacement surgery. Without more detail of the types of hospital admissions that rural and urban patients experienced, it is difficult to interpret this finding as to whether rural patients had better, worse or similar access to hospital services. In contrast, the interview study findings identified access to health services, including hospital services in larger centres, as a major issue for people from rural communities, especially for
poorer people. These apparently discordant findings regarding access to hospital services warrant further exploration.

The Hospital Harms Study showed no evidence of a difference in hospital harm comparing rural to urban patients. This is reassuring to those currently providing hospital care to people from rural communities. Interview Study participants’ views were that generally health care provided in rural hospitals was more patient-centred, friendly and whole person focused, compared to large, rushed and impersonal care in urban hospitals. Some participants noted that technically complex health care was better in urban hospitals. Potentially, different types of quality provided, as indicated in the Interview Study, could translate into different types of harm being experienced in different settings.

The Hospital Harms Study showed that rural patients who required inter-hospital transfer had a more than doubled risk of hospital harm, although information was not collected in the study to clarify if this was related to the poorer clinical status of patients requiring transfer or elements of the transfer process itself. International literature suggests that this excess in adverse outcomes during inter-hospital transfer is a combination of patient factors and system factors. The Interview Study identified transfer as a high risk part of the patient journey. The themes from the Interview Study indicated the need for better co-ordination, communication and consistent processes especially relating to patient transfer, and the need to develop health service networks to support hospital services for rural communities. A common set of quality measures for health services serving rural communities was suggested, including measures relating to inter-hospital transfer, to guide quality improvement activities, while taking local context into account.

For the Hospital Harms Study, patients’ rurality was defined by the address of the general practices attended, rather than home addresses, and the Statistics NZ definition of rurality were applied, with the exception of including small towns or independent urban areas (IUAs) as rural. Different rurality definitions applied including the now
largely superseded rural ranking scale (RRS), which measured rural GPs’ isolation (including distance from the nearest major hospital), on-call commitments, and size of territory covered and distance to nearest urban hospital did not show evidence of association with hospital harm. ‘Drive time to nearest hospital’ showed weak association with hospital harm. The ‘distance to nearest (rural or urban) hospital’ showed strongly statistically significant higher rates of hospital harm per admission for patients distant to either urban or rural hospitals. These different results for association between rurality and hospital harm with different rurality definitions support the Interview Study’s call for an agreed definition of rurality to be developed and adopted that was appropriate for health purposes. This is consistent with current calls within the rural health community in NZ. Fearnley, et al. proposed that the incorrect labelling of people as rural and urban occurs when using the rurality definitions used in the Hospital Harms Study, which may mask the differences in outcomes for people living in small towns and rural communities in NZ that are seen in other countries. In particular, the presence or absence of “base hospitals” in small towns (IUAs) were seen as markers of different types of health service access that needed to be taken into account in rural—urban definitions, although the presence or absence of rural hospitals in small towns was not discussed. Census data shows that 23% of people living in IUAs in NZ had access to a secondary hospital, 41% to a rural hospital and 36% had no hospital in their town. As the services and provider mix at small secondary hospitals in those IUAs with hospitals are changing, such as at Greymouth Base Hospital, demarcations based on hospital services will become more blurred.

Definitions of rurality need to be able to detect difference in health needs and health outcomes to achieve health gain, taking into account the interplay between rurality, poverty and ethnicity. The findings of the Hospital Harms Study of no evidence for an effect of socioeconomic status on likelihood of hospital admission and less harm with increasing disadvantage are difficult to interpret given that one in ten patients had missing data, and rural patients were twice as likely to have socioeconomic data missing. Independent urban areas were generally among the most deprived areas of NZ, particularly in the North Island, and had worse health outcomes than people living in
urban or truly rural communities, for both non-Māori and Māori (with Māori having notably worse rates than non-Māori). This may suggest that any incorrect categorisation of people living in independent urban areas masking poor rural health outcomes (which may be influencing the risk of hospital admission) in NZ could be due to differences in the populations rather than their different access to hospital services. Understanding the interplay of all these aspects would be an important starting point for discussions towards agreeing new rurality definitions for health purposes.

The Hospital Harms Study identified an association between smaller general practice size and lower risk of hospital admissions. Continuity of care was valued among interview study participants. Continuity of care with GPs has been shown to be associated with smaller general practices, and with reduced ambulatory sensitive hospital admissions and reduced mortality. One could postulate that in smaller practices (which are more likely in rural settings in NZ than in urban settings), GPs knew their patients better, which could account for fewer unplanned admissions, but the Hospital Harms Study data did not contain information about type of hospital admissions so this theory cannot be tested. The ongoing HRC/MOH funded study to investigate the effective models of NZ general practice is examining this area further to help understand the link between continuity of care, general practice size and hospital admissions.

For nearly half of all patients who experienced hospital harm, the harm was only detected in the general practice record. These harms would not be detected through the usual methods of hospital record review. The Interview Study identified the need for enhanced information transfer across health service networks. Given trends to discharge patients home earlier, better communication between hospitals and general practice are needed to capture all hospital related harm, not just harm detected in hospital or severe enough to cause patient readmission.

The Hospital Harms Study reported a non-significant tendency for higher risk of hospital admission and rates of hospital harm per admission for Māori compared to
European patients, and it is important to note that the study was not powered to detect such a difference and so the wide confidence intervals are not surprising. This was consistent with MOH reports showing higher hospital admission rates for Māori compared to non-Māori, and NZ research regarding hospital harms. The Interview Study identified a number of areas where hospital services were not meeting the needs of Māori, and areas for improvement in mainstream service provision to improve outcomes for Māori were identified, which is supported by other NZ research into improving health service provision to better meet the needs of Māori. As noted by Baxter and Crampton, focusing on the needs of rural Māori will contribute meaningfully to addressing any health disparities between rural and urban NZers.

The Hospital Harms Study finding that, as patients age, their likelihood of hospital admission went up is no surprise. The population in NZ is ageing and the Interview Study findings indicated a desire from patients and health service providers to provide care for rural communities as close to home as can be done well. This raises a question for debate as to whether developing more rural health hubs with inpatient capacity will be the way forward for better quality care for rural communities, as a distinct reversal of the last 50 years of rural hospital closure.

The Hospital Harm study found that experiencing hospital harm was associated with a more than doubling of total occupied bed days over the three-year study period, as a marker of increased resource use. The Interview Study suggested that focusing on improving the quality of care delivered will improve value for money within the health system, and also create ‘value for care’. The rural quality measures identified, particularly relating to patient transfer, would likely identify areas for improvement that would improve patient safety.

This section has provided commentary on the common findings and themes that have developed out of merging the two studies. The next section addresses the strengths and limitations of the mixed methods methodology used in this research.
12.2.2 Strengths and limitations of the mixed methods approach

In this section the strengths and limitations of mixing the two contributing studies are discussed.

The mixed method approach complemented and enhanced understanding of different aspects of the research question. Data from the two concurrent studies were merged through triangulating information from both arms of the research. This allowed for deeper understanding of the same issue. An example was that the quantitative study showed the potential impact of different rurality definitions on hospital harms outcomes, and the qualitative study described the impact of rurality definitions on resource allocation. Some quantitative findings were able to be made sense of in the qualitative findings, such as the association between inter-hospital transfer for rural patients and higher risk of hospital harm, and the areas for focus to improve inter-hospital transfer processes and suggested relevant quality measures.

The concurrent nature of the data collection meant that any specific areas identified in either study could not be investigated more fully in the other study. This limited the thesis's potential to be explanatory. Continuing with the inter-hospital transfer example, if the Interview Study followed the Hospital Harms Study, more detailed questioning about this area could have been undertaken. If the reverse order was undertaken, the clinical notes of those patients who experienced inter-hospital transfer could have been scrutinised in more detail, or a nested case-control study could have been undertaken, in an attempt to understand the association between transfer and harm, in light of the Interview Study findings of this being perceived as a high-risk part of the patient journey. The design used here precluded such refinements.

The study as designed was not able to identify if different elements within patient safety for rural and urban patients differed while the overall experience of admission and harm was the same, to confirm or refute the views from the Interview Study that in some aspects participants thought rural services provided better care than urban
settings, such as communication and relationships, whereas other areas such as transfer and networks with larger hospitals needed improvement. Having said that, the findings of the Hospital Harms Study, which was exploratory and hypothesis generating by design, generally supported the themes identified in the Interview Study and identified further fruitful areas for research.

As noted in §11.3.2.3, page 275, data on potentially major confounders of patient health or illness status were not collected. These factors are likely to be residual confounders of the Hospital Harms study findings. For example, the finding that older urban patients had increased risk of harm compared to older rural patients (Figure 10.10, page 225) is likely to be confounded by health migration, where older people tend to move to larger centres as they become less well, as frail elderly have been shown to have a greater risk of hospital harm.138

12.3 This thesis’s contribution to the literature

This research contributes to the international literature on health care quality and hospital harm. It is, to the best of my knowledge, the first multicentre interview based research that explores the health care quality, focused on hospital care, as experienced by NZ rural communities, to generate themes on understanding quality in rural settings and areas for improvement. While rural quality frameworks have been published in other countries, this research appears to be the first to propose a NZ quality framework with a rural focus, including a Rural Triple Aim, quality elements for rurally focused health services and focus areas for improvement (see Figure 12.1). This is also the first research I have been able to identify internationally that investigated hospital harm using the general practice electronic patient record; that investigated hospital harm from the perspective of the rurality of patients, rather than rurality of hospitals; and that tested different definitions of rurality to explore their impact on variations in hospital harm by location.
While there was no evidence of increased hospital harm for people living in rural compared to urban communities that require hospital-level care, the alternative rurality definition of ‘distance from nearest hospital’ showed a strongly statistically significant association of greater rate of hospital harm per admission for those living distant to a hospital. The thesis adds to the call for clear rurality definitions for health purposes.\textsuperscript{54}

The need for a new common language to describe different sized hospitals and services within the health service network is also identified. The existing terminologies used are over a decade old and used inconsistently.\textsuperscript{77} Language helps create reality, and terminology that can encompass changes in how health services are delivered as technology progresses and workforces develop will allow ongoing innovation. The value of developing agreed quality measures for services providing care for rural communities that take local context into account in their interpretation is identified as a platform from which quality improvement activities can be driven.

An association between hospital admissions and general practice size is identified, and continuity of care and lower GP to patient ratios in smaller practices are suggested as potential explanations for this finding, although data was not collected to explore this further. The association between hospital harm and resource use seen in the previous NZ study of hospital adverse events\textsuperscript{25} is confirmed.

The significance of access to health services and fairness for rural communities is highlighted. The ‘Rural Triple Aim’ has been developed, where the NZ Triple Aim for Quality Improvement\textsuperscript{12} has been further developed to reflect the important aspects of quality for rural communities. It describes patient- and whānau-centred care including location preferences, as close to home as can be done well, with quality everybody’s job; consistent team-based care across distance equitable for the whole rural community including Māori; and sustainable health service networks focused on value, where value was more than value for money, and included value for care and improving patient flow across distance.
The elements that need to be in place for a high quality rurally focused health services are described, being access, agreed health service network structures and processes, a capable workforce, an adequately resourced and fairly distributed system, with community participation and rural-appropriate quality measures. Patient transfer is identified as a high-risk area for rurally focused health services.

Areas for focus to achieve the Rural Triple Aim are outlined. These include easier access to services locally and better travel and transport support when patients need to travel. Māori focused service design, rurally focused quality measures and community co-design were identified. A whole of system approach to planning, funding and delivering health care across ‘one service, many sites’ health service networks, with the appropriate workforce and information technology to support the network, with consistent clear processes and communication between sites supported by a culture of ‘one team’ was described. The importance of health service networks agreeing what services will be provided at different locations within the network and the workforces required to support this are identified. This may require changes in how people are employed, for example to the network not a specific site, and the type of workforce required in the future, which has training implications. Information technologies, such as telehealth, were key supports in health service networks and needed to become ‘business as usual’.

These threads are combined into a framework for improving health care quality for rural communities, as shown in Figure 12.1. There are tensions in achieving the Triple Aim (Rural or not) as experience of care is often the main focus for providers and communities, but population health and equity, along with value for money, are needed to achieve the best outcomes. Each community of interest often thinks their needs are paramount for equity, and managers and planners are often left to work out how to achieve value for money through fair distribution. If hospital services are not available locally and patients need to travel, the quality and safety of the care they receive can compromise their experience of care, as their family may not be easily able to visit them. The technical quality of hospital services is often assumed to be better when
provided by larger tertiary centres, but outcome data on this is not conclusive,¹⁵⁴ and this can lead to de-skilling of health providers, loss of services or lack of access to new technology in rural and provincial areas. This creates inequalities in the services rural people can easily access compared to their urban neighbours.¹⁵⁵ This reflects the view that with the same resource, the product of quality and access was a constant.⁶ Community and clinical leaders need to embrace all the three arms of the Rural Triple Aim and have robust discussions about where the trade-offs lie, regarding what people are prepared to forgo (for example, some services in some places) to obtain other benefits²⁶¹ (for example, greater equity of access to care). It is hoped that a clearly articulated NZ framework for achieving quality for rural communities will help health planners, providers and affected communities engage in these difficult conversations.

Rural settings are where innovation often starts. Developing health service networks with a rural focus is likely to assist urban components of health service networks to improve as well, as many components of quality are common to all health systems.
**Rural triple aim**

Patient- and whanau- centred, as close to home as can be done well, with quality everybody’s job §5.3.1

Consistent team-based care across distance equitable for Māori and the whole rural community §5.3.2

Sustainable health networks focused on value §5.3.3

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**Quality elements for rurally focused health services**

Access §6.4
- Information
- Local services
- Distant services
- Whanau support

Network structures and processes §7.1
- Agreed, consistent, coordinated
- Virtual and face-to-face
- Common language for network

Capable workforce §7.2
- Communication & relationships
- Cultural capability
- Rural generalists
- Supportive urban clinicians

Adequately resourced, fairly distributed §6.1, 11.1.3, 11.1.7
- Clear rural definition
- Equitable distribution

Community participation §6.3

Appropriate quality standards contextualised for rurally focused health services §7.3, 10.3.4

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**Focus Areas For Improvement**

Easier access to §6.4
- Information
- Local and distant services
- Whānau support

‘One Service, Many Sites’ Health Network §7.1, 7.2
- Network Culture
- Agreed network structure defining where services are provided
- A common language to describe different hospitals
- Workforce retention, development and training
- Information technology and telemedicine
- Clear processes between sites within the network

Māori focused service design §6.2
- Main stream services welcoming
- Including Māori providers in the network
- Consider service design impact on Māori outcomes

Whole of system planning and resourcing §6.3, 11.1.3
- Agreed definition of rurality for health services
- Planning and funding health networks

Greater community participation §6.3

Using rurally focused quality measures to drive improvement §7.3

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*Figure 12.1 Framework for improving health care quality for rural communities*
12.4 Implications for policy and future research

The previous section outlined what this thesis has contributed to the wider body of knowledge. This section describes the impact of the findings for policy and practice and then suggested areas for future research.

The need to improve access to information, health services locally and at distant urban sites, and support for whānau when patients need to travel is a key finding of this research. Transport was a key barrier to poorer people in rural areas, with Māori in rural communities particularly impacted. Health planners at regional and local level need to consider how access for people living distant to where services are provided can be improved, and providers need to cater for the travel needs of those disadvantaged by distance and ability to pay in their communities. The recommendations of the recent review of the National Travel Assistance Scheme\textsuperscript{133} give some high level guidance on direction of travel and need to be implemented.

Maximising health care quality for rural New Zealand communities requires the right balance of local and regional health care provision across health service networks, using different workforce approaches and technologies to provide patient-centred high-quality care. The development of health service networks plays an important role in reducing tensions between individual, community and system aspects of quality. Health service networks allow services to be provided as close to home as possible for people living outside major urban areas, while supporting smooth patient journeys when services are required away from the person's local community. This research sets out key areas for focus to improve health service network capabilities. Central leadership of conversations about establishing health service networks is needed. Redefining the language and terminology used to describe hospitals and services that enable health service
networks to develop would ideally be centrally co-ordinated but would have buy-in by local and regional health planning and provider teams, with support from national professional bodies. Similarly, central leadership in developing agreed definitions of rurality fit for purpose for health contexts is needed. This will then allow discussion about fair distribution of resource over health service networks to be well informed.

It is clear from the findings of this research that achieving the Rural Triple Aim requires the engagement of all services within health service networks. The ‘one service, multiple sites’ concept needs to run beyond the rural and urban hospital borders, into primary care, community care, such as pharmacy, maternity services, home-based support services, aged residential care and social care and potentially to services outside of the health system, such as education and housing. All these organisations have different funding streams and drivers. The health alliancing construct1,262 would be a useful vehicle for the complex networks required.

Systematising and formalising health service networks would assist in making ‘one service, many sites’ a reality in the NZ health system. Leadership from senior executive management and clinical leaders across services within networks is key in this process. Providing time and leadership to develop a culture of ‘one service, different sites’ across the organisations that contribute to the local health service network is required, as well as consideration of how responsibility across the whole network is embedded into usual practice. It needs to be clear how local rural services interact with the larger urban hospital and specialist services that provide services and support, either in the rural or the urban setting. Agreed pathways need to be developed and maintained for patient transfer, with protocols for handover when patients need to move between care settings, and the appropriate use of telehealth. Funding frameworks that work for rural settings need to be explored, such as outcome-based and capacity funding, rather than for delivery of units of service. In parallel with defining what services are provided at different sites within the network is the need for workforce planning for the whole
network. Future workforce requirements of the regulated and unregulated workforces need to be identified and training instigated to produce the required workforce. Analysis of the impact of changes in workforce and service delivery models on Māori health outcomes is vital. Mainstream providers as well as Māori providers need to be considering how to improve the services delivered to Māori communities in their areas. Greater community involvement in service design and implementation will also be beneficial to the whole community.

The call from this research to develop quality measures appropriate for rural communities to guide improvement activities is an important one. The idea needs wide sector agreement and the Health Safety and Quality Commission could be a potential lead organisation for this work. Agreed quality measures with consistent data sources and processes for local contextualisation of measures would need to be determined. Assessment of value for money would require measures to be considered that looked at the total cost of care provided to a community, including the costs of patient and whānau time and travel costs, as well as attributing value for care outcomes that are patient centred. More work is likely to be needed to be done in this area to develop meaningful measures for applying the Rural Triple Aim to rural communities.

Using community profiles, local rural populations could be segmented into those for whom hospital health care is difficult, for example those who are financially disadvantaged, those with limited transport, or the frail elderly. Using the data from local quality measures, a portfolio of quality improvement projects could be developed, for example projects to redesign travel support. Quality improvement projects that are engaged with across sites, with input from local communities within the network, would be likely to be add value.

The ‘Framework for improving healthcare quality for rural communities’ shown in Figure 12.1 has been developed from thematic analysis of the views of a range of rural stakeholders in the Interview Study and findings from analysis of the
Hospital Harms Study. The framework would benefit from further testing for its relevance and implementability. This could be undertaken by a national stakeholder survey or a formal consensus process to develop and prioritise the content with a wider range of health system stakeholders.

The analysis of the association between different rurality definitions and hospital harm suggested that different definitions for rurality may impact on findings of hospital harm. The association between inter-hospital transfer for rural patients and hospital harm also requires further investigation. There was a non-significant tendency towards higher adjusted risk of admission and higher rate of hospital harm per admission for Māori compared to European patients, noting that the study was not powered to detect differences between ethnicities. Future research could be designed to specifically answer these questions and be appropriately sized a priori. Gathering data on the underlying health status of patients, and their level of ‘unwellness’ at point of hospital admission and during the transfer process, with those of similar ‘unwellness’ who were not transferred from an urban setting as the comparison group, would help investigate potential confounding of underlying health status in the association between hospital transfer and hospital harm found here. Further investigation of the clinical and social reasons behind rural and urban patients’ hospital admissions and would help explore the apparently discordant findings from the Hospital Harms Study, that access to hospital admissions was similar for rural and urban patients, whereas the findings of the Interview Study indicated that rural people faced significant issues accessing hospital and other health services not experienced by people living in urban communities. Further investigation of the types of hospital harms detected solely in the general practice record would assist hospital based services in capturing the breadth of harm related to services that are provided.

A limitation of the Interview Study was that views of urban hospital clinicians and managers working within the hospital settings were not included in the description of how networks, technology and workforce can improve health care
quality for rural communities. Undertaking research that tested the findings of the Interview Study with urban hospital providers would give a broader understanding of the topic and identify potential areas for improvement.

It was unclear from this research whether rurality contributed to poorer health status for NZers once socioeconomic disadvantage and ethnicity were been accounted for, and whether rurality contributes to or exacerbates these social determinants of health. Further research looking at health outcomes for rural and urban people that controlled for these factors, where they are measured with sufficient granularity to minimise residual confounding, would help clarify this question.

