

**Reversing the decay of preschool oral health: a mixed
methods approach to examining the influences on
preschool oral health.**

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Abstract

The prevalence of early childhood caries is high in certain populations. Early childhood caries has a significant effect on an individual's immediate oral health status as well as their oral health status later in life. It is important that good oral health behaviours are performed from an early age in order to protect both primary and secondary teeth.

Preschoolers do not have the capacity to properly care for their oral health, and therefore are reliant on their caregivers to perform good oral health behaviours. Local and international health agencies have had an increasing focus on preschool oral health care. Despite its growing importance there is little research on what factors influence how a parent cares for their preschooler's oral health. This thesis aims to fill part of this gap, especially within the New Zealand context. This research takes a closer look at the knowledge factors that parents have, and examines whether these factors have a direct impact on the preschool oral healthcare provided.

This thesis uses a mixed methods approach. The research involved two phases, a quantitative phase (n=1056), where a secondary analysis of an existing dataset was carried out, and a qualitative phase (n=6), which consisted of individual interviews with parents from low income communities. The interview questions were developed after analysing the quantitative data, and were in line with the theoretical framework, the Fisher-Owens Model (Fisher-Owens et al., 2007).

Overall the results showed a plethora of factors influence how a parent cares for their preschooler's oral health. Impacting factors were found to exist on multiple levels. A significant relationship was seen between a parent having oral health knowledge and being more likely to perform recommended oral health behaviours on their preschooler. Differences in parents' knowledge by population characteristics were also seen. Examples of this include parents who had older preschoolers and parents who brushed their own teeth at least twice a day, were both more likely to have the appropriate knowledge. Parents felt they had insufficient information on the recommended preschool oral health behaviours. Parents based a lot of their current knowledge on their own oral health behaviours, as well as information they received from Plunket Services. Parents often noted time pressures and the consumption of sugar as factors that hindered their ability to care for their preschooler's teeth.

Currently there is limited preschool oral health research in New Zealand. Overall, this research expands on the knowledge base for preschool oral health in New Zealand. Establishing factors that influence how a parent cares for their preschooler's oral health in New Zealand provides a good starting point to base future oral health promotion. In particular, identifying that knowledge has a positive effect on the oral health behaviours parents perform on their child provides a mandate to focus on increasing parents' oral health knowledge. Confirming that factors other than knowledge impact how a parent cares for their preschooler's oral health means that a broader approach to improving preschool oral health should be considered.

This thesis will be beneficial for any individual who is involved in paediatric health care, as well as policy makers in this area. An increased focus on preventative action can have a beneficial effect by reducing the health care requirements an individual may have throughout their lifetime. Due to the significant cost (both financial and social) of poor oral health, any reduction in dental caries would result in cost benefits to the individual and the state.

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Abbreviations

2009 NZOHS	2009 New Zealand Oral Health Survey
2015/16 NZHS	2015/16 New Zealand Health Survey
COHS	Community Oral Health Service
dmft	decayed, missing, filled primary teeth
DMFT	Decayed, missing, filled secondary teeth
Fisher-Owens Model	Fisher-Owens Conceptual Model of Oral Health
HPA	Health Promotion Agency
MoH	Ministry of Health
US	United States of America
WHO	World Health Organization

Chapter 1 - Background

1.1 Introduction

Dental caries (tooth decay) is prevalent in almost all population groups and inequalities are evident (Tinanoff & O'Sullivan, 1997). Dental caries can have substantial negative consequences for a person's health and well-being throughout their lifetime. Yet, dental caries is largely preventable (Peres & Heilmann, 2015). Treatment for dental caries is costly for individuals and health care systems and, in many developed countries, it is one of the most expensive diseases to treat (Peres & Heilmann, 2015; Petersen, 2003). As such, dental caries is of substantial public health concern (Bagramian, Garcia-Godoy, & Volpe, 2009; Peres & Heilmann, 2015; Schwendicke, Doost, Hopfenmüller, Meyer-Lueckel, & Paris, 2015).