New Zealand research has shown that independent urban areas, i.e. small towns, are generally among the most deprived areas of NZ, with worse health outcomes compared to people living in urban or truly rural communities. As noted above in §12.2.1, one third of small towns in NZ do not have a rural or urban hospital. It would be worth exploring whether there are differences in health outcomes for people living in IUAs with and without hospitals, particularly looking at time-dependant (such as heart attacks) and non-time-dependant conditions (such as cancer treatment). Given the ageing population and the move to having care closer to home, this would assist in considering whether there was value in opening rural hubs with inpatient capacity (i.e. a modern version of rural hospitals) for small towns that do not currently have inpatient capacity.

This section has summarised the policy implications of this research and suggested future areas for research. The next and final section in this thesis outlines the overall conclusions.
12.5 Conclusions

This thesis set out to understand what influenced the quality of health care that people from rural communities received when they required hospital-level care. It sought to investigate whether there were differences in one aspect of quality, patient safety, in the hospital care that people from rural and urban communities received. It also undertook to identify those measures that could be taken by health care planners, providers and communities to improve hospital care quality for NZ rural communities.

In answering these questions, this thesis provides what I believe to be the first comprehensive multi-site research to explore health care quality in rural NZ communities, focused on hospital care but extending into health care more generally in rural communities. The difficulties of access to health services faced by rural communities, and questions of equity and fairness have been highlighted. The first rural quality framework for NZ, the ‘Rural Triple Aim’ has been developed. The principles include patient- and whānau- centred care including location preferences, as close to home as can be done well, with quality everybody's job; consistent team-based care across distance equitable for Māori and the whole rural community; and sustainable health service networks focused on value, where value was more than value for money, and included value for care and improving patient flow across distance. These principles are similar to the principles for high quality rural health services developed by the Queensland government, but with a clear focus on value that was not represented in the Queensland model.

The elements that need to be in place for high-quality rurally-focused health services have been identified. These include access, agreed health service network structures and processes, a capable workforce, an adequately resourced and fairly distributed system focused on Māori health needs and outcomes, with community participation and appropriate quality measures. Patient transfer between sites
within the health service network has been identified as a major potential risk area. The elements identified are similar to rural quality frameworks developed in the United States\textsuperscript{28,118} but the American frameworks did not focus on the role of health service networks.

This research is also the first I could identify looking at patient experience of harm resulting from hospital admission using the general practice electronic patient record, and that considers rural and urban location of patients, rather than the hospitals’ location.\textsuperscript{22,23} No clear evidence of increased hospital harm for people living in rural compared to urban communities has been identified, with the exception of one of the five alternative rurality definitions tested, but this could be confounded by the underlying health status of patients who experienced harm and these data were not available. The data suggests a non-significant tendency for Māori to be more likely to be admitted to hospital and experience hospital harm compared to Europeans, which is supported by previous NZ reports on hospital admission rates for Māori,\textsuperscript{25,256} and research on hospital harm experienced by Māori.\textsuperscript{147} Inter-hospital transfer only occurred in rural patients in the study, and was associated with more than double the risk of hospital harm, consistent with other countries’ findings.\textsuperscript{140-143} International literature suggest this may be a combination of patient clinical status (sicker people need to be transferred, and sicker patients are more vulnerable to harm) and the transfer process itself.\textsuperscript{142,143} These findings warrant further investigation. The association between hospital harm and increased resource use seen in previous NZ research\textsuperscript{25,139} is confirmed.

Areas for focus to achieve the ‘Rural Triple Aim’ and improve health outcomes for rural communities have been outlined. These include easier access to information, local and distant services and whānau support; Māori focused service design so mainstream health services are welcoming, Māori providers are part of the health service network, and Māori health needs and Māori health outcomes are central in monitoring processes; and community input and co-design in service delivery models. A whole of system approach to planning, funding and delivering health
care across ‘one service, many sites’ health service networks is needed, focused on
developing a ‘one team’ culture, with agreed network structure that defines where
services are provided, with clear processes between sites within the network.
Workforce retention, development and training, along with implementing
telehealth, and agreeing a common language to describe hospitals and service
within the network are required. Developing an agreed definition of rurality for
health purposes is also suggested. Appropriate rurally focused quality measures,
some universal to all hospitals and some specific to the rural environment
(particularly around patient transfer processes), could be used to drive quality
improvement for rurally focused health services. These findings are consistent
with relevant international literature.\textsuperscript{6,9,26-29,155,156} These findings are also largely
consistent with the NHC report\textsuperscript{21} on delivery of appropriate accessible health
services for rural NZ, but the role of rural hospitals in these networks or rurally
focused quality measures are not raised in the NHC report.

These threads of the Rural Triple Aim, the elements of high quality rurally focused
health services and the focus areas for improvement were combined into a
framework for improving health care quality for rural communities, as shown in
Figure 12.1 (page 295).

Further areas for research to more clearly understand any association between
rurality and hospital harm, adjusted for ethnicity and socioeconomic status, and
controlling for illness co-morbidities are suggested. Including the views of grass-
roots urban hospital clinicians and managers about how to implement health
service networks would be valuable. Understanding health outcomes for NZers
living in independent urban areas, and whether the presence of a hospital,
secondary or rural, impacted on their health outcomes would aid decisions about
whether adding inpatient capacity to rural hubs in those small towns without
hospitals would be worthwhile.
The thesis supports calls for clear rurality definitions for health purposes to be developed. These definitions need to contribute to understanding of the interconnection between rurality, socioeconomic status and ethnicity on health outcomes. The need for a common language to describe different sized hospitals and their roles within evolving health service networks is identified. The need to develop agreed quality measures for services providing health care for rural communities, some universal and some rural-specific is also identified. It is clear from the findings of this research that achieving the Rural Triple Aim will require the engagement of the whole health service network, which is wider than just hospital. Systematised and formalised networks between smaller and larger hospitals and primary and community-based services will assist this.

While this thesis’ findings are particularly relevant to the NZ context, many of the findings will be applicable to rural communities and health planners and providers in Australia, Canada and the United Kingdom with similar underlying health systems, and to other rural settings beyond that, when locally contextualised.

It is hoped that the clearly articulated framework for improving quality for rurally focused health services proposed here will assist NZ health policy makers, planners, providers and rural communities engage in the ongoing process of improving the quality of health services for rural communities. Testing this framework with a wider range of rural stakeholders would be a fruitful next step to develop the work of this thesis into relevant, implementable policy and practice.
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306
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316


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Appendix 1 Approach to background literature review

To produce the background section of this thesis, a focused narrative literature review was undertaken to explore what was currently known about health care quality for rural communities as it related to hospital care, focused on the New Zealand context. I chose to make international comparisons mainly with Australia, North America and Great Britain, as developed countries with similar health systems and varying degrees of rurality.

Key definitions of quality and rurality in New Zealand, the United States, Great Britain, Canada and Australia were sought, looking at grey literature published by key agencies that are thinkers and leaders in health care in each country, including the Institute of Medicine and the Institute of Healthcare Improvement in the United States, the King’s Fund, and the Nuffield Trust in the United Kingdom, New Zealand’s Health Quality and Safety Commission, and national health care quality and statistical bodies and health ministries in each country. Key academic literature in the area was reviewed with hand searching of their references. This provided a basic understanding of quality and rurality definitions and frameworks in these countries.

Targeted literature searches were then undertaken looking at academic literature from developed countries focused on Great Britain, Europe, North America, and Australasia regarding:

- Definitions of rural, NZ and international
- What does it mean to be rural?
- Theoretical frameworks for rural health
- Quality and Quality frameworks in health care including for rural communities
- Evolution of hospitals to current day focused on NZ
- Influence of hospital size on quality
- The Treaty of Waitangi and health care quality for Māori
- Quality measures for the hospital journey, with focus on rural health care
- Concepts of patient safety and harms
- Measuring patient harms and rural and urban differences in patient harms including transfers
- Enablers to improve health care quality for rural communities, including technology and telemedicine, networks, workforce and community participation

The OVID Medline database was searched as below, and abstracts scanned to identify articles of relevance which were read. The searches were supplemented by Google Scholar searches where limited information was identified through OVID.

The ‘developed countries group’ included the following terms connected with OR:

  exp Australia; exp New Zealand; exp Great Britain; exp Northern Ireland or exp Ireland; exp North America; exp Europe; exp Japan

Although Japan was included in my countries group, I did not focus on articles from Japan in the final synthesis of data.

The ‘rural group’, which included rural populations, rural health and rural health services used the following terms combined with OR:

  exp Rural Health; exp Rural Health Services; exp Rural Population
I undertook individual searches relating to the 11 topics listed in bullet point above by combining 'developed countries group', 'rural group' and search terms relating to each topic using AND.

**Examples** of the types of terms used for the individual searches are given below:

**Topic: Quality and access of health services:** Quality of Health Care OR exp Health Services Accessibility

**Topic: Quality assurance, process and outcome measures in hospitals:** (exp Outcome and Process Assessment (Health Care) or exp Quality Assurance) AND Health Care exp Hospitals

**Topic: Quality indicators:** exp Quality Improvement OR exp Quality Indicators, Health Care

**Topic: Community participation:** exp Community Participation OR community codesign.mp. or Community-Based Participatory Research
Appendix 2 Rural Ranking Scale.


Access

Travelling Time from the Surgery to Major Hospital
- Major hospital within 30 minutes   0
- Major hospital within 30 - 45 minutes   5
- Major hospital within 45 - 60 minutes   10
- Major hospital within 60 - 90 minutes   15
- No major hospital within 90 minutes   20

Travelling Time to most distant practice boundary
- Under 30 minutes   0
- 30 - 60 minutes   5
- over 60 minutes   10

Regular (at least once monthly) Peripheral Clinics
- No   0
- Yes   5

Isolation

Travelling Time to Nearest General Practitioner Colleague at Place of Work
- 0 - 15 minutes   0
- 15 - 60 minutes   5
- over 60 minutes   10

On Call Duty
- 1 in 6   10
- 1 in 5   10
- 1 in 4   10
- 1 in 3   20
- 1 in 2   30
- 1 in 1   40

On call for Major Trauma
- Not on call for Major Trauma   0
- On call, but with double-crewed road ambulance with at least one paramedic (at all times) available within 30 minutes   5
- On call, with other ambulance arrangements   15

Discretionary Points The District Health Board may at its discretion award additional points to General Practitioners in areas where the recruitment and retention of General Practitioners is difficult.
No General Practitioner may have a score of greater than 100 points. A score of 35 or more denotes a General Practitioner as rural for the purposes of the scale.
Appendix 3 Non-Māori health outcomes, age-standardised to the NZ Māori population in 2001. Adapted from Mātātuhi Tuawhenua: Health of Rural Māori 2012

<table>
<thead>
<tr>
<th>Selected Non-Māori health-related statistics, by rural-urban status (adapted from Mātātuhi Tuawhenua: Health of Rural Māori 2012)</th>
<th>Main and satellite urban</th>
<th>Independent urban</th>
<th>Rural and other areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population estimate (n=3,559,550)</td>
<td>2,717,220 (76%)</td>
<td>358,910 (10%)</td>
<td>483,420 (14%)</td>
</tr>
<tr>
<td>Socioeconomic indicators, 2006, crude rate (%; 95% CI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School completion (level 2 Certificate or higher), 15+ years</td>
<td>66.6 (66.6-66.7)</td>
<td>51.2 (51.1-51.2)</td>
<td>56.6 (56.5-56.8)</td>
</tr>
<tr>
<td>Unemployed, 15+ years</td>
<td>3.7 (3.7-3.7)</td>
<td>3.3 (3.2-3.3)</td>
<td>4.7 (4.7-4.8)</td>
</tr>
<tr>
<td>Total personal income &lt;$10,000, 15+ years</td>
<td>21.7 (21.6-21.7)</td>
<td>17.9 (17.7-18.0)</td>
<td>19.4 (19.3-19.5)</td>
</tr>
<tr>
<td>Receiving means-tested benefit, 15+ years</td>
<td>16.9 (16.9-17.0)</td>
<td>16.8 (16.7-16.9)</td>
<td>11.4 (11.3-11.5)</td>
</tr>
<tr>
<td>Not living in own home, 15+ years</td>
<td>46.2 (46.1-46.2)</td>
<td>36.2 (36.0-36.4)</td>
<td>35.4 (35.2-35.5)</td>
</tr>
<tr>
<td>Living in household without telecommunication access, all ages</td>
<td>1.2 (1.2-1.2)</td>
<td>1.5 (1.5-1.5)</td>
<td>1.1 (1.1-1.2)</td>
</tr>
<tr>
<td>Living in household without motor vehicle access, all ages</td>
<td>5.1 (5.1-5.1)</td>
<td>5.3 (5.2-5.4)</td>
<td>1.2 (1.2-1.3)</td>
</tr>
<tr>
<td>Household crowding</td>
<td>9.5 (9.5-9.6)</td>
<td>4.3 (4.2-4.4)</td>
<td>3.3 (3.3-3.4)</td>
</tr>
<tr>
<td>Health status indicators % or rate, (95%CI) age-standardised to 2001 NZ Māori population</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Percent of people with a disability</td>
<td>14.4 (13.9-14.9)</td>
<td>24.2 (22.4-26.1)</td>
<td>16.7 (15.4-18.0)</td>
</tr>
<tr>
<td>Cardiovascular mortality, rate per 100,000, 2004-2008, aged 35+ years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cardiovascular mortality</td>
<td>162.8 (160.6-165.0)</td>
<td>175.1 (169.5-180.8)</td>
<td>134.3 (129.7-139.0)</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>92.5 (90.8-94.2)</td>
<td>105.0 (100.6-109.7)</td>
<td>78.5 (75.0-82.2)</td>
</tr>
<tr>
<td>Stroke</td>
<td>37.8 (36.8-38.8)</td>
<td>35.6 (33.4-37.9)</td>
<td>27.6 (25.6-29.8)</td>
</tr>
<tr>
<td>Heart failure</td>
<td>2.9 (2.7-3.1)</td>
<td>4.0 (3.4-4.8)</td>
<td>2.7 (2.2-3.4)</td>
</tr>
<tr>
<td>Cancer mortality, rate per 100,000, 2004-2008, aged 25+ years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>119.0 (116.5-121.6)</td>
<td>129.5 (122.7-136.7)</td>
<td>103.3 (97.6-109.2)</td>
</tr>
<tr>
<td>Males</td>
<td>147.4 (144.6-150.2)</td>
<td>163.3 (156.1-170.8)</td>
<td>127.1 (121.5-133.0)</td>
</tr>
<tr>
<td>Suicide (all ages)</td>
<td>8.3 (7.9-8.8)</td>
<td>13.5 (11.7-15.6)</td>
<td>12.3 (10.8-14.0)</td>
</tr>
<tr>
<td>Low birthweight, 2008-2010, rate per 1000 live births</td>
<td>57.9 (56.6-59.3)</td>
<td>55.4 (51.4-59.6)</td>
<td>53.1 (49.4-57.1)</td>
</tr>
<tr>
<td>Infant mortality, 2004-08, rate per 1000 live births</td>
<td>4.2 (3.9-4.5)</td>
<td>3.7 (2.9-4.6)</td>
<td>5.1 (4.2-6.2)</td>
</tr>
<tr>
<td>Unintentional injury mortality, 2004-08, rate per 100,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-14 years</td>
<td>5.2 (4.4-6.2)</td>
<td>8.5 (5.7-12.7)</td>
<td>7.4 (5.3-10.2)</td>
</tr>
<tr>
<td>15-64 years</td>
<td>14.0 (13.2-14.8)</td>
<td>34.4 (30.6-38.6)</td>
<td>34.9 (31.5-38.6)</td>
</tr>
<tr>
<td>65+ years</td>
<td>54.7 (51.6-57.9)</td>
<td>59.2 (52.4-66.9)</td>
<td>58.4 (50.3-67.7)</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Avoidable mortality, 0-74 years, 2004-08, rate per 100,000</td>
<td>99.3 (97.9-100.8)</td>
<td><strong>125.7 (120.9-130.8)</strong></td>
<td>96.7 (93.0-100.6)</td>
</tr>
<tr>
<td>Amenable mortality, 0-74 years, 2004-08, rate per 100,000</td>
<td>66.6 (65.4-67.8)</td>
<td><strong>86.5 (82.3-90.8)</strong></td>
<td>69.4 (66.2-72.7)</td>
</tr>
</tbody>
</table>

Key: *Italics = lower rate/percent; Bold = higher; normal = middle or within 95%CI of others*
Appendix 4 Rural hospitals in New Zealand

including those accredited
Appendix 5 *Te Tiriti o Waitangi*, Treaty of Waitangi principles

*Te Tiriti o Waitangi, The Treaty of Waitangi Principles*, taken from Ministry of Health website

The principles of partnership, participation and protection underpin the relationship between the Government and Māori under the Treaty of Waitangi.

**Partnership** involves working together with iwi, hapū, whānau and Māori communities to develop strategies for Māori health gain and appropriate health and disability services.

**Participation** requires Māori to be involved at all levels of the health and disability sector, including in decision-making, planning, development and delivery of health and disability services.

**Protection** involves the Government working to ensure Māori have at least the same level of health as non-Māori, and safeguarding Māori cultural concepts, values and practices.
Appendix 6 Summary of research findings sent to participants

Summary sent to health provider participants

Summary of findings from ‘exploring and improving hospital care quality for New Zealand rural communities’ study

Tēnā koe, greetings. Last year I spoke with you, when I interviewed people in four rural New Zealand areas about health care quality when people needed hospital care. The following is a summary of my findings. I would welcome any comments you may have, including suggestions of any important quality measures that are not in the list on page 3. I plan to visit your area in February 2018 to share the overall findings of the research with you before it is finalised. Thank you very much for being a part of this research.

Being rural

‘Rural’ was seen as a gradient from small town to remote. The key factors contributing to people’s definitions were population density, distance, isolation, and geography, and access to services.

Rural health

Rural health at the local level involved the ability to work in a generalist model, the breadth of practice, the close connections locally with other health care providers and the sense of teamwork this brought. The role of the local health services in the community’s psyche gave a close connection with the community. It also included having to provide more emergency care and on-call work than urban providers. This was often in a context of shortages and having less health care workers in the area.

People described rural health in terms of access issues, lack of local services and the need to travel to larger hospitals for services not provided locally, with associated costs. People had to compromise on the level of care they were willing to accept at times, a situation not faced by urban people. All rural people were affected by having to travel for health care, but this was magnified for poorer people.

The attributes of a rural health practitioner were a broad skill set, with well-developed emergency care skills; being flexible as a person; being happy to live and work in a small community; being relaxed about being on-call; knowing their limits and enjoying autonomy whilst being good in a team.

Principles of health care quality

These following ten principles were identified by communities, health planners and providers alike.
• Health care should be patient- and whānau- centred
• Care should be evidence informed
• Care should be consistent
• Care should be as close to home as can be done well
• Care across networks should be seamless
• An equitable approach to whole region’s needs should underpin resource allocation decisions
• Services need to be sustainable
• Care should be efficient and cost-effective
• Value is more than value for money
• Quality is everybody’s job

The components of health care quality

People viewed the health care staff and the health care system as important contributors to quality.

The staff. Clinical competence was important to people, that providers were skilled and up to date. Cultural competence was also seen as a core part of being competent as a clinician. Understanding Māori views of health and understanding and respecting Tikanga were important.

Relationships and communication were equally as important as clinical competence. This included listening, caring, compassion, kindness, and not being rushed. Including patients and their whānau in decision making was important. Teamwork and communication between staff was also valued.

The system. The system needed to be accessible, in terms of information, and services – general practice (especially after hours), ambulance and hospital services. If people needed to travel, they needed support for their family and whānau to be able to come and stay with them.

The systems needed to be consistent across different sites, with the right balance between face to face services, and using technology such as telemedicine. Facilities needed to be fit for purpose, and allow for private conversations between people and providers – be it the receptionist at the GP practice, or with the consultant in the 4 bed hospital room.

Service users didn’t see the clear distinctions that health providers did between general practice, rural secondary and tertiary hospitals. Services need to be adequately resourced, and fairly distributed.

Quality improvement

A wide range of quality assurance and quality improvement activities were happening across rural general practices and rural hospitals. There were few staff with dedicated quality roles in smaller rural hospitals but the expectation was that all the quality aspects that the larger urban hospitals covered would be met. Maintaining the broad range of skills required to work in a rural hospital was a significant budgetary and manpower challenge but this was recognised as being
critical to maintaining quality. The importance of clinical leadership in quality improvement was highlighted.

Examples of quality improvement approaches included daily board rounds or staff huddles to have an interdisciplinary team approach to care every day; visual display boards at each patient’s bed showing important information such as falls risk; processes to allow staff to quickly orientate to new ward environments and staff training focused on patient transfer skills.

Focusing on the use of patient time as a quality improvement driver was improving the patient experience. This included a focus on useful vs not-useful time whilst a person was admitted, and distance people travelled to receive outpatient care.

There were quality activities focused on improving the local health care network between primary care, the smaller rural hospital and the larger urban hospital. These included sharing staff, IT systems, training opportunities and protocols across the network. It also involved focusing on improving transfer processes, including using telemedicine across the different sites.

**Areas for further development.** Benchmarking and further developing networks between rural hospitals was discussed. There was some benchmarking across rural hospitals happening at local and national level and there was scope to develop this further. The Rural General Practice Network and Rural Hospital Network were highly valued. Further developing national rural hospital networking opportunities was suggested, for example regular virtual meetings for rural hospital clinical leads, rural nurses and rural staff with a quality improvement focus. Credentialing for rural hospitals and having rural hospital medicine departments within relevant DHBs could be developed. For GP led smaller rural hospitals, guidance around the skills based courses that GPs should attend would be useful. Patients and communities could be more involved in the improvement process, such as better ways of canvassing patient experience, increasing community awareness of the importance of giving feedback, and tracking patient feedback over time in specific areas.

**Quality concerns**

When analysing the concerns expressed by people about care they had seen or received, the vast majority of these concerns were covered within the Health and Disability Commission’s Code of Health and Disability Services Consumers’ Rights framework. Most of the concerns mapped to right 4, the right to services of an appropriate standard. Access issues were included within this.

**Quality measures**

Most people thought quality outcomes from the patient’s perspective should be the same wherever care was provided, and that quality measures used should be the same for rural and urban settings. The interpretation of these measures was where local context needed to be taken into account. How the desired quality outcomes were achieved would be different in different settings.
The range of measures identified that reflected health care quality in a rural setting are listed below. Some were currently collected, and others were not. Measures related to the patient experience, and to the systems within which care was provided, including inter-hospital transfer processes.

- **Patient experience measures**
  - Relationships and communication
  - Being treated with respect, compassion and empathy
  - Being involved in decision making and supported in decision made
  - Being treated with respect/cultural competence
  - Continuity with same clinical team
  - Staff having time to care
  - Family involvement
  - The hospital setting (privacy, quiet ward at night)
  - Timeliness of care and use of patient’s time

- **System measures of quality**
  - Cost and Equity
  - Access to services and information
  - Local hospital measures
    - Standardised mortality ratios
    - Post op complications
    - Length of stay and readmission rates
    - Best practice medicine provided
    - Staff competent and trained
    - Hospital based rehabilitation measures
    - Adverse event processes
  - Systems between hospitals for planned and unplanned transfer measures
    - Review of transfers part of quality assurance and improvement
    - Planning the transfer (necessity, timeliness, appropriate mode, ease of set up, patient and whānau kept informed)
    - During the transfer (appropriate handover, patient comfort, appropriate staff involved, data capture during transfer, staff comfort)
    - At the end of the transfer (receiving hospital ready, staff easy return to start point)
  - Handover of care from hospital to community setting
  - Value for money measures

**Effective networks support high quality care**

People wanted to receive their health care as close to home as could be done safely. For this to happen reliably, health care providers needed to be working together.
Key factors to support effective networks across geographical boundaries included access to information and services for people. Appropriate systems for communication and patient transfer between hospitals, with clear processes to support this, and good relationships between the clinical teams in different settings were vital. Clinical leadership and management support was needed to create opportunities for respectful relationships to develop. Time spent by clinicians in each other’s settings maintained relationships across distance, which allows the network to function effectively. Trust and confidence was the ‘glue’ that held networks together.

Involving communities in developing and implementing different approaches to delivering health care allowed them to feel ownership of the solutions, and to improve the design of solutions. Services need to be adequately resourced, and fairly distributed across the region’s health system.

**The role of information technology in enhancing high quality care**

A greater role for *telemedicine* in rural health services was seen as the way of the future. Three sites had integrated telemedicine into acute care pathways between the rural hospital and the larger hospital. The success of it was more influenced by the enthusiasm and support from clinicians and management, particularly at the larger urban site, rather than the actual technology and where it was sited within facilities. More buy-in from clinicians at larger urban hospitals would allow further service development.

Telemedicine for planned clinical consultations at a distance saved time, disruption to family and work, and travel costs for patients and their whānau. Having a clinician (often a nurse) with the patient helped the virtual consultation go smoothly. Telemedicine was also seen as a good option when specialist travel was disrupted by weather. Child health, renal medicine, oncology, dermatology and cardiology were areas where virtual consultations had been used, or were seen as easily implementable.

*A shared electronic health record* that primary care and hospitals within the health network could access was important, and when in place was highly regarded. *E-referrals and agreed electronic health pathways* improved patient flow and ensured referrals didn’t fall through the cracks. *Free wi-fi* for people when they were admitted to hospital improved their experience in hospital. *Professional development for rural clinicians* was enhanced through using videoconferencing for continuing education for clinical staff at hospitals, and for education and case discussions between hospital doctors, rural GPs and rural nurses.

Affordable reliable rural broadband and fibre to all rural hospitals and easy interoperability between different videoconferencing systems was needed. Developing a ‘rural flag’ within large urban hospitals’ patient management system could identify people as rural to help discharge planning and follow-up decisions.

**Community participation**

The sense of community connectedness was seen as being stronger in rural areas. Local community members were often part of the health system staff so care was
more personal. Rural communities would pull together to fundraise and support local people and services. Key local people voluntarily acted as reference points who people turned to for advice. Community participation in health services was seen as having tremendous potential to influence change positively. More participation in formal interface committees such as DHB consumer councils and advisory groups, more people from within the local community being employed as community based health navigators, and a greater recognition of voluntary roles could facilitate this.

Health agencies needed to change to meet people’s expectations and needs. They needed to adopt a whānau ora approach, where the needs and wishes of the person and their whānau, and of communities, guided design, not the needs of the organisation providing the service. What the community would want may well be quite different to how things had previously been provided. Having lay people involved co-design of the system improved the outcome.

People may not have accessed services that they were entitled to because they didn’t know that the service was available or that they qualified for it. When communicating with people, and producing information about services, health providers needed to take time and care so that people understood the information being given. Messages from different parts of the health system need to consistent. Information needed to be freely available, using multiple communication channels, such as printed information, smart phone technology and user-friendly online information.

Feedback

Please provide any comments you have about this summary, including any important quality measures not listed on page 3, to me at carol.atmore@otago.ac.nz or Department of General Practice and Rural Health, University of Otago, PO Box 56, Dunedin 9054. Thanks! Dr Carol Atmore 13 September 2017
Summary sent to community participants

SUMMARY OF RESEARCH FINDINGS FROM ‘EXPLORING AND IMPROVING HOSPITAL CARE QUALITY FOR NEW ZEALAND RURAL COMMUNITIES’ STUDY

Tēnā koe, greetings. Last year I spoke with you, when I interviewed people in four rural New Zealand areas about health care quality when people needed hospital care. The following is a summary of my findings. I would welcome any comments you may have. I plan to visit your area in February 2018 to share the overall findings of the research with you before it is finalised. Thank you very much for being a part of this research.

Rural health

The positives of rural healthcare included the close connections within the community and the sense of teamwork this brought. The negatives included a lack of local services and the need to travel to larger hospitals for services not provided locally. This led to extra costs, travel and access difficulties. All rural people were affected by having to travel for health care, but this was a bigger issue for poorer people.

Principles of health care quality

Health care should be patient- and whānau- centred, informed by best evidence, consistent and seamless between different health providers and hospital settings. It should be delivered as close to home as can be done well. Services need to be fairly distributed and sustainable in the longer term. Care should be efficient and cost-effective, but value is more than value for money. Quality is everybody’s job.

The components of health care quality

The staff. It was important to people that health providers were skilled and up to date. It was also important that health providers respected a person’s culture, and that they understood Māori views of health and observed Tikanga relevant to health.

Relationships and communication were also very important. This included listening, caring, compassion, kindness, and not being rushed. Including patients and their whānau in decision making was important, as was staff teamwork and communication.
The system. General practice (especially after hours), ambulance and hospital services needed to be easy to access. If people needed to travel to a larger hospital for health care, they needed financial support for their family and whānau to be able to stay with them.

The way care was provided by the local rural hospital and the partner larger hospital needed to be consistent. The right balance between face to face services, and using technology such as telemedicine needed to be found. Privacy was an important issue, be it at the front counter at the GP practice, or in the hospital ward four bed room.

Quality measures
Most people thought that from the point of view of the person needing health services, quality outcomes should be the same wherever care was provided. How it was achieved would be different in different settings.

Effective networks support high quality care
People wanted to receive their health care as close to home as could be done safely. For this to happen reliably, health care providers needed to be working together. Services need to be adequately resourced, and fairly distributed across the region’s health system.

Community participation and patient centredness
Community connectedness was seen as being stronger in rural areas. Local community members often worked in or around the so care was more personal. Community participation in health services was seen as having tremendous potential for good. People could be involved in local health committees, and as volunteers.

Health agencies needed to change to meet people’s expectations and needs. They needed to adopt a whānau ora approach, where the needs and wishes of the person and their whānau, and of communities, guided design, not the needs of the organisation providing the service. What the community would want may well be quite different to how things had previously been provided. Having community members involved in designing the system improved the outcome.

Patient- and whanau- centred care meant taking time for communication, compassion and caring, respecting people’s culture and involving patients and whānau in care and decision making.
Considering the spiritual and social needs as well as physical and mental health needs of the person was important. Involving whānau in decisions and follow-up arrangements for when a person was at home relieved the burden on the sick person so they could focus on getting well.

The large urban hospital staff and systems should be mindful that someone was from a rural area, and the impact of distance and travel had on them and their whānau. Rural people understood that some things they had to travel for, but there should be better coordination of, and timing of appointments when they needed to travel.

When communicating with people, and producing information about services, health providers needed to take time and care so that people understood the information being given. Messages from different parts of the health system need to consistent. Information needed to be freely available, using multiple communication channels, such as printed information, smart phone technology and user-friendly online information.

**Feedback**

Please provide any comments you have about this summary to me at carol.atmore@otago.ac.nz, or in the reply paid envelopes to me at Department of General Practice and Rural Health, University of Otago, PO Box 56, Dunedin 9054. Once again, thank you very much for being involved.

**Dr Carol Atmore 11 September 2017**
Appendix 7 Ethics Approval and Ngai Tahu consultation documents
Professor S Devoy
Department of General Practice & Rural Health
Dunedin School of Medicine
University of Otago Medical School

Dear Professor Devoy,

I am again writing to you concerning your proposal entitled "Describing and improving hospital care quality for New Zealand rural communities", Ethics Committee reference number 15/034.

Thank you for your e-mail of 11th June 2016, with attached revised ethics application, addressing the issues raised by the Committee.

On the basis of this response, I am pleased to confirm that the proposal now has full ethical approval to proceed.

Approval is for up to three years from the date of this letter. If this project has not been completed within three years from the date of this letter, re-approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

The Human Ethics Committee asks for a Final Report to be provided upon completion of the study. The final report template can be found on the Human Ethics Web Page:
http://www.otago.ac.nz/council/committees/committees/HumanEthicsCommittees.shtml

Yours sincerely,

[Signature]

Mr Gary Wite
Manager, Academic Committees
Tel: 479 9259
Email: gary.wite@otago.ac.nz

[Mr P. M. Scrimgeour, Head of Department, Department of General Practice & Rural Health]
Ngai Tahu Research Consultation Committee
Te Komiti Rakahau ki Kāi Tahu

Tuesday, 1st March 2016,

Professor Susan Dovey,
Dunedin School of Medicine - General Practice and Rural Health,
DUNEDIN,

Te Tumu Professor Professor Susan Dovey,

Exploring and improving hospital care quality for New Zealand rural communities

The Ngai Tahu Research Consultation Committee (the committee) met on Tuesday, 1st March 2016 to discuss your research proposal.

By way of introduction, this response from The Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngai Tahu and the University. In the statement of principles of the Memorandum it states “Ngai Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngai Tahu to research undertaken at the University of Otago”. As such, this response is not “approval” or “sanction” for the research, rather it is a normal response from a Ngai Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and consent to research involving Māori, including methodology they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McKechnie:

“Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon, adequately informing a party about relevant information upon which the proposal is based, listening to what the other has to say with an open mind (so that there is no reason to be persuaded against the proposal’s undertaking), that is in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal.”

The Committee considers the research to be of importance to Māori Health.

As this study involves human participants, the Committee strongly encourage that quality data be collected as part of the research project as a right to express their self-identity. That is the questions on self-identified ethnicity and descent, these questions are contained in the latest version.

The Committee suggests including in the research team a researcher with expertise in analysing and interpreting data by ethnicity.

The Committee suggests information of the research findings to Māori health organisations regarding this study.

The Ngai Tahu Research Consultation Committee has membership of 11:

Te Rūnanga o Otago Incorporated

Era Maruho Rākau ki Pōhiri o 1
Te Rūnanga o Moeraki

343
Ngai Tahu Research Consultation Committee

Te Kōmiti Rakairau ki Kāi Tahu

We wish you every success in your research and the committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 01 March 2016 to 1 September 2017.

Nīhau kia ora

[Signature]

Mark Brutton
Kāwhiahaua Rangahau Mōtūi
Research Manager Mōtūi
Research Division
Te Whare Wānanga o Otāgo
Ph: +64 3 479 8738
Email: mark.brutton@otago.ac.nz
Website: www.otago.ac.nz

The Ngai Tahu Research Consultation Committee has memberhip:\n
Te Rangatira a Otāgo Incorporated
Kāwhiahaua Rānake ki Pototoraiki
Te Rūnanga o Ngai Tahu
Appendix 8 Comparisons to aid Interview study site selection
<table>
<thead>
<tr>
<th>Hospital</th>
<th>Beds</th>
<th>Wards</th>
<th>Medical Staff</th>
<th>ED</th>
<th>Theatre</th>
<th>Specialist Outpts</th>
<th>Other</th>
<th>% Maori and % Quintile 5</th>
<th>Drive distance to urban hospital</th>
<th>Primary Care on site</th>
<th>Town size approx</th>
<th>Population served</th>
<th>Ownership structure</th>
</tr>
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<td>26, no maternity</td>
<td>One</td>
<td>RHM</td>
<td>No, part of GP</td>
<td>No</td>
<td>Visiting</td>
<td>Lab, PT, OT, radiology including CT, community nursing, chemotherapy, palliative care</td>
<td>8%, 0%</td>
<td>2.5 hours</td>
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<td>11 +3 maternity</td>
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<td>GP and RHM</td>
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<td>No</td>
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<td>Lab, PT, OT, radiology, dentist, community nursing, CMH</td>
<td>55%, 64%</td>
<td>2 hrs</td>
<td>Yes</td>
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<td>Medical Surgical Paediatrics RHM and Specialist</td>
<td>Yes</td>
<td>Full surgery Resident and Visiting</td>
<td>Lab, PT, OT, radiology including CT, community nursing, chemotherapy, palliative care, CMH, AOD</td>
<td>9%, 13%</td>
<td>Christchurch 3 hours</td>
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<td>One and birthing unit</td>
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<td>Visiting</td>
<td>Lab, limited PT, OT, radiology, community nursing, CMH, AOD</td>
<td>10%, 11%</td>
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RHM = rural hospital medicine doctors; PT = physiotherapy; OT = occupational therapy; CMH = community mental health; AOD = alcohol and other drugs service; GP = General practitioner; ED = emergency department; Lab = laboratory services available (not necessarily provided 24/7); CT = Computerised Tomography

Information accessed from hospital, District Health Board and Statistics New Zealand websites
Appendix 9 Interview schedules

Initial draft before discussion with supervisors, rural advisors and Māori consultation liaison, and pretesting

TOPIC AREAS FOR INTERVIEW SPINE

Rurality and Health

- What does health mean to you/what does it mean to you to be healthy? What would it take to make your community more healthy?
- What does being rural mean to you? How would you define ‘rural’?
- What do you consider to be the key factors or defining characteristics of rural health?
- Are there advantages that being rural has over urban when you need health care? If so, what are they?
- Are there disadvantages that being rural has over urban when you need health care? If so, what are they?

Hospital care

- Given that health care is constantly evolving, what is the current role of your local hospital in your community, and how do you see it changing with time?
- When you think of hospitals, how would you describe the smaller and larger hospitals? Do the terms rural, base hospital, secondary, tertiary work for you, or does another set of terms work better?
- Where do you think different types of hospital services are best provided;
  - What types of hospital should be as close to home as possible
  - What types of hospital services should be provided at a more specialised hospital and are reasonable to travel for
  - How does the need to travel impact on hospital services, and how could it be made easier?
- What would be needed to move from the current situation to the right mix of services you described above?

Quality

- When thinking about hospital services, (e.g. the last time you or your family was in hospital) what do you think contributes to good quality care?
- What do you think contributes to poor quality care?
• Do perceptions of healthcare quality differs in rural and urban hospital settings? If so, how?
• When people in your community need to be transferred to another hospital for care, what makes this a good experience? A bad experience? How quality is maintained during this process?
• How does/could services respect your view of health? What could be improved?

Quality measurement.
• How should quality be measured in hospital care? When thinking about the last time you or your family was in hospital and what marked out good quality care, how could you measure it?
• Should it be measured the same or differently for rural vs urban settings?

Health networks
• How does your local community and rural hospital sit within your health network?
• What enable the network to work well? What hinders it?
• How would larger hospitals ideally function within your health network?

Enablers - What will make things better?
• What role do new technologies have in improving quality. List and discuss, with prompts if not mentioned eg patient portal, health related apps, shared electronic health record, electronic communication between providers, videoconferencing and telemedicine
• What supports and hinders using these technologies?
• How does having students and staff involved in teaching and universities/polytechs affect health care in your community?
Final version after input and pretesting, for provider interviews

TOPIC AREAS FOR INTERVIEW SPINE  Wairoa - Providers  150616

INTRODUCTION: Who I am, (GP, health services management background, from Whakatane, mother 2 teenage children, recently moved to Dunedin from West Coast)

What I’m doing – HRC funded research, Foxley Fellowship, working at University of Otago.

Aim to look at health care quality when people who live in rural communities need hospital level care, whether at a local smaller or distant larger hospital; and how it can be improved.

I’m talking to people who live and work in four rural communities in NZ, Wairoa, Kaitaia, Central Otago and Greymouth. I’ll be recording our conversations to analyse what is said when I’m back in Dunedin. I’ll use these to describe how quality is achieved currently for rural communities, and what could be done to improve services. I’ll form this into a report that I will bring back to discuss with you later next year; and disseminate the findings to health care planners and providers.

For the university, I need to ask you to read the information sheet and sign the consent form at the back, and leave for me at the end – would you like to take a moment to do that now?

I’m going to ask a few questions to prompt a conversation about the topic.

Rurality and Health

- How would you define ‘rural’?
  - What are the key factors or defining characteristics of rural health
  - Are there advantages that being rural has over urban when providing health care? If so, what are they?
  - Are there disadvantages that being rural has over urban when providing health care? If so, what are they?

- Do you think that where people receive healthcare affects their health and wellbeing?

Quality and Hospital Care

- What does health care quality mean to you?
  - what do you think contributes to good quality care?
  - What do you think contributes to poor quality care?
• How should quality be measured in hospital care?

• Do you think people’s view of quality differs in rural and urban hospital settings? If so, how?

• Should quality be measured the same or differently for smaller rural and larger urban hospitals?

• What is the role of the local hospital in rural communities? How do you see it changing with time?

• Where do you think different types of hospital services are best provided;
  o What types of services should be provided locally for rural communities?
  o What types of services are best at a more specialised hospital and are reasonable to travel for
  o How does the need to travel impact on hospital services? How could things be done differently to make it easier?

• When people need to be transferred from a rural hospital to another hospital for care, how quality is maintained during this process? How is it measured?

• What helps the flow and linkages between local primary and community care, your local rural hospital and the large hospitals to work well?
  o What hinders it?

• How would rural and secondary/tertiary hospitals ideally function within your local health system?
  o Should more specialist services be provided rurally?
  o If so, how? What would need to change?

**Enablers - What will make things better?**

• What role do new technologies have in improving quality? e.g.
  o patient portal,
  o health related apps,
  o shared electronic health record,
  o electronic communication between providers,
  o videoconferencing and
  o telemedicine
What supports and hinders using these technologies?

Does having health students and staff involved in teaching and learning influence the quality of health care provided rurally? If so, how?

How do rurally based health care teachers get support?
  o What works well,
  o what doesn't
  o what could be improved?
Final version after input and pretesting, for community focus groups

TOPIC AREAS FOR INTERVIEW SPINE  Wairoa – community;  15 06 16

INTRODUCTION: Who I am, (GP, health services management background, from Whakatane, mother 2 teenage children, recently moved to Dunedin from West Coast)

What I’m doing – HRC funded research, Foxley Fellowship, University of Otago.

Aim to look at health care quality when people who live in rural communities need hospital care, whether at a local smaller or distant larger hospital; and how it can be improved.

I’m talking to people who live and work in four rural communities in NZ, Wairoa, Kaitaia, Central Otago and Greymouth. I’ll be recording our conversations to analyse what is said when I’m back in Dunedin. I’ll draw the threads of what people are saying across these areas to tell a story of how quality is achieved currently for rural communities, and what could be done to make things better. I’ll form this into a report that I will bring back to discuss with you later next year; and use to talk to health care planners and providers about the findings.

For the university, I need to ask you to read the information sheet and sign the consent form at the back, and leave for me at the end – would you like to take a moment to do that now?

I’m going to ask a few questions that I hope will help us have a conversation about these things.