Dental caries can occur in people of all ages, including young children (Colak, Dülgergil, Dalli, & Hamidi, 2013). Early childhood caries is defined as “the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in a primary tooth in a preschool-age child between birth and 71 months of age” (American Academy of Pediatric Dentistry, American Academy of Pediatrics, & American Academy of Pediatric Dentistry Council on Clinical Affairs, 2005). This thesis focuses on early childhood caries as it can have life-long consequences (Colak et al., 2013; Mofidi, Zeldin, & Rozier, 2009). As parents are the main carer of their preschooler's oral health, this thesis aims to explore factors that influence how parents care for their preschooler's oral health. This thesis also examines differences in knowledge and behaviours by sociodemographic characteristics.

1.1.1 Research questions

This research aims to address the following over-arching research question:

What factors influence the oral health care parents provide for their preschooler?

The sub-questions chosen to help answer this over-arching question are:

- i. *Does a parent's knowledge of preschool oral health have an association with the oral health care they provide for their preschooler?*
 - This has been examined by looking at whether a parent's level of oral health knowledge differs by child and respondent characteristics?

- ii. *What factors other than knowledge influence the oral health care that a parent provides for their preschooler?*

This has been examined by looking at whether:

- there are differences in how parents care for their preschooler's oral health, by population characteristics?
- differences in population characteristics impact how parents care for their preschooler's oral health?
- there are community and environmental factors that impact how parents care for their preschooler's oral health?

1.1.2 Thesis outline

This thesis aims to answer the research questions stated above in Section 1.1.1. To answer the questions the thesis first (Chapter 1) provides a background and introduces early childhood caries. Chapter 2 provides a review of the current and relevant literature. Chapter 3 presents the methodology and methods that were used in the thesis to allow the research questions to be answered, and Chapter 4 presents the results. Chapter 5 provides a discussion of the results and answers the research questions.

1.1.2 Chapter outline

This chapter presents the significance of dental caries as a public health issue. The chapter begins with Section 1.2 defining dental caries and its measures, and Section 1.3 discusses the prevalence of dental carries. Section 1.4 introduces early childhood caries in more detail, while Section 1.5 outlines the consequences of early childhood caries. Section 1.6 discusses the aetiology and prevention of dental caries. The aetiology of dental caries is broken down into child, family and community- and environmental-level influences. Socioecological models of health are described in Section 1.7. A conclusion of Chapter 1 is then presented in Section 1.9.

1.2 Dental caries – definition and measures

1.2.1 Definitions

Dental caries is a progressive, preventable, chronic disease, defined as “a localized, post-eruptive, pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity” (World Health Organization, 1962, p. 9). Early

childhood caries is a specific form of dental caries that refers to the presence of the disease in children of preschool age (hereafter ‘preschoolers’). As mentioned earlier, early childhood caries is defined as “the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in a primary tooth in a preschool-age child between birth and 71 months of age” (American Academy of Pediatric Dentistry et al., 2005).

1.2.2 Measures

There are several measures of dental caries prevalence that were reported on in this thesis. These measures include: the proportion of children who are caries-free, the proportion of children who have untreated dental caries, the proportion of children who are missing one or more teeth due to dental caries; and the sum of the number of decayed, missing and filled primary (dmft) or secondary (DMFT) teeth due to dental caries. The DMFT index is the most widely used measure of an individual’s oral health status (Kirch, 2008). Each measure provides an indication of oral health status; the dmft/DMFT reflects an individual’s life-time dental caries experience. These measures were chosen to report on as they are commonly used within the oral health literature. In New Zealand these measures are also commonly used, such as by the Ministry of Health (MoH) in their large oral health survey in 2009 (Ministry of Health, 2010). Using the same measures makes it easier to compare results between studies.