Rurality and Health

- What does it mean to you to be healthy?
  - as an individual and a community?
- What does being rural mean to you? How would you define ‘rural’?
  - What do you consider to be the key factors or defining characteristics of rural health
  - Are there advantages that being rural has over urban when you need health care? If so, what are they?
  - Are there disadvantages that being rural has over urban when you need health care? If so, what are they?
- Does where you get health care affect your health and wellbeing?
- How do/could health services respect your view of health? What could be improved?
Quality and Hospital Care

- What does health care quality mean to you?
  - When thinking about hospital services, (e.g. the last time you or your family was in hospital) what do you think contributes to good quality care?
  - What do you think contributes to poor quality care?

- How should quality be measured in hospital care?
  - When thinking about the last time you or your family was in hospital and what marked out good quality care, how could you measure it?

- What is the role of your local hospital in your community
  - How do you see it changing with time?
- Do you think people’s view of quality differs in rural and urban hospital settings? If so, how?

- Should quality be measured the same or differently for smaller rural and larger urban hospitals?

- Where do you think different types of hospital services are best provided;
  - What types of services should be provided in your community?
  - What types of services are best at a more specialised hospital and are reasonable to travel for
  - How does the need to travel impact on hospital services? How could things be done differently to make it easier?

- When people in your community need to be transferred to another hospital for care
  - What makes this a good experience?
  - A bad experience?
  - Could it be made a better quality experience? If so, how?

- What helps the flow and linkages between local primary and community care, your local rural hospital and the large hospitals to work well? What hinders it?

- Should more specialist services be provided locally? If so, how?

Enablers - What will make things better?

- What role do new technologies have in improving quality e.g.
- patient portal,
- health related apps,
- shared electronic health record,
- electronic communication between providers,
- videoconferencing and
- telemedicine

- What supports and hinders using these technologies?

- Does having health students and staff involved in teaching and learning influence the quality of health care provided rurally? If so, how?

- How do rurally based health care teachers get support?
  - What works well,
  - what doesn’t
  - what could be improved?
Appendix 10 Coding Frameworks

Initial coding framework

THEME CODING AND FRAMEWORK v 1 after initial interview analysis
030816

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Coding framework after one quarter of transcripts coded, and change to NVivo made

**THEME CODING AND FRAMEWORK v 7 after first Kaitaia interview analysis**

140916

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### Appendix 11 Initial code book

**Hospital care for rural communities – Initial coding framework developed 17/05/17**

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<td>The benefits of services being available close to home</td>
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<td>3.15 Patient Satisfaction</td>
<td>Comments about patient satisfaction - could link into 3.12?</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>3.16 Staff satisfaction</td>
<td>Providers' views about staff satisfaction - could link into 3.11?</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Subsection</td>
<td>Description</td>
<td>Count 1</td>
<td>Count 2</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------</td>
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</tr>
<tr>
<td>3.17 Changing patient expectations of quality</td>
<td>Comments about how expectations of quality are changing as time goes by - links in to 2.14?</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>3.2 Quality differences in rural vs urban hospitals</td>
<td>From interview spine. People's views, either from provider or user perspective, of how quality is different in different sized hospitals</td>
<td>39</td>
<td>152</td>
</tr>
<tr>
<td>3.21 Risk management</td>
<td>Sub set of quality differences that relate to differences in risk assessment and management at smaller compared to larger hospitals</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.3 Quality concerns</td>
<td>Concerns that people raised about quality at smaller hospitals</td>
<td>19</td>
<td>53</td>
</tr>
<tr>
<td>3.31 Transfer concerns</td>
<td>Concerns that people raised about quality during the transfer process</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td>Comments</td>
<td></td>
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</tr>
<tr>
<td>3.4 Quality Improvement &amp; assurance</td>
<td>Comments about quality improvement and assurance activities as part of providing quality care</td>
<td>30</td>
<td>106</td>
</tr>
<tr>
<td>3.41 Skills maintenance</td>
<td>Maintaining staff skills as part of QI/QA</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>3.42 Quality coordinator role and network</td>
<td>Comments about the potential role of a quality coordinator across rural hospitals, and the potential to further develop rural hospital and workforce networks</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>3.5 Quality measures</td>
<td>Comments about how quality should be measured across different sized hospitals with different settings and workforces</td>
<td>39</td>
<td>118</td>
</tr>
<tr>
<td>3.51 Transfer measures</td>
<td>Comments on what would be useful measures of quality during inter-hospital transfer</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>3.6 Poor quality</td>
<td>Topic area from interview spine and views on poor quality</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>3.61 Examples of poor quality</td>
<td>specific examples of poor quality services that people had received</td>
<td>19</td>
<td>68</td>
</tr>
<tr>
<td>3.62 Responses to poor quality</td>
<td>Descriptions of how people had responded to poor quality services</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>3.7 Impact of Urban Quality standards in rural setting</td>
<td>Comments about the application of urban quality standards in a rural setting</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>4. Concept of Health</td>
<td>Topic area from interview spine, asked for community and Maori focus groups</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.1 Health of the community</td>
<td>People’s views about what makes a community healthy</td>
<td>8</td>
<td>29</td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td>Page 1</td>
<td>Page 2</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>4.2 Individual health</td>
<td>People’s views about what makes a person healthy</td>
<td>9</td>
<td>35</td>
</tr>
<tr>
<td>4.3 Maori view of health</td>
<td>People’s views about health from a Maori perspective</td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td>4.4 Health Outcomes</td>
<td>Comments about health outcomes - when review, consider incorporating into another heading</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5. Barriers to Change</td>
<td>Topic area developed out of responses to questions in interview spine</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.01 Perceptions of rural and primary care</td>
<td>Urban perceptions of what rural health and primary care are</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>5.02 Infrastructure, Processes and Service planning</td>
<td>Organisational barriers to improvements due to lack of infrastructure, and (largely DHB, but some MOH) processes and service planning that don't accommodate rural realities. May need further breaking down.</td>
<td>32</td>
<td>82</td>
</tr>
<tr>
<td>5.03 Workforce lack or overworked</td>
<td>Staff shortages, not enough of the right staff or staff overworked so can’t engage</td>
<td>17</td>
<td>26</td>
</tr>
<tr>
<td>5.04 Silos</td>
<td>Silos between providers at local level (including health and other social sectors), and between rural and urban hospitals and staff</td>
<td>22</td>
<td>45</td>
</tr>
<tr>
<td>5.05 Change management and resistance to change</td>
<td>Difficulties with getting people to change, both from individual and process perspective</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>5.06 DHB vs small business or rural model</td>
<td>The tensions between the DHB’s processes and that of rural hospitals and general practices’ processes and model</td>
<td>8</td>
<td>30</td>
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</tr>
<tr>
<td>5.07 Clinician reluctance</td>
<td>Reluctance on part of clinicians to work differently</td>
<td>21</td>
<td>46</td>
</tr>
<tr>
<td>5.08 DHB culture</td>
<td>The culture of DHBs that block change or understanding of rural needs and services</td>
<td>18</td>
<td>55</td>
</tr>
<tr>
<td>5.09 Lack of trust, respect and or communication</td>
<td>Lack of trust and respect between health care providers at rural and urban hospitals, and lack of communication between health care providers at rural and urban hospitals and between providers and patients</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>5.09 Lack of trust and or respect</td>
<td></td>
<td>6</td>
<td>7</td>
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<td>Section</td>
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<td>Count</td>
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<tr>
<td>5.10 Personalities</td>
<td>Comments about how people can block change</td>
<td>6</td>
<td>9</td>
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<tr>
<td>5.11 Leadership lack</td>
<td>Lack of leadership as a barrier to change</td>
<td>9</td>
<td>18</td>
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<tr>
<td>5.12 Access to information</td>
<td>Lack of access to information for providers and patients as barrier to change</td>
<td>9</td>
<td>25</td>
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<tr>
<td>5.13 Patient reluctance re IT</td>
<td>Reluctance from patients to adopt new technology</td>
<td>2</td>
<td>3</td>
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<tr>
<td>5.14 Lack of influence</td>
<td>Feeling of lack of influence to change things, from providers and community</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>5.15 Cultural competence or dissonance</td>
<td>Lack of cultural awareness and competence from providers or services, which can cause a dissonance for Maori users</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>5.16 National body barriers</td>
<td>National bodies, e.g NZMC, MOH, professional colleges, that cause barriers to service change for rural communities</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>---------------------------</td>
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<tr>
<td>6. Service Delivery Models</td>
<td>Descriptions of current and emerging service delivery models</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>6.1 Rural Service delivery</td>
<td>Components of good rural service delivery</td>
<td>35</td>
<td>94</td>
</tr>
<tr>
<td>6.2 Service development</td>
<td>New and emerging ways that services are being provided</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>6.21 Integration</td>
<td>Descriptions of integration across local communities and with larger hospitals - could link into 6.5?</td>
<td>20</td>
<td>71</td>
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<tr>
<td>6.22 Maori focused services</td>
<td>Descriptions of services being developed that focus on Maori in community - could link with 7.23?</td>
<td>11</td>
<td>56</td>
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<tr>
<td>Section</td>
<td>Description</td>
<td>Pages</td>
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<tr>
<td>6.23 Leadership</td>
<td>Role of good leadership in service development - could link with 7.7?</td>
<td>4</td>
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<tr>
<td>6.24 Primary care developments and focus</td>
<td>Description of service developments with primary care focus</td>
<td>11</td>
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<tr>
<td>6.25 Rural focus for urban hospital services</td>
<td>Descriptions where urban hospital staff and services are focusing on the needs of their rural communities</td>
<td>4</td>
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<tr>
<td>6.3 Transport and Travel</td>
<td>Service delivery models relevant to transport and travel</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>6.4 Transfer</td>
<td>Service delivery models relevant to inter-hospital transfer</td>
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<tr>
<td>6.5 Regional care networks</td>
<td>Descriptions of service delivery models related to regional health care delivery networks. Could link with 6.21?</td>
<td>30</td>
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<tr>
<td>7. Enablers</td>
<td>Topic area from interview spine</td>
<td>2</td>
<td>2</td>
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</tr>
<tr>
<td><strong>7.1 Information Technology</strong></td>
<td>All comments re information technology, needs to be split into constituents e.g. telemedicine for clinical consultations; shared electronic health records; videoconferencing for education and meetings; health related apps for self-management; manage my health for provider-patient interface</td>
<td>38</td>
<td>175</td>
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<tr>
<td><strong>7.2 Networks</strong></td>
<td>The role of networks in improving regional service provision</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td><strong>7.21 Communication &amp; Relationships</strong></td>
<td>The importance of communication and relationships in networks functioning</td>
<td>32</td>
<td>75</td>
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<tr>
<td><strong>7.22 Professional respect</strong></td>
<td>The importance of professional respect in effective networks</td>
<td>10</td>
<td>19</td>
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<tr>
<td>7.23 Whanau ora</td>
<td>Role of whanau ora in effective networks. Maybe move into 6.22 as one person's comments?</td>
<td>1</td>
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<td>7.24 Upskilling and maintaining skills</td>
<td>Importance of staff having the right skill set in the right setting for effective networks</td>
<td>6</td>
<td>11</td>
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<tr>
<td>7.25 Processes and structures</td>
<td>The importance of having process and structure to support and enable networks to function</td>
<td>27</td>
<td>82</td>
</tr>
<tr>
<td>7.3 Workforce</td>
<td>Topic area from interview spine and general comments about workforce as an enabler</td>
<td>22</td>
<td>53</td>
</tr>
<tr>
<td>7.31 Peer support</td>
<td>Importance of peer support for rural practitioners</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>7.32 Navigators and similar</td>
<td>Role of navigators, kaiawhina and other support roles for patient care in rural areas</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>7.33 Job satisfaction</td>
<td>Role of enjoying the job for rural retention</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>7.34 Home-grown</td>
<td>Value of home-grown staff for sustainable workforce development</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>7.35 Orientation to local situation</td>
<td>Importance of adapting workforce needs to local situation</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>7.36 New workforce</td>
<td>New workforces suggested to provide better rural health care</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>7.4 Teaching, Training and Mentoring</td>
<td>Topic area from interview spine, comments relating to teaching students, how that benefits local care provision and how needs of teachers and students are met</td>
<td>29</td>
<td>89</td>
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<tr>
<td>7.5 Community participation</td>
<td>Value of community participation in service planning and provision</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>7.6 Patient centredness</td>
<td>The importance of patient centredness to providing better care</td>
<td>16</td>
<td>30</td>
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<tr>
<td>7.61 Health literacy</td>
<td>Comments relating to improving health (and digital) literacy for patients</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>7.62 Listening to patient and whanau</td>
<td>Importance of listening to patients and whanau in care planning and provision - may fit within 7.5 and/or 7.65?</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Section</td>
<td>Topic</td>
<td>Description</td>
<td>Page</td>
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<tr>
<td>7.63</td>
<td>Continuity and Wrap around services</td>
<td>Importance of care continuity and services that support the person and their whānau so they can live at home</td>
<td>4</td>
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<tr>
<td>7.64</td>
<td>Access to information</td>
<td>Importance of access to health information to provide patient centred care - linked to health literacy</td>
<td>11</td>
</tr>
<tr>
<td>7.65</td>
<td>Involving patient and whānau in care and decision making</td>
<td>A key part of patient centred care</td>
<td>10</td>
</tr>
<tr>
<td>7.7</td>
<td>Leadership</td>
<td>Importance of leadership in improving quality - may link into 6.23?</td>
<td>9</td>
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<tr>
<td>7.8</td>
<td>Rural focused contracting and funding</td>
<td>Comments regarding the need to have a different approach to contracting for and funding when rural health services, compared to urban health services</td>
<td>12</td>
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<tr>
<td><strong>8. Equity</strong></td>
<td>Comments identifying equity issues for rural people. Could link with 2.11?</td>
<td>13</td>
<td>33</td>
</tr>
<tr>
<td><strong>8.1 Socioeconomic health determinants</strong></td>
<td>Comments relating to equity from a socioeconomic determinants of health perspective</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td><strong>9. Killer quotes</strong></td>
<td>Good quotes that might want to use in final write up</td>
<td>29</td>
<td>131</td>
</tr>
</tbody>
</table>
Appendix 12 Mindmaps

5/15/94 My current thoughts about main issues/themes were:

- Rural
  - Rural advantages
  - Rural disadvantages

- Care
  - Quality
  - Transfer
  - Technical process

- Travel

- Community/relationships
  - Continuity

- Finance
  - Shortage
  - Lack of certainty

- Patient's view, artificial environment
  - Practice-Hospital separate artificial

- Continuity of care
  - Safety overreaching yardstick for where services should be provided

- Measures should measure both technical + relationships aspect

- Funding

- Buy-in
  - Process

- Policy
  - Policy implementation
Principles of Healthcare Quality

- Evidence informed
- Efficient and cost effective
- Patient and family centered
- Respectful of patient
- Continuous improvement
- Reduction in variation

Counter is that distance can affect decisions made

The whole topic then as an alternative quality framework
Components of Hospital/health Care Quality

- Staff
  - Clinical staff
  - Dr nurse
  - ATT

- Systems
  - Protocols
  - Guidelines

- Teamwork
  - Communication between staff

- Culture
  - Understanding local beliefs and practices
  - Respect for the staff
  - Respect for the patient
  - Treat staff like a patient

- Competence
  - Skilled to provide culturally competent care

- Relationships and Communication
  - Caring
  - Trust

- Adequate resourcing

- Accessibility
  - GP
  - Ambulance

- System

- Hospital Setting
  - Physical building
  - Privacy

- Equipment
  - Good and

- Worker support
  - Access to information
  - Travel

- Services required
  - Needs
  - Time frame

- CP

= Quality measures should include cultural competence
Appendix 13 Interview Study research methods checklist

Interview Study research methods reported using COREQ-32 framework\(^{213}\)

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Domain 1. Research team and reflexivity</strong></td>
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</tr>
<tr>
<td></td>
<td><strong>Personal Characteristics</strong></td>
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<tr>
<td>1</td>
<td>Interviewer/facilitator</td>
<td>Carol Atmore</td>
</tr>
<tr>
<td>2</td>
<td>Credentials</td>
<td>PhD candidate</td>
</tr>
<tr>
<td>3</td>
<td>Occupation</td>
<td>General practitioner and health services clinical leader</td>
</tr>
<tr>
<td>4</td>
<td>Gender</td>
<td>Female</td>
</tr>
<tr>
<td>5</td>
<td>Experience and training</td>
<td>Pakeha (New Zealand European) with experience undertaking focus groups and interviews both in clinical leadership role, and as a GP for the basic interview technique</td>
</tr>
<tr>
<td></td>
<td><strong>Relationship with participants</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Relationship established</td>
<td>Most of the West Coast people interviewed and about one third of the people in the focus groups were known to the interviewer before the study commenced; one quarter of the people individually interviewed at Wairoa were known; and none of the participants in Kaitaia or Central Otago were known in advance.</td>
</tr>
<tr>
<td>7</td>
<td>Participant knowledge of the interviewer</td>
<td>All people individually interviewed and those organising the focus groups were contacted by e-mail a few weeks before the interviews took place and informed of the researcher’s background and the reasons behind the interview as part of the recruitment process and at the beginning of each interview and focus group as part of the consent process (see Appendix 1)</td>
</tr>
<tr>
<td>8</td>
<td>Interviewer characteristics</td>
<td>The researcher’s role as a GP and health services clinical leader would be likely to influence how people responded at interview. People in clinical and management roles may feel an affinity which would make it easier to have a detailed conversation. Community may feel reticent to express their views due to a perceived power differential, or conversely may feel that by telling their experiences</td>
</tr>
</tbody>
</table>
the researcher may be able to solve problems they had faced or give advice, which was carefully avoided.

**Domain 2. Study design**

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Methodological orientation and Theory</td>
<td>Pragmatism, using mixed methods methodology and applying thematic analysis for the interpretation of this study data</td>
</tr>
<tr>
<td>10</td>
<td>Sampling</td>
<td>Purposive sampling for all focus groups and 32 out of 36 individual interviews; snowball sampling for 4 individual interviews</td>
</tr>
<tr>
<td>11</td>
<td>Method of approach</td>
<td>A mix of telephone and e-mail</td>
</tr>
<tr>
<td>12</td>
<td>Sample size</td>
<td>36 individual interviews; 34 people in 4 community focus groups; 39 people in 4 Māori focus groups</td>
</tr>
<tr>
<td>13</td>
<td>Non-participation</td>
<td>All people approached for individual interviews participated. The number of people approached to participate in the focus groups was not known to me. One person attending a focus group left after the initial explanation of the purpose of the research.</td>
</tr>
<tr>
<td>14</td>
<td>Setting of data collection</td>
<td>Individual interviews: people's place of work or a setting they suggested, including their home or a café, with one by videoconference. Focus groups: A meeting room within the hospital (four focus groups), at the local Primary Health Organisation (one focus group) and a community organisation meeting room (three focus groups), with one attendee participating by videoconference.</td>
</tr>
<tr>
<td>15</td>
<td>Presence of non-participants</td>
<td>There were no other people present during the interviews and focus groups</td>
</tr>
<tr>
<td>16</td>
<td>Description of sample</td>
<td>Individual interviews: clinician and management leaders from rural and urban settings and GPs. Focus groups: adults aged from 22-80. Interviews took place between June and November 2016.</td>
</tr>
<tr>
<td>17</td>
<td>Interview guide</td>
<td>An interview schedule of 16 questions grouped under 3 headings was used as a loose guide to the interviews and</td>
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<td>No</td>
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<td>Description</td>
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<td></td>
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<td>focus groups (see Appendix 9). The schedule was piloted for both types of interview.</td>
</tr>
<tr>
<td>18</td>
<td>Repeat interviews</td>
<td>No repeat interviews were carried out</td>
</tr>
<tr>
<td>19</td>
<td>Audio/video recording</td>
<td>All interviews were digitally recorded using a small handheld digital recorder</td>
</tr>
<tr>
<td>20</td>
<td>Field notes</td>
<td>Field notes were made in a research journal after each interview</td>
</tr>
<tr>
<td>21</td>
<td>Duration</td>
<td>Individual interviews were 45-75 minutes duration; focus groups were 1 hour 15 to 1 hour 40 minutes duration</td>
</tr>
<tr>
<td>22</td>
<td>Data saturation</td>
<td>Data saturation was not a predefined end-point for the number of interviews undertaken, but by the last site visit there were few new themes emerging</td>
</tr>
<tr>
<td>23</td>
<td>Transcripts returned</td>
<td>Transcripts were not returned to participants for comment or correction</td>
</tr>
</tbody>
</table>

**Domain 3. Analysis and findings**

**Data analysis**

<p>| 24 | Number of data coders               | One (Carol Atmore), with checking of a selection of interviews by supervisors to verify appropriateness of coding framework                  |
| 25 | Description of coding tree          | The coding tree was based initially around the main questions asked at interview and then expanded inductively through coding                 |
| 26 | Derivation of themes                | Themes were identified loosely in advance but the final themes were derived from the data                                                   |
| 27 | Software                            | NVivo Pro 11                                                                                                                               |
| 28 | Participant checking                | Study participants were sent a summary of initial findings and feedback requested (see Appendix 6). All participants were invited to presentations of the research findings during February to April 2018. |
| 29 | Quotations presented                | Participant quotations, identified by an anonymised code, were included to illustrate the findings                                            |
| 30 | Data and findings consistent        | Examples given to assist reader in assessing this                                                                                           |
| 31 | Clarity of major themes             | The major themes were clearly presented in the results and discussion chapters                                                               |</p>
<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>Clarity of minor themes</td>
<td>The contributing minor themes (categories) were discussed under the major themes headings, and divergent views included</td>
</tr>
</tbody>
</table>
## Appendix 14 ISBAR Communication Tool

ISBAR communication tool (adapted from Canterbury District Health Board. ISBAR\(^{229}\))

<table>
<thead>
<tr>
<th>ISBAR structured communication framework to improve communication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identification</strong> (yourself, whom you are speaking to)</td>
</tr>
<tr>
<td><strong>Situation</strong> (Identify the patient and what is going on with them)</td>
</tr>
<tr>
<td><strong>Background</strong> (succinct summary of the patient’s condition and history)</td>
</tr>
<tr>
<td><strong>Assessment</strong> (clinical findings)</td>
</tr>
<tr>
<td><strong>Recommendation</strong> (what you required, suggested actions, clarify what action expected)</td>
</tr>
</tbody>
</table>
### Appendix 15 Quality measures suggested by participants

Table of quality measures suggested by participants.

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>Patient experience</th>
<th>Systems of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff capability</td>
<td>Continuity, Being treated with respect/cultural competence, Family and whānau involvement, Relationships and communication, Communication, Being treated with compassion and empathy, Being involved in decision making and supported in decision made, Staff having time to care, Family and whānau involvement</td>
<td>Standardised mortality ratios, Post op complications, Length of stay and readmission rates, Best practice medicine provided, Staff competent and trained, Hospital based rehabilitation measures</td>
</tr>
<tr>
<td>Access</td>
<td>Access to services, Access to information</td>
<td></td>
</tr>
<tr>
<td>Network structures and processes</td>
<td>Privacy, Quiet ward for sleeping at night, Timeliness of care and use of patient’s time</td>
<td>Standardised mortality ratios, Cleanliness, Adverse event processes, Planning the transfer, Is the transfer needed?, Is the transfer to the right place of care for that patient?</td>
</tr>
<tr>
<td>Measure Type</td>
<td>Patient experience</td>
<td>Systems of care</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is the mode of transport appropriate and timely?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is the time from decision to patient leaving, appropriate?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is setting up the transfer easy?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is the family informed about the transfer process?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During the transfer Is there clinician to clinician handover at start of transfer?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is the patient comfortable?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Are the staff trained and skilled for the transfer?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is the right data captured during transfer?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Are staff comfortable during transfer?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>At the end of the transfer Are the receiving hospital expecting the patient, and ready for their arrival?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can the staff get back to their start point easily?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Handover of care from hospital to community setting</td>
</tr>
<tr>
<td>Community participation</td>
<td>Timely transparent feedback mechanisms to family and whānau when concerns expressed</td>
<td></td>
</tr>
<tr>
<td>Fair distribution of resource</td>
<td>Cost and Equity Value for money measures</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 16 Excerpt from original grant application, ‘Patient harms in New Zealand general practices: Records review study’

“This research started in October 2014, data downloads from study general practices will be completed by December 2015, and reviews of downloaded records will be completed by December 2016. Three years of general practice consultation records and associated records of prescriptions, laboratory and radiological investigations, referrals and hospital discharge summaries are being reviewed in the study for a total of 9000 randomly selected general practice patients, with equal number of patients selected who attended rural or urban practices, as well as small, medium-sized and large practices.

Three years of general practice consultation records and associated records of prescriptions, laboratory and radiological investigations, referrals and hospital discharge summaries will be reviewed in the study for 9000 randomly selected general practice patients. Twelve practices from each of the six locality/size groups shown in Figure 1 will be randomly selected and invited to participate in the study, expecting that 10 practices from each group will be engaged.

Figure 1: Study design using PHO data from the July quarter, 2013

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Small practices</td>
<td>Total patients 1,236,370 Average patients/practice = 1739</td>
<td>Medium-sized practices Total patients 1,234,157 Average patients/practice = 6530</td>
<td>Large practices Total patients 1,242,854 Average patients/practice = 12,813</td>
<td>711 small practices Total patients = 1,236,370 Average patients/practice = 1739</td>
<td>189 medium-sized practices Total patients = 1,234,157 Average patients/practice = 6530</td>
</tr>
<tr>
<td>446 urban practices</td>
<td>265 rural practices</td>
<td>155 urban practices</td>
<td>34 rural practices</td>
<td>70 urban practices</td>
<td>27 rural practices</td>
</tr>
<tr>
<td>10 study practices</td>
<td>10 study practices</td>
<td>10 study practices</td>
<td>10 study practices</td>
<td>10 study practices</td>
<td>10 study practices</td>
</tr>
<tr>
<td>150 study pts/practice = Records of 1500 patients</td>
<td>150 study pts/practice = Records of 1500 patients</td>
<td>150 study pts/practice = Records of 1500 patients</td>
<td>150 study pts/practice = Records of 1500 patients</td>
<td>150 study pts/practice = Records of 1500 patients</td>
<td>150 study pts/practice = Records of 1500 patients</td>
</tr>
</tbody>
</table>
We developed the study design using 2013 July quarter data from the Primary Health Organisation (PHO) enrolment database. We will use similar calculations from the most recent 2014 quarter in the proposed study as numbers of practices and patients change over time. We determined that in July 2013 there were 3,713,381 enrolled patients in 997 New Zealand general practices (excluding general practices based in aged care residential facilities, universities or polytechnics, or that are specialty practices such as sports medicine, men’s health, or appearance medicine clinics).

Study methods involve data being downloaded electronically from practice computers and transferred onto the data form developed in the feasibility study. The GP investigators review each record to establish whether patients experienced harm from their healthcare and (if so) the types of patient harms, their preventability and severity according to the definitions developed in the feasibility study (HRC 11-555) conducted in preparation for the current research. In the analysis, study data will be weighted to account for the different probabilities of both patients and general practices being represented in each study group and for cluster effects. Probabilities of harm types, severity, and preventability will be calculated overall and for each practice group. Hypotheses relating to practice location and size will be explored with modelling techniques.

For the purposes of the study, patient harm is defined as physical or emotional negative consequences to patients directly arising from health care, beyond the usual consequences of care and not attributable to the patient’s health condition (including delays in treatment associated with failure to resolve patient experiences of poor health, inconvenience and additional financial costs to patients). Errors, or mistakes in care, will not be studied in this research unless they are associated with patient harm. Many harms result from standard, correct care and are not associated with errors. Many errors are not associated with harm.
To define rural and urban practices, the Rural Ranking Scale (RRS) is used. This scale was developed in 1995 as an objective measure for allocating public funding to support the recruitment and retention of rural general practitioners and to assist the provision of after-hours care in rural and remote communities. By this measure, practices with a score of >35 capture the features of rurality that make them substantially different from an urban practice. However, the RRS was being reviewed at the time of the study’s commencement. Thus data is being collected about study practices’ RRS, if they have one, and rural and urban practices are also defined by their addresses in locations meeting the Statistics New Zealand definitions of urban and rural,(ref) with one exception. General practices in Statistics New Zealand’s “independent urban communities” are included in the rural general practice group as these communities are smaller centres (not cities) without many of the specialty services provided by large hospitals. Independent urban communities include such towns as Whitianga, Greymouth, Martinborough, and Wanaka. Many of the patients of general practices in these towns are drawn from surrounding rural areas. The proposed research assumes that people enrolled at rural or urban practices reside in rural or urban areas.

Survey data statistical analysis tools appropriate for the sampling design are being used by the study's biostatistician (Dr Ari Samaranayaka) to analyse abstracted data. These are the 'svy' group of tools in Stata. Sampling weights are being used to accommodate the study design features that allow (for example) a higher probability of selecting a larger practice into the sample but a lower probability of selecting a patient from those practices for records review. Probabilities of harm, harm types, harm severity, and harm preventability will be calculated overall and for each practice group.

A mixed model analysis (the 'xtmixed' group of tools in Stata) is being used to explore the hypotheses relating to harm differences associate with location and size. Mixed effects modelling is also necessary to accommodate multiple harms
(with multiple scores for preventability and severity) for some patients, and to include the 5% double-reviewed records.”

Appendix 17 Inter-rater reliability of hospital harms identified by SHARP reviewers

Table 1 Examples of individual harms identified by different reviewers

<table>
<thead>
<tr>
<th>Patient ID</th>
<th>Reviewer A description of harm</th>
<th>Reviewer B description of harm</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 632</td>
<td>Reaction from contrast during discography</td>
<td>Discogram: feeling terrible the following day: severe headache, neck pain, nausea. Had been advised effects of this Ix likely to be minimal. Returned to hopsital, reviewed by neurosurgical reg, admitted for 5 days, had MRI scan.</td>
<td>Same Harm</td>
</tr>
<tr>
<td>Patient 760</td>
<td>Consultation 89 states the patient is extremely rigid as pyramidal a side effect of medication. As there was no diagnosis of parkinsons disease, the side effect may have been avoidable. Needs discussion.</td>
<td>Cognitive impairment probably not helped by being on nortriptyline, fluoxetine, etc etc. And at one point 16 meds / polypharmacy</td>
<td>Same Harm</td>
</tr>
<tr>
<td>Patient 1347</td>
<td>Consultation 14 Whenever he has Butamenide - has to rush to toilet to pass urine++. Makes him feel unwell as well. Still taking Frusemide and no gout for ages. Stop Butemanide, continue Frusemide. IE malaise on butaminide</td>
<td>Consultation 60 Phlebitis post sclerotherapy</td>
<td>Different Harm</td>
</tr>
</tbody>
</table>
Table 2. Number of individual hospital harms identified by double GP reviewers during SHARP Study

<table>
<thead>
<tr>
<th>No. of harms, Reviewer A</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of harms, Reviewer B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>135</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>135</td>
</tr>
<tr>
<td>1</td>
<td>55</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>67</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>37</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>258</td>
</tr>
</tbody>
</table>
### Appendix 18 Outline of tables to present

Table 1. Characteristics of NZ general practices participating in the SHARP Study

<table>
<thead>
<tr>
<th>All New Zealand general practices in 2014</th>
<th>Randomly selected general practices</th>
<th>Participating general practices*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice s n (%)</td>
<td>Enrolled patients n (%)</td>
<td>Mean patients per practice</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Urban large</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban small</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal Urban</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural large</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural small</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal Rural</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. SHARP Study patient characteristics for whole cohort, patients with hospital admissions and patients with hospital harm-related admissions

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Subset</th>
<th>Total n = n (%)</th>
<th>Hospital admission n = n (%)</th>
<th>Hospital harm n= (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Interquartile Range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min-max</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age groups (years)</td>
<td>0-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40-59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60-79</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>80+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>European</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Māori</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pacific</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio-economic status - NZDep</td>
<td>Quintile 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quintile 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator</td>
<td>Subset</td>
<td>Total n = n (%)</td>
<td>Hospital admission n = n (%)</td>
<td>Hospital harm n= (%)</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
<td>------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>No data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practice Size</td>
<td>Large</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practice size and</td>
<td>Rural large</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>location</td>
<td>Rural medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rural small</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban large</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban small</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital harms</td>
<td>Any hospital harm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No hospital harm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harms</td>
<td>Any harm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No harm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Characteristics of rural and urban patients who had identified hospital admission events (AE) and admission events resulting in harm (AERH)

<table>
<thead>
<tr>
<th></th>
<th>All patients with admission events (AE)</th>
<th>Urban patients with admission events</th>
<th>Rural patients with admission events</th>
<th>All patients with admission events resulting in harm</th>
<th>Urban patients with admission events resulting in harm</th>
<th>Rural patients with admission events resulting in harm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n =</td>
<td>n (% AE)</td>
<td>n (% AE)</td>
<td>n = (% AE)</td>
<td>n (% AERH)</td>
<td>n (% AERH)</td>
</tr>
<tr>
<td>Sex:</td>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>Mean Median (IQR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age group in years</td>
<td>0-19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40-59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All patients with admission events (AE) | Urban patients with admission events | Rural patients with admission events | All patients with admission events resulting in harm | Urban patients with admission events resulting in harm | Rural patients with admission events resulting in harm
--- | --- | --- | --- | --- | ---
| n = | n (% AE) | n (% AE) | n = (% AE) | n (% AERH) | n (% AERH)
| 60-79 | | | | | |
| 80+ | | | | | |

**Ethnicity**
- European
- Māori
- Pacific
- Other

**Socio-economic status**
- Quintile 1
- Quintile 2
<table>
<thead>
<tr>
<th>Practice size</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
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Table 5. Comparison of patients who did and did not have a hospital admission

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Table 6. Comparison of patients with hospital admissions resulting in harm, and patients with hospital admissions that did not result in harm, by age, sex, ethnicity, NZDep quintile and practice size.

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<td>Unadjusted Risk ratio (95%CI)</td>
<td>p-value</td>
<td>Adjusted Risk ratio (95%CI)</td>
<td>p-value</td>
</tr>
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<td>--------------------------------------</td>
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<tr>
<td>Urban med</td>
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<tr>
<td>Urban small</td>
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<td></td>
</tr>
</tbody>
</table>

Table 7 Unadjusted and adjusted rate ratios for admission events resulting in harm for rural to urban location, age, sex, ethnicity, and NZDep quintile and practice size.
<table>
<thead>
<tr>
<th>Sex (female compared to male)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity (compare to European)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pacific</td>
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<td></td>
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<tr>
<td>Other</td>
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<td></td>
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<tr>
<td>Socioeconomic status</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(compared to Quintile 1)</td>
<td></td>
<td></td>
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<tr>
<td>Quintile 2</td>
<td></td>
<td></td>
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<tr>
<td>Quintile 3</td>
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<tr>
<td>Quintile 4</td>
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<tr>
<td>Quintile 5</td>
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<td></td>
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<tr>
<td>No data on socioeconomic</td>
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<tr>
<td>status</td>
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<td></td>
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<tr>
<td>Interaction term, location</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>and socioeconomic status</td>
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<tr>
<td>Practice size (compared to</td>
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<td>large)</td>
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<tr>
<td>Medium</td>
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<tr>
<td>Small</td>
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</tbody>
</table>
Table 8 A table comparing the demographics of patients with full data on hospital admission length of stay, to those with incomplete data on length of hospital admissions

<table>
<thead>
<tr>
<th>Location</th>
<th>Total hospital admissions</th>
<th>Complete LOS data n</th>
<th>Rural patients, complete LOS data n</th>
<th>Urban patients, complete LOS data n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n=</td>
<td>n (%)</td>
<td>n(%)complete</td>
</tr>
<tr>
<td>Location</td>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Female</td>
<td></td>
<td></td>
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<tr>
<td>Age in years</td>
<td>Mean (SD)</td>
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<tr>
<td></td>
<td>Median (IQR)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Age group in years</td>
<td>0-19</td>
<td></td>
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<tr>
<td></td>
<td>20-39</td>
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<td></td>
<td>40-59</td>
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<td></td>
<td>60-79</td>
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<td>80+</td>
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<tr>
<td>Ethnicity</td>
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<tr>
<td></td>
<td>Māori</td>
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<tr>
<td></td>
<td>Pacific</td>
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<tr>
<td></td>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio-economic status - NZDep</td>
<td>Total hospital admissions</td>
<td>Complete LOS data n =</td>
<td>Rural patients, complete LOS data n =</td>
<td>Urban patients, complete LOS data n =</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------</td>
<td>----------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td></td>
<td>n=</td>
<td>n (%)</td>
<td>n(%complete)</td>
<td>n(%complete)</td>
</tr>
<tr>
<td>Quintile 1</td>
<td></td>
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<tr>
<td>Quintile 2</td>
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<tr>
<td>Quintile 3</td>
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<td>Quintile 4</td>
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<td>Quintile 5</td>
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<td></td>
</tr>
<tr>
<td>No data</td>
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<td></td>
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</tr>
<tr>
<td>Practice Size</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Large</td>
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</tr>
<tr>
<td>Medium</td>
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<tr>
<td>Small</td>
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<td></td>
</tr>
<tr>
<td>Size and location</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Rural large</td>
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<tr>
<td>Rural med</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Rural small</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban large</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban med</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Urban small</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Harm</td>
<td>No hospital harm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hospital harm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 9 Number of admission events, mean length of stay and total occupied bed days for patients who experienced hospital harm and patients who did not

<table>
<thead>
<tr>
<th></th>
<th>Total n=</th>
<th>Hospital harm n=</th>
<th>No hospital harm n=</th>
<th>uIRR (95%CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean number of admission events per person (min-max)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean length of stay per admission episode (min-max)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean total occupied bed days (min-max)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 10 Comparison between rural and urban location and number of admission events, number of admission events resulting in harm, mean length of stay and total occupied bed days

<table>
<thead>
<tr>
<th></th>
<th>Total n=</th>
<th>Rural n=</th>
<th>Urban n=</th>
<th>uIRR</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean number of admission events per person (min-max)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean number admission events per person resulting in harm (min-max)</td>
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<td></td>
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<tr>
<td>Mean length of stay (min-max)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean total occupied bed days (min-max)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Table 11 The effect of hospital harm and demographic variables on total occupied bed days

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted Risk Ratio of total OBD (95%CI)</th>
<th>p-value</th>
<th>Adjusted Risk Ratio of total OBD (95%CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (rural compared to urban)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital harm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year increments)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (female compared to male)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity (compare to European)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic status (compared to Quintile 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quintile 2</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Quintile 3</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Quintile 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quintile 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No data on socioeconomic status</td>
<td>Practice size (compared to large)</td>
<td>Medium</td>
<td>Small</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------------------</td>
<td>--------</td>
<td>------</td>
<td></td>
</tr>
</tbody>
</table>

Table 12. Harms reviewed by more than one reviewer

<table>
<thead>
<tr>
<th>Concordance of reviewers</th>
<th>Hospital harms n = n (%)</th>
<th>All harms n = n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harms identified by both/all reviewers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harms identified by only one reviewer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 13. Kappa Statistic for variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unweighted kappa statistic (95% CI)</th>
<th>Linearly Weighted kappa statistic (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of harms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preventability of harms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity of harms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 14. Different rurality definitions and size of variable sub-groups

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Subset (number of practices)</th>
<th>Total n= n (%)</th>
<th>Hospital admission n= (%)</th>
<th>Hospital harm n= (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case: Location</td>
<td>Urban</td>
<td>Rural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Rural ranking scale (binary)</td>
<td>Urban &lt;35</td>
<td>Rural ≥35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Rural ranking scale (3 part)</td>
<td>Urban &lt;35</td>
<td>Moderate rural 35-49 (Most rural)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Nearest Base Hospital</td>
<td>Close (≤20 km)</td>
<td>Intermediate (21-50 km)</td>
<td>Far (&gt; 50 km)</td>
<td></td>
</tr>
<tr>
<td>4. Distance to nearest hospital by location</td>
<td>Urban (all 31 km or less,)</td>
<td>Rural, &lt;30 km</td>
<td>Rural, ≥30 km</td>
<td></td>
</tr>
<tr>
<td>5. Drive time to nearest hospital</td>
<td>15 minutes or less</td>
<td>16 to 30 minutes</td>
<td>More than 30 minutes</td>
<td></td>
</tr>
</tbody>
</table>
Table 15. Effect of different rurality definitions on risk of hospital admission, hospital related harm and rate of hospital harm per admission event

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Subset</th>
<th>Adjusted risk ratio of hospital admission (95% CI)</th>
<th>p-value</th>
<th>Adjusted risk ratio of hospital harm (95% CI)</th>
<th>p-value</th>
<th>Adjusted rate ratio of hospital events resulting in harm per hospital admission event (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case: Location</td>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1. Rural ranking scale (binary)</td>
<td>Urban &lt;35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rural £35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Rural ranking scale (3 part)</td>
<td>Urban &lt;35</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Moderate rural 35-49</td>
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<tr>
<td></td>
<td>Most rural</td>
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<td></td>
</tr>
<tr>
<td>3. Nearest Base Hospital</td>
<td>Close (£20 km)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intermediate (21-50 km)</td>
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<tr>
<td></td>
<td>Far (£50 km)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4. Distance to nearest hospital by location</td>
<td>Urban (all 31 km or less)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Rural, &lt;30 km</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Rural, £30 km</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5. Drive time to nearest hospital</td>
<td>15 minutes or less</td>
<td>16 to 30 minutes</td>
<td>More than 30 minutes</td>
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</tr>
</tbody>
</table>
Appendix 19 Data definitions for Stata do-file

**Variables:**

- **patientid**: unique patient identifier (NOT NHI)
- **age**: age in years
- **c_age**: age centred on mean age
- **agegroup20**: age in 20 year age bands,
  
  - 1 = 0-19; 2 = 20-39; 3 = 40-59; 4 = 60-79; 5 = 80+
- **gendernum**: Sex, 0 = Male, 1 = Female
- **nzdepquintiles**: New Zealand Deprivation Quintiles 1 = wealthiest, 5 = poorest
- **ethnicgrps**: Abbreviated ethnic groups,
  
  - 1 = European (NZ European and European), 2 = Māori, 3 = Pacific, 4 = Other, 9 = no data
- **ethn4**: abbreviated ethnic groups used in calculations,
  
  - 1 = European (NZ European and European), 2 = Māori, 3 = Pacific, 4 = Other + no data
- **ethn3**: 3 category abbreviated ethnic groups used in interaction calculations when needed
  
  - 1 = European (NZ European and European), 2 = Māori, 3 = Pacific + Other + no data
location: Location of general practice contributing patient records, 0 = urban, 1 = rural

study_group: describing the general practice contributing randomly selected patient notes,

1 = large rural, 2 = medium rural, 3 = small rural, 4 = large urban, 5 = medium urban, 6 = small urban

size: describing the general practice contributing randomly selected patient notes,

1 = large, 2 = medium, 3 = small

nadmitepisode: number of admission events

n_harmadmits: number of admission events resulting in hospital harm

hospadmit_y_n: Hospital admission identified; 0 = no hospital admission, 1 = any hospital admission

noadmit: no hospital admission: 0 = hospital admission, 1 = no hospital admission

totalhospitalharm_y_n: all patients with identified hospital harm, whether an associated hospital admission was identified; 0 = no hospital related harm identified, 1 = any hospital related harm identified

hospharm_and_admission: all patients with identified hospital harm and an identified hospital admission; 0 = no hospital related harm identified, 1 = any hospital related harm identified

nohospharm: no hospital harm: 0 = hospital harm, 1 = no hospital harm

harmstatus: Any harm; 0 = no harm; 1 = any harm
completelos: complete data on length of hospital stays available; 1 = yes; 0 = no

overnightadmiteps: number of hospital admission events that included overnight admissions (i.e. not day stay admissions)

numberdaystay: Number of day stay admissions

avlos: mean length of stay for all admissions for those patients in complete data on length of stay for every identified hospital admission

totalobd: total occupied bed days over 3 year period for those patients with complete data on length of stay for every identified hospital admission

patweight: patient weight determined for the practice size each patient record belonged to

age2: square of age, used in quadratic analysis

rrs: rural ranking scale (RRS) number of the general practice

nearest_hosp: nearest hospital to general practice in km

nearest_base_hosp: nearest base hospital to general practice in km

drivetimenh: drive time to nearest hospital in minutes

rrs2: 2 part rurality definition from rural ranking scale; 0 = RRS < 35, 1 = RRS >= 35

rrs3: 3 part rurality definition from RRS; 0: RRS < 35, 1= RRS 35-49, 2 = RRS>= 50
nbh: distance to nearest base hospital (NBH); 0 = general practice <= 20 km from NBH; 1 = general practice 21-50 km from NBH; 2 = general practice >50 km from NBH

rural3: Distance from general practice to nearest hospital by location; 0 = all urban (all 31 km or less), 1 = Rural general practices <30 km; 2 = Rural general practices, >=30 km

hospdrivetime: drive time from general practice to nearest hospital; 0 = 15 minutes or less, 1 = 16 to 30 minutes, 2 = more than 30 minutes (all < 60 minutes)

metmeanagehospadmit: mean age of patients with and identified hospital harm and hospital admission (used in methods section)

metmeanagenohospadmit: mean age of patients with and identified hospital harm and no identified hospital admission (used in methods section)

prevrev1,2,: preventability of harm code assigned by multiple reviewers;

1 = not preventable, standard treatment; 2 = not preventable, originated in primary care;

3 = not preventable, originated in secondary care; 4 = preventable and originated in secondary care OR not preventable and originated in primary care; 5 = potentially preventable in primary care; 6 = preventable in primary care

sevrev1,2,: severity of harm code assigned by multiple reviewers;

1 = mild, 2 = moderate, 3 = severe, 4 = death

freqharmrev1,2: number of harms recorded by multiple reviewers
rater1,2reduced: recoded number of harms, with 7 or more harms coded as 7+ harms

bintransfer: binary transfer status, 1 = experienced transfer, 0 = no transfer

rural admit: 1 = rural patient with admission, 0 = urban patient with admission

rural harm: 1 = rural patient with harm during admission, 0 = rural patient with no harm during admission
Appendix 20 Do-file for Stata analysis

//opening 9076 patients file, lowercase all variables and merge rural codes for 44 practices
use "C:\Users\Carol Atmore\Documents\Foxley research\Hospital Harms study\Stata files\Final analysis\Clean stata files\Original 9076 patients.dta", clear
rename *,lower
merge m:1 practiceid using "C:\Users\Carol Atmore\Documents\Foxley research\Hospital Harms study\Stata files\Practice rurality info.dta"
drop _merge
//merge preventability severity and where harm detected and type file
merge 1:1 patientid using "C:\Users\Carol Atmore\Documents\Foxley research\Hospital Harms study\Stata files\Final analysis\Clean stata files\172 patients prev sev and where harm detected info.dta"

//generating contracted ethnicity codes missing included in other
gen ethn4=1 if ethnicgps<2
replace ethn4=2 if ethnicgps>1& ethnicgps<3
replace ethn4=3 if ethnicgps>2& ethnicgps<4
replace ethn4=4 if ethnicgps>3
label variable ethn4 "Prioritised Ethnicity"
label define ethn4lbl 1 "European" 2 "Maori" 3 "Pacific" 4 "Other"
label values ethn4 ethn4lbl
tab ethn4

//generating a hlow-high deprvation group
gen nzdep3=1 if nzdepquintiles<4
replace nzdep3=2 if nzdepquintiles>3 & nzdepquintiles<9
replace nzdep3=3 if nzdepquintiles>8
label variable nzdep3 "Low high deprivation"
label define nzdep3lbl 1 "Quintile 1-3" 2 "Quintile 4-5" 3 "No data"
label values nzdep3 nzdep3lbl
tab nzdep3

//creating alternative rurality measures
//Rurality measure of Rural Ranking Scale 35 or more
generate rrs2 = 1 if rrs<35
replace rrs2 = 2 if rrs>=35
label define rrs2 1 "Urban" 2 "Rural"
label values rrs2 rrs2
label variable rrs2 "Rurality measure of Rural Ranking Scale 35 or more"
tab rrs2
//Degrees of rurality from Rural Ranking Scale
generate rrs3 = 1 if rrs<35
replace rrs3 = 2 if rrs>=35 & rrs<50
replace rrs3 = 3 if rrs>=50
label define rrs3 1 "RRS < 35" 2 "RRS 35 to 49" 3 "RRS 50 or more"
label values rrs3
label variable rrs3 "Degrees of rurality from Rural Ranking Scale"
tab rrs3

//Nearest base hospital
generate nbh = 1 if nearest_base_hosp<=20
replace nbh = 2 if nearest_base_hosp > 20 & nearest_base_hosp <= 50
replace nbh = 3 if nearest_base_hosp > 50
label variable nbh "Nearest base hospital"
label define nbhlbl 1 "20 km or less" 2 "21 to 50 km" 3 "50 km or more"
label values nbh nbhlbl
tab nbh

//Distance to nearest hospital by location
generate rural3 = 1 if (location<1)
replace rural3 = 2 if (location >0 & nearest_hosp <30)
replace rural3 = 3 if (location >0 & nearest_hosp >=30)
label variable rural3 "Distance to nearest hospital by location"
label define rural3lbl 1 "Urban" 2 "Rural, less than 30 km" 3 "Rural, 30 km or more"
label values rural3 rural3lbl
tab rural3

//Drive time to nearest hospital
gen hospdrivetime = .
replace hospdrivetime = 1 if drivetimenh <= 15
replace hospdrivetime = 2 if drivetimenh > 15 & drivetimenh <= 30
replace hospdrivetime = 3 if drivetimenh > 30
label variable hospdrivetime "Drive time to nearest hospital"
label values hospdrivetime hospdrivetimelbl
label define hospdrivetimelbl 1 "15 minutes or less" 2 "16 to 30 minutes" 3 "more than 30 minutes"
label values hospdrivetime hospdrivetimelbl
tab hospdrivetime

//adding weights
gen patweight=. 
replace patweight=(58*7176)/(1502) if study_group==1 // large rural
replace patweight=(66*3090)/(1537) if study_group==2 // medium rural
replace patweight=(75*1375)/(1493) if study_group==3 // small rural
replace patweight=(271*8045)/(1501) if study_group==4 // large urban
replace patweight=(263*3124)/(1543) if study_group==5 // medium urban
replace patweight=(255*1440)/(1500) if study_group==6 // small urban
table study_group, content(mean patweight) m
tab patweight

// creating svyset to include practice clustering and practice weights
svyset practiceid [pweight=patweight]

//creating average length of stay data
generate n_overnightadmiteps = nadmitepisode - numberdaystay if totalobd!=.
generate avlos = totalobd / n_overnightadmiteps if totalobd!=.
replace avlos=0 if n_overnightadmiteps==0
label variable n_overnightadmiteps "Number of non day stay admission episodes"
label variable avlos "Average LOS "

//Labelling hospital harm terms
label variable hosp_harm_and_admission "Hospital harm"
label variable totalhospharm_y_n "All hospital harm including no detected admission"
label define hosp_harm_and_admissionlbl 0 "No hospital harm" 1 "Hospital harm"
label values hosp_harm_and_admission hosp_harm_and_admission lbl

//create age squared
gen age2=age^2

//creating 'no admit' variable for CI calculations
generate noadmit = 1 if hospadmit_y_n<1
replace noadmit = 0 if hospadmit_y_n>0
label define noadmit 0 "Admit" 1 "No admit"
label values noadmit noadmit
label variable noadmit "No hospital admission episodes"
tab noadmit

//creating 'nohospharm' variable for CI calculation
generate nohospharm = 1 if (hospadmit_y_n>0 & n_harmadmits==.)
replace nohospharm = 0 if (hospadmit_y_n>0 & n_harmadmits<20)
label define nohospharm 0 "Hosp harm admit" 1 "No hospital harm admit"
label values nohospharm nohospharm
label variable nohospharm "No hospital admission with harm episodes"
tab nohospharm

//creating 'noprevharm' variable for CI calculation
generate noprevharm = 1 if (hosp_harm_and_admission==1 & anyprevharm!=.)
replace noprevharm = 0 if (hosp_harm_and_admission==1 & anyprevharm==1)
label define noprevharm 0 "Any preventable hosp harm" 1 "No preventable harm"
label values noprevharm noprevharm
label variable noprevharm "No preventable hospital harm"
tab noprevharm

//generalting binary complete LOS yes/no
gen completelos=.
replace completelos=0 if (totalobd==. & hospadmit_y_n==1)
replace completelos=1 if totalobd<100
label define completelos 0 "Incomplete LOS data" 1 "Complete LOS data"
label values completelos completelos
label variable completelos "Data on LOS"
tab completelos

//generating transfer and rural patients with harm codes
gen transfers = nadmissions - nadmitepisode
label variable transfers "Number of transfers"
tab transfers
gen bintransfer = transfers
recode bintransfer 0=0 1=1 2=1 3=1
label variable bintransfer "Any transfer"
label define bintransferlbl 0 "No" 1 "Yes"
label values bintransfer bintransferlbl

gen ruraladmit = 1 if (hospadmit_y_n==1 & loc==1)
replace ruraladmit = 0 if (hospadmit_y_n==1 & loc==0)
label variable ruraladmit "Rural admission"
label define ruraladmitlbl 0 "No" 1 "Yes"
label values ruraladmit ruraladmitlbl
tab ruraladmit

gen ruralharm = 1 if (ruraladmit==1 & hospharm_and_admission==1)
replace ruralharm = 0 if (ruraladmit==1 & hospharm_and_admission==0)
label variable ruralharm "Hospital harm for rural patient"
label define ruralharmlbl 0 "No" 1 "Yes"
label values ruralharm ruralharmlbl
tab ruralharm

//generating alternative rural harm definitions using alternative definitions of rural

//generating mean age centred
center age
//ethnicity3 european, Maori, other
clonedvar ethn3=ethn4
recode ethn3(3=4)

//Labels
label variable age "Age"
label list location
label define newlocation 0 "Urban" 1 "Rural"
label values location newlocation
tab location
label variable location "Location"
label variable agegroup20 "Age group by 20 year age bands"
label variable gendernum "Sex"
label define sex 0 "Male" 1 "Female"
label values gendernum sex

//demographic variables by single subvariable
recode agegroup20 (1=1)(*=2), gen(agegroup1)
recode agegroup20 (2=1)(*=2), gen(agegroup2)
recode agegroup20 (3=1)(*=2), gen(agegroup3)
recode agegroup20 (4=1)(*=2), gen(agegroup4)
recode agegroup20 (5=1)(*=2), gen(agegroup5)

recode ethn4 (1=1)(*=2), gen(ethneuro)
recode ethn4 (2=1)(*=2), gen(ethnmaori)
recode ethn4 (3=1)(*=2), gen(ethnpac)
recode ethn4 (4=1)(*=2), gen(ethnoth)

recode nzdepquintiles (1=1)(*=2), gen(ses1)
recode nzdepquintiles (2=1)(*=2), gen(ses2)
recode nzdepquintiles (3=1)(*=2), gen(ses3)
recode nzdepquintiles (4=1)(*=2), gen(ses4)
recode nzdepquintiles (5=1)(*=2), gen(ses5)
recode nzdepquintiles (9=1)(*=2), gen(sesnil)

recode size (1=1)(*=2), gen(large)
recode size (2=1)(*=2), gen(medium)
recode size (3=1)(*=2), gen(small)

recode study_group(1=1)(*=2), gen(rurallarge)
recode study_group (2=1)(*=2), gen(ruralmedium)
recode study_group (3=1)(*=2), gen(ruralsmall)
recode study_group (4=1)(*=2), gen(urbanlarge)
recode study_group (5=1)(*=2), gen(urbanmedium)
recode study_group(6=1)(*=2), gen(urbansmall)

//all above gets the files ready for analysis

//comparing detected admission with no detected admission for hospital harms
(for methods Table 2)
tab hospadmit totalhospharm_y_n
summ age if ( totalhospharm_y_n==1 & hospadmit_y_n==1), detail
summ age if ( totalhospharm_y_n==1 & hospadmit_y_n==0), detail

//comparing detected admission with no detected admission for hospital harms
(tab gen gendernum hospadmit_y_n if totalhospharm_y_n, exp chi2 exact colu

//comparing detected admission with no detected admission for hospital harms
(tab ethn4 hospadmit_y_n if totalhospharm_y_n, exp chi2 exact colu

//comparing detected admission with no detected admission for hospital harms
(tab nzdepquintiles hospadmit_y_n if totalhospharm_y_n, exp chi2 exact colu

//comparing detected admission with no detected admission for hospital harms
(tab loc hospadmit_y_n if totalhospharm_y_n, exp chi2 exact colu
tab size hospadmit_y_n if totalhospharm_y_n, exp chi2 exact colu
//checking for normal distribution for age
hist age if( totalhospharm_y_n==1), by(hospadmit_y_n)
ranksum age if(totalhospharm_y_n==1), by(hospadmit_y_n)

//ttest after checking for unequal variance using Levene's test for unequal variance (robvar command) - add 'unequal' at end of ttest command if unequal variance shown - note didn't use!! as not normally distributed
robvar age if ( totalhospharm_y_n==1), by (hospadmit_y_n )
ttest age if ( totalhospharm_y_n==1), by (hospadmit_y_n )

//Creating Table 3 SHARP Study patient characteristics, Characteristics of people with an identified hospital admission and Characteristics of people with hospital harm, and graphs
//total cohort
summ age, detail
hist age
tab gendernum
tab agegroup20
tabulate nzdepquintiles
tabulate ethn4
tab location
tab agegroup20
tab size
tab study_group
tab harmstatus
tab hospadmit
tab totalhospharm_y_n

//patients with hosp admits and p values for this vs no admit
tab loc hospadmit, col chi2
tab gendernum hospadmit, col chi2
summ age if hospadmit==1, detail
summ age if hospadmit!=1, detail
tab agegroup20 if hospadmit==1
tab ethn4 if hospadmit==1
tab nzdepquintiles if hospadmit==1
tab size if hospadmit==1
tab study_group if hospadmit==1
tab harmstatus if hospadmit==1
tab hospharm_and_admission if hospadmit==1
hist age, by(hospadmit_y_n)
ranksum age, by(hospadmit_y_n)
tab agegroup1 hospadmit, col chi2
tab agegroup2 hospadmit, col chi2
tab agegroup3 hospadmit, col chi2
tab agegroup4 hospadmit, col chi2
tag agegroup5 hospadmit, col chi2
tab ethn4 hospadmit, col chi2
tab ethneuro hospadmit, col chi2
tab ethnmaori hospadmit, col chi2
tab ethnpac hospadmit, col chi2
tab ethnoth hospadmit, col chi2
tab nzdepquintiles hospadmit, col chi2
tab ses1 hospadmit, col chi2
tab ses2 hospadmit, col chi2
tab ses3 hospadmit, col chi2
tab ses4 hospadmit, col chi2
tab ses5 hospadmit, col chi2
tab sesnil hospadmit, col chi2
tab size hospadmit, col chi2
tab study_group hospadmit, col chi2
tab rurallarge hospadmit, col chi2
tag ruralmedium hospadmit, col chi2
tag ruralsmall hospadmit, col chi2
tag urbanlarge hospadmit, col chi2
tag urbanmedium hospadmit, col chi2
tag urbansmall hospadmit, col chi2
tag urbansmall hospadmit, row chi2

//patients with harm and p values vs no harm
	tab loc if hospharm_and_admission==1
tag gender if hospharm_and_admission==1
tagg sum age if hospharm_and_admission==1, detail
tagg sum age if hospharm_and_admission==0, detail
tag agegroup20 if hospharm_and_admission==1
tag ethn4 if hospharm_and_admission==1
tag nzdepquintiles if hospharm_and_admission==1
tag size if hospharm_and_admission==1
tag study_group if hospharm_and_admission==1
tag harmstatus if hospharm_and_admission==1
tag hist age, by(hospharm_and_admission)
tag ranksum age, by(hospharm_and_admission)
tag loc hospharm_and_admission, col chi2
tag size hospharm_and_admission, col chi2
tag study_group hospharm_and_admission, col chi2
tag rurallarge hospharm_and_admission, col chi2
tag ruralmedium hospharm_and_admission, col chi2
tag ruralsmall hospharm_and_admission, col chi2
tag urbanlarge hospharm_and_admission, col chi2
tag urbanmedium hospharm_and_admission, col chi2
tag urbansmall hospharm_and_admission, col chi2
tab gendernum hosparm_and_admission, col chi2
tab ethn4 hosparm_and_admission, col chi2
tab ethn4 hosparm_and_admission, col chi2
tab ethneuro hosparm_and_admission, col chi2
tab ethnmaori hosparm_and_admission, col chi2
tab ethnpac hosparm_and_admission, col chi2
tab ethnoth hosparm_and_admission, col chi2
tab nzdepquintiles hosparm_and_admission, col chi2
tab ses1 hosparm_and_admission, col chi2
tab ses2 hosparm_and_admission, col chi2
tab ses3 hosparm_and_admission, col chi2
tab ses4 hosparm_and_admission, col chi2
tab ses5 hosparm_and_admission, col chi2
tab sesnil hosparm_and_admission, col chi2

//Figures 1 to 3
histogram age, width(5) percent graphregion(fcolor(white) lcolor(white)
ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white)
ifcolor(white) ilcolor(white))
histogram age if hospadmit ==1, width(5) percent graphregion(fcolor(white)
ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white)
ifcolor(white) ilcolor(white))
histogram age if hosparm_and_admission ==1, width(5) percent
graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))
plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))

//Creating Table 4 R vs U hospital admission and hospital harm  Note didn’t present CI and RR in final output but did include p values if stat sig
  tab hospadmit_y_n location, row chi2
tab hosparm_and_admission location, row chi2
tab gendernum location, col chi2
summ age, detail
summ age if (loc==0 ), detail
summ age if (loc==1 ), detail
hist age, by(location)
ranksum age, by(loc)
tab agegroup20 location, col chi2
tab agegroup1 location, chi2
tab agegroup2 location, chi2
tab agegroup3 location, chi2
tab agegroup4 location, chi2
tab agegroup5 location, chi2
tab ethn4 location, col chi2
tab ethneuro location, chi2
tab ethnmaori location, chi2
tab ethnpac location, chi2
tab ethnoth location, chi2
tab nzdepquintiles location , col chi2
tab ses1 location, chi2
tab ses2 location, chi2
tab ses3 location, chi2
tab ses4 location, chi2
tab ses5 location, chi2
tab sesnil location, chi2
tab size location , col chi2
tab totalhospharm_y_n location, col chi2
summ age if hospadmit_y_n > 0, detail
summ age if (loc==0 & hospadmit_y_n > 0), detail
summ age if (loc==1 & hospadmit_y_n > 0), detail
hist age if (hospadmit_y_n==1), by(loc)
ranksum age if (hospadmit_y_n==1), by(loc)
tab agegroup20 location if hospadmit_y_n > 0, col chi2
tab ethn4 location if hospadmit_y_n > 0, col chi2
tab ethneuro location if hospadmit_y_n > 0, col chi2
tab ethnmaori location if hospadmit_y_n > 0, chi2
tab ethnpac location if hospadmit_y_n > 0, chi2
tab ethnoth location if hospadmit_y_n > 0, chi2
tab nzdepquintiles location if hospadmit_y_n > 0, col chi2
tab ses1 location if hospadmit_y_n > 0, chi2
tab ses2 location if hospadmit_y_n > 0, chi2
tab ses3 location if hospadmit_y_n > 0, chi2
tab ses4 location if hospadmit_y_n > 0, chi2
tab ses5 location if hospadmit_y_n > 0, chi2
tab sesnil location if hospadmit_y_n > 0, chi2
tab size location if hospadmit_y_n > 0, col chi2
tab large location if hospadmit_y_n > 0, chi2
tab medium location if hospadmit_y_n > 0, chi2
tab small location if hospadmit_y_n > 0, chi2
tab hospharm location if hospadmit_y_n > 0, col chi2
tab hospadmit_y_n hospharm_and_admission, col chi2
bysort gendernum :tab hospadmit_y_n hospharm_and_admission, col chi2
bysort agegroup20 :tab hospadmit_y_n hospharm_and_admission, col chi2
bysort ethn4 :tab hospadmit_y_n hospharm_and_admission, col chi2
bysort nzdepquintiles :tab hospadmit_y_n hospharm_and_admission, col chi2
bysort size :tab hospadmit_y_n hospharm_and_admission, col chi2
tab gendernum location if (hospharm_and_admission==1) , col chi2
summ age if (hospharm_and_admission==1), detail
summ age if (loc==0 & (hospharm_and_admission==1)), detail
summ age if (loc==1 & (hospharm_and_admission==1)), detail
hist age if (hospharm_and_admission==1), by(loc)
ranksum age if (hospharm_and_admission==1), by(loc)
tab agegroup20 location if (hospharm_and_admission==1), col chi2
tab ethn4 location if (hospharm_and_admission==1), col chi2
tab ethnmaori location if (hospharm_and_admission==1), chi2
tab ethnnpo location if (hospharm_and_admission==1), chi2
tab ethnneuro location if (hospharm_and_admission==1), chi2
tab ethnmaori location if (hospharm_and_admission==1), chi2
tab ethnpac location if (hospharm_and_admission==1), chi2
tab ethnoth location if (hospharm_and_admission==1), chi2

//Table 5 Number of admission events for rural and urban people and graph

summ nadmitepisode
summ nadmitepisode, detail
total nadmitepisode
summ nadmitepisode if location ==1
total nadmitepisode if location==1
summ nadmitepisode if location ==0
total nadmitepisode if location==0
tab n_harmadmits location, row chi2
hist nadmitepisode, by(loc)
ranksum nadmitepisode, by(loc)
ttest n_harmadmits, by(location)
gen numharmadmitsperpatient = n_harmadmits/hospadmit
hist numharmadmitsperpatient, by(loc)
ranksum numharmadmitsperpatient, by(loc)

//Figure 5 admission event frequency
recode nadmitepisode (10/max=10 "10+"), gen (nadmitepisode\n graph bar (count), over(nadmitepisode) graphregion(fcolor(white)
 lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white)
 ifcolor(white) ilcolor(white))
summ n_harmadmits
summ n_harmadmits, detail
total n_harmadmits
summ n_harmadmits if location ==1
total n_harmadmits if location==1
summ n_harmadmits if location ==0
total n_harmadmits if location==0
tab hospadmit_y_n hospharm_and_admission, row
bysort loc:tab hospadmit_y_n hospharm_and_admission, row

// Creating Table 6 Comparison of people who did and did not have a hospital
admission, number, % with 95% CI then unadjusted and adjusted rate ratios
tab gendernum hospadmit, row chi2
summ age if hospadmit==1, detail
summ age if hospadmit==0, detail
ci means age if ( hospadmit_y_n ==1 )
ci means age if ( hospadmit_y_n ==0 )
tab agegroup20 hospadmit, row chi2
tab ethn4 hospadmit, row chi2
tab nzdepquintiles hospadmit, row chi2
tab loc hospadmit, row chi2
tab size hospadmit, row chi2
tab study_group hospadmit, row chi2
tab hosparm_and_admission
histogram age if hospadmit ==0, width(5) percent
histogram age if hospadmit ==1, width(5) percent
bysort gendernum: ci prop hospadmit
bysort agegroup20: ci prop hospadmit
bysort ethn4: ci prop hospadmit
bysort nzdepquintiles: ci prop hospadmit
bysort location : ci prop hospadmit
bysort size : ci prop hospadmit
bysort study_group : ci prop hospadmit
bysort harmstatus : ci prop hospadmit
bysort gendernum: ci prop noadmit
bysort agegroup20: ci prop noadmit
bysort ethn4: ci prop noadmit
bysort nzdepquintiles: ci prop noadmit
bysort location : ci prop noadmit
bysort size : ci prop noadmit
bysort study_group : ci prop noadmit
bysort harmstatus : ci prop noadmit

//unadjusted rate ratios
svy: poisson hospadmit gendernum, irr
svy: poisson hospadmit c.c_age, irr
svy: poisson hospadmit i.agegroup20,irr
testparm i.agegroup20
pwcompare agegroup20, effect eform
svy: poisson hospadmit i.ethn4 ,irr
testparm i.ethn4
pwcompare ethn4, effect eform
svy: poisson hospadmit i.nzdepquintiles ,irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
svy: poisson hospadmit loc ,irr
svy: poisson hospadmit i.size ,irr
testparm i.size
pwcompare size, effect eform
svy: poisson hospadmit b4.study_group ,irr
testparm b4.study_group
pwcompare study_group, effect eform

//adjusted rate ratios
svy: poisson hospadmit_y_n i.location i.gendernum c.c_age i.nzdepquintiles i.ethn4 i.size, irr

//age interactions
svy: poisson hospadmit_y_n i.location i.gendernum c.c_age##c.c_age i.nzdepquintiles i.ethn4 i.size, irr
margins, at(age=(0(5)105))
marginsplot
svy: poisson hospadmit_y_n i.location i.gendernum c.c_age##c.c_age##c.c_age i.nzdepquintiles i.ethn4 i.size, irr
margins, at(age=(0(5)105))
marginsplot
svy: poisson hospadmit_y_n i.location i.gendernum c.c_age##c.c_age##c.c_age i.nzdepquintiles i.ethn4 i.size, irr
margins, at(age=(0(5)105))
marginsplot

//graph Figure 6
svy: poisson hospadmit_y_n i.location i.gendernum c.c_age##c.c_age##c.c_age i.nzdepquintiles i.ethn4 i.size, irr
margins, at(age=(0(5)105))
marginsplot, graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))

//age and gender interaction
svy: poisson hospadmit_y_n i.location c.c_age##c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
margins gendernum, at(age=(0(5)105))
marginsplot
testparm c.c_age#c.c_age#c.c_age#i.gendernum
svy: poisson hospadmit_y_n i.location c.c_age##c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
testparm c.c_age#i.gendernum
margins gendernum, at(age=(0(5)105))
marginsplot

//interactions, location and age, gender, ethnicity, nz dep, size
svy: poisson hospadmit_y_n i.gendernum c.c_age##c.c_age##c.c_age##i.location i.nzdepquintiles i.ethn4 i.size, irr
margins location , at(age=(0(5)105))
marginsplot
svy: poisson hospadmit_y_n i.gendernum c.c_age##c.c_age##c.c_age
c.c_age##i.location i.nzdepquintiles i.ethn4 i.size, irr
svy: poisson hospadmit_y_n i.gendernum c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.location i.nzdepquintiles i.ethn4 i.size, irr
svy: poisson hospadmit_y_n i.location c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
svy: poisson hospadmit_y_n i.location#i.ethn4 c.c_age##c.c_age##c.c_age
i.gendernum i.nzdepquintiles i.size, irr
testparm location#ethn4
svy: poisson hospadmit_y_n i.location#i.nzdepquintiles
c.c_age##c.c_age##c.c_age i.gendernum i.ethn4 i.size, irr
testparm location#nzdepquintiles
svy: poisson hospadmit_y_n i.location##i.size c.c_age##c.c_age##c.c_age
i.gendernum i.ethn4 i.nzdepquintiles, irr
testparm location##size

//Selecting Final model - with with age^3 or only age^2 - testing using Bayesian
information criterion, comparing likelihood ratio, lower value better
poisson hospadmit_y_n i.location c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size
[pweight=patweight], irr cluster(practiceid)
estat ic
poisson hospadmit_y_n i.location c.c_age##c.c_age
i.gendernum i.nzdepquintiles i.ethn4 i.size
[pweight=patweight], irr cluster(practiceid)
estat ic

//Final model for risk of hospital admission
svy: poisson hospadmit_y_n i.location c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr

//Figure 8
svy: poisson hospadmit_y_n i.location c.age##c.age##c.age
c.age##c.age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
margins gendernum , at(age=(0(5)105))
marginsplot, graphregion(fcolor(white) lcolor(white) ilcolor(white)
ilcolor(white)) plotregion(fcolor(white) lcolor(white) ilcolor(white)
ilcolor(white))
forvalues age=0(5)105 {
    display "Age=`age'"
    margin gendernum, dydx(age) at(age=`age')
    margin gendernum, dydx(age) at(age=`age') pwcompare(effect)
}
testparm i.ethn4
pwcompare ethn4, effect eform
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
testparm i.size
pwcompare size, effect eform

//Figure 7
margins size
marginsplot, recast(bar) graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))

//Creating Table 7 Comparing people with admission events resulting in harm compared to those not resulting in harm by demographics and unadjusted Risk ratio and adjusted
tab gendernum hosp Pharm_and_admission, row chi2
summ age if hospadmit==1, detail
summ age if hosp Pharm_and_admission==1, detail
summ age if nohosp Pharm==1, detail
ci means age if ( hospadmit==1 )
ci means age if ( hosp Pharm_and_admission==1 )
ci means age if ( nohosp Pharm==1 )
tab agegroup20 hosp Pharm_and_admission, row chi2
tab ethn4 hosp Pharm_and_admission, row chi2
tab nzdepquintiles hosp Pharm_and_admission, row chi2
tab loc hosp Pharm_and_admission, row chi2
tab size hosp Pharm_and_admission, row chi2
tab harmstatus hosp Pharm_and_admission, row chi2
tab hosp Pharm_and_admission
bysort gendernum: ci prop hosp Pharm_and_admission
bysort agegroup20: ci prop hosp Pharm_and_admission
bysort ethn4: ci prop hosp Pharm_and_admission
bysort nzdepquintiles: ci prop hosp Pharm_and_admission
bysort location: ci prop hosp Pharm_and_admission
bysort size: ci prop hosp Pharm_and_admission
bysort study_group: ci prop hosp Pharm_and_admission
bysort harm status: ci prop hosp Pharm_and_admission
bysort gendernum: ci prop nohosp Pharm
bysort agegroup20: ci prop nohosp Pharm
bysort ethn4: ci prop nohosp Pharm
bysort nzdepquintiles: ci prop nohosp Pharm
bysort location: ci prop nohosp Pharm
bysort size: ci prop nohosp Pharm
bysort study_group: ci prop nohosp Pharm
bysort harm status: ci prop nohosp Pharm
svy: poisson hosparm_and_admission gendernum, irr
svy: poisson hosparm_and_admission c.c_age, irr
svy: poisson hosparm_and_admission i.agegroup20,irr
svy: poisson hosparm_and_admission i.ethn4 ,irr
svy: poisson hosparm_and_admission i.nzdepquintiles ,irr
svy: poisson hosparm_and_admission loc ,irr
svy: poisson hosparm_and_admission i.size ,irr
svy: poisson hosparm_and_admission b4.study_group ,irr

//adjusted risk ratios people with hospital harms vs those without
svy: poisson hosparm_and_admission i.location i.gendernum  c.c_age
i.nzdepquintiles i.ethn4 i.size, irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
testparm i.ethn4
pwcompare ethn4, effect eform
testparm i.size
pwcompare size, effect eform

//age test for nonlinearity - quadratic relationship
svy: poisson hosparm_and_admission i.location i.gendernum  c.c_age##c.c_age
i.nzdepquintiles i.ethn4 i.size, irr
svy: poisson hosparm_and_admission i.location i.gendernum
cc_age##c.c_age##c.c_age i.nzdepquintiles i.ethn4 i.size, irr

//age (age^2) and gender interaction - yes
svy: poisson hosparm_and_admission i.location c.c_age##c.c_age##i.gendernum
i.nzdepquintiles i.ethn4 i.size, irr
testparm c.c_age#c.c_age#i.gendernum
svy: poisson hosparm_and_admission i.location c.c_age##c.c_age
cc_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
testparm c.c_age#i.gendernum

//Better model interatciton gender and age or age^2 better
poisson hosparm_and_admission i.location c.c_age##c.c_age##i.gendernum
i.nzdepquintiles i.ethn4 i.size [pweight=patweight], irr cluster(practiceid)
estat ic
poisson hosparm_and_admission i.location c.c_age##c.c_age
cc_age##i.gendernum i.nzdepquintiles i.ethn4 i.size [pweight=patweight], irr
cluster(practiceid)
estat ic

//interactions, location and age,
svy: poisson hosparm_and_admission i.gendernum  c.c_age##c.c_age
cc_age##i.location i.nzdepquintiles i.ethn4 i.size, irr
testparm c.c_age#i.loc
svy: poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
c.c_age##i.location i.nzdepquintiles i.ethn4 i.size, irr
testparm c.c_age#c.c_age#i.location

//Better model interactiton location and age or age^2 - age better
poisson hospharm_and_admission i.gendernum c.c_age##c.c_age##i.location
i.nzdepquintiles i.ethn4 i.size [pweight=patweight], irr cluster(practiceid)
estat ic
poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
i.nzdepquintiles i.ethn4 i.size [pweight=patweight], irr
cluster(practiceid)
estat ic

//interactions, location and , ethnicity, nz dep, size - note zero rural pacific people
with hospital harm so Pacific and other combined to test for interaction - none for
Ethn3, dep or location
donevar ethn3=ethn4
recode ethn3(3=4)
svy: poisson hospharm_and_admission i.location##i.ethn3 c.c_age##c.c_age
i.gendernum i.nzdepquintiles i.size, irr
testparm location#ethn3
svy: poisson hospharm_and_admission i.location##i.nzdepquintiles
c.c_age##c.c_age##c.c_age i.gendernum i.ethn4 i.size, irr
testparm location#nzdepquintiles
svy: poisson hospharm_and_admission i.location##i.size
c.c_age##c.c_age##c.c_age i.gendernum i.ethn4 i.nzdepquintiles , irr
testparm location#size

//Final model Comparing people with admission events resulting in harm
compared to those not resulting in harm, including age^2 and interactions
between age^2 and sex, and age and location, 17 EPV
svy: poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
i.c.age##i.gendernum c.c_age##i.location i.ethn4 i.nzdepquintiles
i.ethn4 i.size, irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
testparm i.ethn4
pwcompare ethn4, effect eform
testparm i.size
pwcompare size, effect eform

svy: poisson hospharm_and_admission i.gendernum c.age##c.age
c.age##c.age##i.gendernum c.age##i.location i.ethn4 i.nzdepquintiles i.ethn4
i.size, irr

//Figure 9 age and risk of harm
margins , at(age=(0(5)105))
marginsplot, graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))
// Figure 10 interaction age and location
margins location, at(age=(0(5)105))
marginsplot, graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))
margins, dydx(gendernum) at(age=(0(5)105))
// Figure 11 interaction between age^2 and sex
margins gendernum, at(age=(0(5)105))
marginsplot, graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))
margins, dydx(gendernum) at(age=(0(5)105))

// Table 8 poisson regression for harm admissions per hospital admission incidence rate ratio unadjusted and adjusted
// Unadjusted
svy: poisson n_harmadmits i.location, exposure( nadmitepisode) irr
svy: poisson n_harmadmits i.gendernum, exposure( nadmitepisode) irr
svy: poisson n_harmadmits c.c_age, exposure( nadmitepisode) irr
svy: poisson n_harmadmits i.nzdepquintiles, exposure( nadmitepisode) irr
pwcompare nzdepquintiles, effect eform
svy: poisson n_harmadmits i.ethn4, exposure( nadmitepisode) irr
pwcompare ethn4, effect eform
svy: poisson n_harmadmits i.size, exposure( nadmitepisode) irr
// Adjusted
svy: poisson n_harmadmits i.gendernum i.location c.c_age i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
testparm i.ethn4
pwcompare ethn4, effect eform
testparm i.size
pwcompare size, effect eform

// Testing for non linear association for age, Table 8
svy: poisson n_harmadmits i.gendernum i.location c.c_age##c.c_age i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
// Tests for interaction table 8
svy: poisson n_harmadmits i.gendernum i.location c.c_age i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
testparm i.ethn4
pwcompare ethn4, effect eform
testparm i.size
pwcompare size, effect eform
svy: poisson n_harmadmits i.gendernum##i.location c.c_age i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
svy: poisson n_harmadmits i.gendernum##c.c_age i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
testparm i.location#i.nzdepquintiles
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.ethn4 i.size, exposure( nadmitepisode) irr
testparm i.location##i.ethn4
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
testparm i.location#i.ethn4
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
testparm i.location#i.nzdepquintiles
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.ethn4 i.nzdepquintiles i.size, exposure( nadmitepisode) irr
testparm i.location#i.ethn4
svy: poisson n_harmadmits i.gendernum##c.c_age i.location##i.size i.nzdepquintiles i.ethn4 , exposure( nadmitepisode) irr
testparm i.location#i.size

//Final model for Table 8, poisson regression for harm admissions per hospital admission incidence rate ratio including interaction between location and nzdep
svy: poisson n_harmadmits i.gendernum c.c_age i.location##i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
testparm i.ethn4
pwcompare ethn4, effect eform
testparm i.size
pwcompare size, effect eform
testparm i.location##i.nzdepquintiles

//Figure 12 lcoation nzdep interaction
margins nzdep#loc
marginsplot
svy: poisson n_harmadmits i.gendernum c.c_age i.location##i.nzdepquintiles i.ethn4 i.size, exposure( nadmitepisode) irr
margins nzdepquintiles#loc, saving(tempmargins.dta, replace)
preserve
use tempmargins.dta, clear
drop if _m1==9
twoway (connected _margin_m1 if _m2==0, lcolor(cranberry)
mcolor(cranberry))(rcap_ci_lb_ci_ub_m1 if _m2==0, lcolor(cranberry)) ///
(connected _margin_m1 if _m2==1, lcolor(navy) mcolor(navy))(rcap_ci_lb
_ci_ub_m1 if _m2==1, lcolor(navy)), ///
legend(order(1 3) label(1 "Urban") label(3 "Rural") ytitle("Rate")
ylabel(0(0.5)2.5,nogrid) ///

453
//Table 10 comparing demographics of those with and without complete LOS data, and rural and urban for complete LOS, including p values

tab gendernum completelos, row chi2
summ age if completelos==1, detail
summ age if hospadmit==1, detail
hist (age), by (completelos)
ranksum (age), by (completelos)
tab agegroup20 completelos, row
tab ethn4 completelos, row
tab nzdepquintiles completelos, row
tab loc completelos, row
tab size completelos, row
tab study_group completelos, row
tab hospfarm_and_admission completelos, row
tab loc completelos, col chi2
hist (age) if (completelos==1), by (loc)
ranksum (age) if (completelos==1), by (loc)
tab agegroup1 completelos, col chi2
tab agegroup2 completelos, col chi2
tab agegroup3 completelos, col chi2
tab agegroup4 completelos, col chi2
tab agegroup5 completelos, col chi2
tab ethn4 completelos, col chi2
tab ethneuro completelos, col chi2
tab ethnaori completelos, col chi2
tab ethnpac completelos, col chi2
tab ethnoth completelos, col chi2
tab nzdepquintiles completelos, col chi2
tab ses1 completelos, col chi2
tab ses2 completelos, col chi2
tab ses3 completelos, col chi2
tab ses4 completelos, col chi2
tab ses5 completelos, col chi2
tab sesnil completelos, col chi2
tab size completelos, col chi2
tab large completelos, col chi2
tab medium completelos, col chi2
tab small completelos, col chi2
tab hospfarm completelos, col chi2
tab study_group completelos, col chi2
tab rurallarge completelos, col chi2
tab ruralmedium completelos, col chi2
tab ruralsmall completelos, col chi2  
(tab urbanlarge completelos, col chi2  
(tab urbanmedium completelos, col chi2  
(tab urbansmall completelos, col chi2  
(summ age if (completelos==1 & loc==1), detail  
(summ age if (completelos==1 & loc==0), detail  
(tab gendernum loc if (completelos==1), row chi2  
(tab gendernum loc if (completelos==1), col chi2  
(tab size loc if (completelos==1), col chi2  
(tab large loc if (completelos==1), col chi2  
(tab medium loc if (completelos==1), col chi2  
(tab small loc if (completelos==1), col chi2  
(tab agegroup20 loc if (completelos==1), col chi2  
(tab agegroup1 loc if (completelos==1), col chi2  
(tab agegroup2 loc if (completelos==1), col chi2  
(tab agegroup3 loc if (completelos==1), col chi2  
(tab agegroup4 loc if (completelos==1), col chi2  
(tab agegroup5 loc if (completelos==1), col chi2  
(tab ethn4 loc if (completelos==1), col chi2  
(tab ethneuro loc if (completelos==1), col chi2  
(tab ethnmaori loc if (completelos==1), col chi2  
(tab ethnpac loc if (completelos==1), col chi2  
(tab ethnoth loc if (completelos==1), col chi2  
(tab nzdepq quintiles loc if (completelos==1), col chi2  
(tab ses1 loc if (completelos==1), col chi2  
(tab ses2 loc if (completelos==1), col chi2  
(tab ses3 loc if (completelos==1), col chi2  
(tab ses4 loc if (completelos==1), col chi2  
(tab ses5 loc if (completelos==1), col chi2  
(tab sesnil loc if (completelos==1), col chi2  
(tab hospharm loc if (completelos==1), col chi2  

//Data on day stays etc  
(tab numberdaystay if completelos==1  
(tab numberdaystay if (completelos==1 & numberdaystay!=0)  
(tab numberdaystay if (completelos==1 & numberdaystay!=0 & novernightadmits==0)  
(tab novernightadmits if totalobd!=.  
(tab novernightadmits if (totalobd!=. & novernightadmits!=0)  
(tab numberdaystay novernightadmits if (totalobd!=. & novernightadmits!=0)  
(tab numberdaystay novernightadmits if completelos==1  
(summ numberdaystay if completelos==1, det  
test numberdaystay if completelos==1, loc  

//Table 10 harm no harm, number of admissions, ave LOS and OBD of admissions when LOS data known
summ nadmitepisode if (totalobd!=.), det
summ nadmitepisode if (totalobd!=. & hospharm_and_admission ==1), det
summ nadmitepisode if (totalobd!=. & hospharm_and_admission ==0), det
svy: poisson nadmitepisode hospharm_and_admission if totalobd!=., irr
svy: nbreg nadmitepisode hospharm_and_admission if totalobd!=., irr

summ avlos if (totalobd!=.), det
summ avlos if (totalobd!=. & hospharm_and_admission ==1), det
summ avlos if (totalobd!=. & hospharm_and_admission ==0), det
svy: poisson avlos hospharm_and_admission if totalobd!=., irr
svy: nbreg avlos hospharm_and_admission if totalobd!=., irr
summ totalobd if (totalobd!=.), det
summ totalobd if (totalobd!=. & hospharm_and_admission ==1), det
summ totalobd if (totalobd!=. & hospharm_and_admission ==0), det
svy: poisson totalobd hospharm_and_admission if totalobd!=., irr
svy: nbreg totalobd hospharm_and_admission if totalobd!=., irr

//Table 15 R vs U number of admissions, number of harm admissions, ave LOS and OBD of admissions when LOS data known
summ nadmitepisode if (totalobd!=.), det
summ nadmitepisode if (totalobd!=. & loc ==1), det
summ nadmitepisode if (totalobd!=. & loc ==0), det
svy: poisson nadmitepisode loc if totalobd!=., irr
svy: nbreg nadmitepisode loc if totalobd!=., irr
summ nadmitepisode if (totalobd!=. & numberdaystay==0), det
summ nadmitepisode if (totalobd!=. & numberdaystay==0 & loc ==1), det
summ nadmitepisode if (totalobd!=. & numberdaystay==0 & loc ==0), det
svy: poisson nadmitepisode loc if (totalobd!=. & numberdaystay==0), irr
svy: nbreg nadmitepisode loc if (totalobd!=. & numberdaystay==0), irr
summ numberdaystay if (totalobd!=.), det
summ numberdaystay if (totalobd!=. & loc ==1), det
summ numberdaystay if (totalobd!=. & loc ==0), det
svy: poisson numberdaystay loc if totalobd!=., irr
svy: nbreg numberdaystay loc if totalobd!=., irr
summ n_harmadmits if (totalobd!=.), det
summ n_harmadmits if (totalobd!=. & loc ==1), det
summ n_harmadmits if (totalobd!=. & loc ==0), det
svy: poisson n_harmadmits loca if totalobd!=., irr
svy: nbreg n_harmadmits loca if totalobd!=., irr
summ avlos if (totalobd!=.), det
summ avlos if (totalobd!=. & loc ==1), det
summ avlos if (totalobd!=. & loc ==0), det
svy: poisson avlos loc if totalobd!=., irr
svy: nbreg avlos loc if totalobd!=., irr
summ totalobd if (totalobd!=.), det

456
summ totalobd if (totalobd!=. & loc ==1), det
summ totalobd if (totalobd!=. & loc ==0), det
svy: poisson totalobd loc if totalobd!=., irr
svy: nbreg totalobd loc if totalobd!=., irr

//Table 11 Unadjusted and Adjusted Total occupied bed days for admission events resulting in harm
//unadjusted
svy: nbreg totalobd i.hospharm_and_admission , irr
svy: nbreg totalobd i.location, irr
svy: nbreg totalobd c.c_age , irr
svy: nbreg totalobd i.gendernum , irr
svy: nbreg totalobd i.ethn4, irr
testparm i.ethn4
pwcompare ethn4, effect eform
svy: nbreg totalobd i.nzdepquint, irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
svy: nbreg totalobd i.size, irr
testparm i.size
pwcompare size, effect eform

//testing for nonlinear association with age (linear)
svy: nbreg totalobd c.c_age , irr
svy: nbreg totalobd i.hospharm_and_admission c.c_age##c.c_age2 , irr

//testing for individual factors to add in final model
svy: nbreg totalobd i.hospharm_and_admission c.c_age, irr
svy: nbreg totalobd i.hospharm_and_admission i.loc, irr
svy: nbreg totalobd i.hospharm_and_admission i.gendernum , irr
svy: nbreg totalobd i.hospharm_and_admission i.ethn4, irr
testparm i.ethn4
pwcompare ethn4, effect eform
svy: nbreg totalobd i.hospharm_and_admission i.nzdep , irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform
svy: nbreg totalobd i.hospharm_and_admission i.size, irr
testparm i.size
pwcompare size, effect eform

//model with 8 slots
svy: nbreg totalobd i.hospharm_and_admission i.location c.c_age i.nzdepquintiles, irr
testparm i.nzdepquintiles
pwcompare nzdepquintiles, effect eform

//testing for interactions (none)
svy: nbreg totalobd i.hospharm_and_admission i.location##c.c_age i.nzdepquintiles, irr
svy: nbreg totalobd i.hospharm_and_admission##i.location c.c_age i.nzdepquintiles, irr
svy: nbreg totalobd i.hospharm_and_admission##c.c_age i.location i.nzdepquintiles, irr
svy: nbreg totalobd i.hospharm_and_admission##c.c_age i.location##i.nzdepquintiles, irr
testparm i.location#i.nzdepquintiles

//adding ethnicity in to final model to check doesn’t improve it
svy: nbreg totalobd i.hospharm_and_admission i.location c.c_age i.ethn4, irr
testparm i.ethn4
pwcompare ethn4, effect eform

//Table 15 (new 12) Different rurality definitions and subgroup sizes, total, admissions, harm
tab loc
tab hospadmit_y_n loc, row
tab hosparm_and_admission loc, row
tab rrs2
tab hospadmit_y_n rrs2, row
tab hosparm_and_admission rrs2, row
tab rrs3
tab hospadmit_y_n rrs3, row
tab hosparm_and_admission rrs3, row
tab nbh
tab hospadmit_y_n nbh, row
tab hosparm_and_admission nbh, row
tab rural3
tab hospadmit_y_n rural3, row
tab hosparm_and_admission rural3, row
tab hospdrivetime
tab hospadmit_y_n hospdrivetime, row
tab hosparm_and_admission hospdrivetime, row

//Table 16 (new 13) Different definitions of rurality and final models
//Risk of hospital admission

458
svy: poisson hospadmit_y_n i.location c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
svy: poisson hospadmit_y_n i.rrs2 c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
testparm i.rrs3
pwcompare rrs3, effect eform
svy: poisson hospadmit_y_n i.nbh c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
testparm i.nbh
pwcompare nbh, effect eform
svy: poisson hospadmit_y_n i.rural3 c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
testparm i.rural3
pwcompare rural3, effect eform
svy: poisson hospadmit_y_n i.hospdrivetime c.c_age##c.c_age##c.c_age
c.c_age##c.c_age##i.gendernum i.nzdepquintiles i.ethn4 i.size, irr
testparm i.hospdrivetime
pwcompare hospdrivetime, effect eform

//Risk of hospital harm
svy: poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
cc.c_age##c.c_age##i.gendernum c.c_age##i.location i.ethn4 i.nzdepquintiles
i.ethn4 i.size, irr
svy: poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
cc.c_age##c.c_age##i.gendernum c.c_age##i.rrs2 i.ethn4 i.nzdepquintiles i.ethn4
i.size, irr
svy: poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
cc.c_age##c.c_age##i.gendernum c.c_age##i.rural3 i.ethn4 i.nzdepquintiles i.ethn4
i.size, irr
testparm i.rrs3
pwcompare rrs3, effect eform
svy: poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
cc.c_age##c.c_age##i.gendernum c.c_age##i.nbh i.ethn4 i.nzdepquintiles i.ethn4
i.size, irr
testparm i.nbh
pwcompare nbh, effect eform
svy: poisson hospharm_and_admission i.gendernum c.c_age##c.c_age
cc.c_age##c.c_age##i.gendernum c.c_age##i.rural3 i.ethn4 i.nzdepquintiles i.ethn4
i.size, irr
testparm i.rural3
pwcompare rural3, effect eform
svy: poisson hospharm_and_admission i.gendernum  c.c_age##c.c_age  
c.c_age##c.c_age##i.gendernum c.c_age##i.hospdrivetime i.ethn4 i.nzdepquintiles  
i.ethn4 i.size, irr  
testparm i.hospdrivetime  
pwcompare hospdrivetime, effect eform  

//rate harm per admission event  
svy: poisson n_harmadmits i.gendernu c.c_age i.location##i.nzdepquintiles i.ethn4  
i.size, exposure( nadmitepisode) irr  
svy: poisson n_harmadmits i.gendernu c.c_age i.rrs2##i.nzdepquintiles i.ethn4  
i.size, exposure( nadmitepisode) irr  
svy: poisson n_harmadmits i.gendernu c.c_age i.rrs3##i.nzdepquintiles i.ethn4  
i.size, exposure( nadmitepisode) irr  
testparm i.rrs3  
pwcompare rrs3, effect eform  
svy: poisson n_harmadmits i.gendernu c.c_age i.nbh##i.nzdepquintiles i.ethn4  
i.size, exposure( nadmitepisode) irr  
testparm i.nbh  
pwcompare nbh, effect eform  

svy: poisson n_harmadmits i.gendernu c.c_age i.nbh##i.nzdepquintiles i.ethn4  
i.size, exposure( nadmitepisode) irr  
testparm i.hospdrivetime  
pwcompare hospdrivetime, effect eform  
svy: poisson n_harmadmits i.gendernu c.c_age i.rural3##i.nzdepquintiles i.ethn4  
i.size, exposure( nadmitepisode) irr  
testparm i.rural3  
pwcompare rural3, effect eform  

//averaging nzdep for nearest base hospital adjusted rate ratio hospital harm per  
admission  
margins rural3, pwcompare  

//Figure 13  
margins nzdepquintiles#rural3  
marginsplot  
testparm nzdepquintiles#rural3  
margins, dydx(rural3) at(nzdep=(1 2 3 4 5 9))  
svy: poisson n_harmadmits i.gendernu c.c_age i.hospdrivetime##i.nzdepquintiles  
i.ethn4 i.size, exposure( nadmitepisode) irr  
testparm i.hospdrivetime  
pwcompare hospdrivetime, effect eform  

//Risk of preventable harm with different rurality definitions
svy: poisson anyprevharm i.location i.gendernum c.c.age i.ethn4 , irr
svy: poisson anyprevharm i.rrs2 i.gendernum c.c.age i.ethn4 , irr
svy: poisson anyprevharm i.rrs3 i.gendernum c.c.age i.ethn4 , irr

pwcompare rrs3, effect eform
svy: poisson anyprevharm i.nbh i.gendernum c.c.age i.ethn4 , irr

pwcompare nbh, effect eform
svy: poisson anyprevharm i.rural3 i.gendernum c.c.age i.ethn4 , irr

pwcompare rural3, effect eform
svy: poisson anyprevharm i.hospdrivetime i.gendernum c.c.age i.ethn4 , irr

//Figure 13
svy: poisson n_harmadmits i.gendernu c.c.age i.rural3##i.nzdepquintiles i.ethn4 i.size, exposure( nadmiteepisode) irr
margins nzdepquintiles#rural3, saving(tempmargins.dta, replace)
preserve
use tempmargins.dta, clear
drop if _m1==9
twoway (connected _margin _m1 if _m2==1, lcolor(navy) mcolor(navy))(rcap _ci_lb _ci_ub _m1 if _m2==1, lcolor(navy)) //
   (connected _margin _m1 if _m2==2, lcolor(maroon) mcolor(maroon))(rcap _ci_lb _ci_ub _m1 if _m2==2, lcolor(maroon)) //
   (connected _margin _m1 if _m2==3, lcolor(orange) mcolor(orange))(rcap _ci_lb _ci_ub _m1 if _m2==3, lcolor(orange)), ///
   legend(order(1 3 5) label(1 "Urban") label(3 "Rural, less than 30 km") label(5 "Rural, 30 km or more")) ytitle("Rate")
   ylabel(0(0.5)2.5,nogrid) ///
   graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))
restore

//Preventability, severity and where harm detected and type of harms by rural urban location

tab anyprevharm if hosparm_and_admission==1

//Preventability, severity and where harm detected and type of harms by rural urban location

tab anyprevharm loc if hosparm_and_admission==1

tab anyprevharm loc if hosparm_and_admission==1, col chi2

tab highestseverity loc if hosparm_and_admission==1, col chi2

tab anyharmgpdetected

tab anyharmgpdetected loc if hosparm_and_admission==1, col chi2

tab anyharmgpdetected harmtype if hosparm_and_admission==1, col chi2

tab anyharmgpdetected size, col chi2

tab anyharmgpdetected gendernum, col chi2

tab anyharmgpdetected ethn4, row chi2
tab anyharmgpdetected nzdepq, row chi2

//Creating Table xx Comparing people with any preventable vs no preventable hospital harm by demographics and unadjusted Risk ratio and adjusted
tab gendernum anyprevharm if hospfarm_and_admission, row chi2
summ age if anyprevharm==1, detail
summ age if (anyprevharm & hospfarm_and_admission==1), detail
summ age if anyprevharm==0, detail

ci means age if ( anyprevharm==1 )
ci means age if ( hospfarm_and_admission==1 )
ci means age if ( anyprevharm==0 )
tab agegroup20 anyprevharm if hospfarm_and_admission==1, row chi2
tab ethn4 anyprevharm if hospfarm_and_admission==1, row chi2
tab nzdepquintiles anyprevharm if hospfarm_and_admission==1, row chi2
tab loc anyprevharm if hospfarm_and_admission==1, row chi2
tab size anyprevharm if hospfarm_and_admission==1, row chi2
tab study_group anyprevharm if hospfarm_and_admission==1, row chi2
bysort gendernum: ci prop anyprevharm if hospfarm_and_admission==1
bysort agegroup20: ci prop anyprevharm if hospfarm_and_admission==1
bysort ethn4: ci prop anyprevharm if hospfarm_and_admission==1
bysort nzdepquintiles: ci prop anyprevharm if hospfarm_and_admission==1
bysort location : ci prop anyprevharm if hospfarm_and_admission==1
bysort size : ci prop anyprevharm if hospfarm_and_admission==1
bysort study_group : ci prop anyprevharm if hospfarm_and_admission==1
bysort harmstatus : ci prop anyprevharm if hospfarm_and_admission==1
bysort gendernum: ci prop noprevharm
bysort agegroup20: ci prop noprevharm
bysort ethn4: ci prop noprevharm
bysort nzdepquintiles: ci prop noprevharm
bysort location : ci prop noprevharm
bysort size : ci prop noprevharm
bysort study_group : ci prop noprevharm
bysort harmstatus : ci prop noprevharm
svy: poisson anyprevharm c.c_age, irr
svy: poisson anyprevharm i.agegroup20,irr
svy: poisson anyprevharm i.ethn4,irr
svy: poisson anyprevharm i.nzdepquintiles,irr
svy: poisson anyprevharm loc,irr
svy: poisson anyprevharm i.size ,irr
svy: poisson anyprevharm b4.study_group ,irr
svy: poisson anyprevharm gendernum ,irr

//adjusted risk ratios people with preventable harms vs those without any preventable harms with ethn4 and nzdep separately
svy: poisson anyprevharm i.location i.gendernum c.c_age i.ethn4 , irr
testparm i.ethn4
pwcompare ethn4, effect eform

//Maximum severity of harm
tab highestseverity location, chi2 col
tab highestseverity gendernum, chi2 col

//test for violation of proportional odds (didn't violate)
gologit2 highestseverity i.location patweight, cluster(practiceid) eform autofit
gologit2 highestseverity i.gendernum patweight, cluster(practiceid) eform autofit

//ologit ordinaloutcome c.continuousvar i.categoricalvar, cluster(clustervar) or -template to use
ologit highestseverity i.location patweight, cluster(practiceid) or
ologit highestseverity c.age patweight, cluster(practiceid) or
ologit highestseverity i.gendernum patweight, cluster(practiceid) or
ologit highestseverity i.location c.age i.gendernum patweight, cluster(practiceid) or

//Table xx association between hospital transfer and risk of hospital harm
total nadmitepisode
total nadmissions
total nadmitepisode if loc==0
total nadmitepisode if loc==1
total nadmissions if loc==0
total nadmissions if loc==1	tab transfers	tab transfers loc

histogram age if bintransfer ==1, width(5) percent graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))
histogram age if (ruraladmit ==1), width(5) percent graphregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white)) plotregion(fcolor(white) lcolor(white) ifcolor(white) ilcolor(white))
summ age if (ruraladmit==1 & bintransfer ==1), detail
summ age if (ruraladmit==1 & bintransfer ==0), detail
summ age if (bintransfer ==1 & ruralharm ==1), detail
summ age if (bintransfer ==1 & ruralharm ==0), detail
histogram age if (ruraladmit ==1), by (bintransfer)
ranksum age if (ruraladmit ==1), by (bintransfer)
tab bintransfer loc, col chi2
bysort loc: ci prop bintransfer
svy: poisson hospfarm_and_admission i.bintransfer, irr
svy: poisson hospfarm_and_admission i.bintransfer i.loc, irr
tab hospfarm_and_admission bintransfer, row chi2
tab ruralharm bintransfer, row exact
svy: poisson ruralharm i.bintransfer, irr
svy: poisson ruralharm i.bintransfer c.age, irr
svy: poisson ruralharm i.bintransfer i.gendernum, irr

//Kappa Number of harms that were hospital related harms
use "C:\Users\Carol Atmore\Documents\Foxley research\Hospital Harms study\Stata files\Final analysis\Clean stata files\Original 9076 patients.dta", clear
rename * ,lower
merge 1:1 patientid using "C:\Users\Carol Atmore\Documents\Foxley research\Hospital Harms study\Stata files\Final analysis\Clean stata files\Aug18 for analysis All Harms identified by both GP reviewers.sav.dta"
//hospital harm/no harm kappa with 95% CI
tab harmstatusn_1 harmstatusn_2 if hospadmit_y_n==1
kapci harmstatusn_1 harmstatusn_2 if hospadmit_y_n==1
//number of hospital harms kappa with 95% CI
tab freqharms_1 freqharms_2 if hospadmit_y_n==1
kapci freqharms_1 freqharms_2 if hospadmit_y_n==1, reps(1000) seed(12345)
kapi freqharms_1 freqharms_2 if hospadmit_y_n==1, wgt(w) reps(1000) seed(12345)
tab n_agreed_harms hospharm_and_admission if hospharm_and_admission==1
total n_agreed_harms if hospharm_and_admission==1
//Kappa Prev and sev of hospital related harms with 95% CI
drop _merge
merge 1:m patientid using "C:\Users\Carol Atmore\Documents\Foxley research\Hospital Harms study\Stata files\Final analysis\Clean stata files\GP reviewer double coded for preventability and severity for Kappa.sav.dta"
kapi prevrev1 prevrev2 if hospharm_and_admission==1, reps(1000) seed(12345)
kapi sevrev1 sevrev2 if hospharm_and_admission==1, reps(1000) seed(12345)
kapi sevrev1 sevrev2 if hospharm_and_admission==1, wgt(w) reps(1000) seed(12345)