1.3 Dental caries - prevalence

1.3.1 Global

Dental caries is prevalent in almost all population groups (Petersen, 2003). It is estimated that, worldwide, five billion people are affected by dental caries (Peres & Heilmann, 2015). The World Health Organization (WHO) estimates that in developed countries almost all adults, and 60 – 90% of school children, are affected by dental caries (Petersen, 2003). Until recent decades, the prevalence of dental caries in the developing world was relatively low (Petersen, 2003). However, in those countries the prevalence of dental caries is now increasing, with the increased consumption of sugar playing a substantial role (Petersen, 2003; Petersen, Bourgeois, Ogawa, Estupinan-Day, & Ndiaye, 2005). In developing countries, due to the limited access to oral health services, over 90% of dental caries remain untreated (Petersen, 2003).

Dental caries prevalence is disproportionally distributed within and among countries (Petersen, 2003). As with other non-communicable diseases, the greatest proportion of dental caries

occurs in the most vulnerable and socially disadvantaged population groups (Peres & Heilmann, 2015; Thomson et al., 2004). That the highest concentration of dental caries exists in the most disadvantaged societies is both unfair and unjust (Peres & Heilmann, 2015). However, dental caries is largely preventable and such inequalities are avoidable.

Despite its prevalence, in the last three decades in the developed world, significant reductions in the rate of dental caries have occurred (Petersen, 2003; Pretty & Ellwood, 2013; Schwendicke et al., 2015). Such improvements are attributed to the fluoridation of community water supplies, and to the increased awareness of oral self-care and hygiene practices (Armfield, 2007). However, improvements in oral health have not occurred in all population groups, with dental caries prevalence in lower socioeconomic population groups either increasing or remaining consistent (Petersen, 2003). This trend is supported by a growing body of literature which shows the disparities in the rate of dental caries between population groups is worsening, as it becomes more concentrated in fewer areas of society (Peres & Heilmann, 2015; Schwendicke et al., 2015). The increase in dental caries prevalence appears to be mostly occurring in lower socioeconomic groups, new immigrants and children (Bagramian et al., 2009). Research has partially linked this trend to disadvantaged population groups having increased exposure to dental caries risk factors and inadequate access to appropriate health services (Peres & Heilmann, 2015; Petersen, 2003).

1.3.2 New Zealand

In New Zealand, dental caries is the most prevalent chronic disease among all population groups (Ministry of Health, 2006). The 2009 New Zealand Oral Health Survey (2009 NZOHS), which reports on the most recent national oral health data, found that the mean DMFT for adults (n=2209 adults) aged 18 years and over was 13.9 (0.8 decayed, 4.6 missing and 8.5 filled teeth) (Ministry of Health, 2010). In children aged two to 11 years, the mean dmft was 1.6 (Ministry of Health, 2010). Further, just over half of children aged five to 17 years (58% five to 11-year olds and 56% 12 to 17-year olds) had experienced dental caries (Ministry of Health, 2010). Furthermore, just over one third (35%) of New Zealand adults, and approximately one in six (15.9%) children aged two to 17 years, had untreated decay in one or more of their teeth (Ministry of Health, 2010).

Disparities in New Zealand adults

The 2015/16 New Zealand Health Survey (2015/16 NZHS) reported that Māori adults were one and a half (RR 1.5) times as likely, and Pacific adults were twice (RR 2.0) as likely, to have had a tooth removed in the past 12 months, than non-Māori and non-Pacific adults, respectively (Ministry of Health, 2016). Differences were also seen by deprivation. Adults living in the most deprived areas were one and a half times (RR 1.5) as likely to have a tooth extracted in the previous 12 months as adults living in the least deprived areas (Ministry of Health, 2016). These findings are likely to be an underestimation, given they are based on self-reported data.

Disparities in New Zealand children

In New Zealand, the distribution of dental caries in the child population is similar to that in the adult population, with differences in prevalence by ethnicity and deprivation evident. The 2015/16 NZHS found that Māori children (0 to 12-years) were 1.7 times as likely as non-Māori children, and Pacific children (0 to 12-years) two and a half (RR 2.5) times as likely as non-Pacific children, to have had a tooth extracted in the past 12 months (Ministry of Health, 2016). The need for extraction is indicative of disease severity.

1.4 Early childhood caries

Early childhood caries occurs worldwide. Its prevalence is estimated to range from 1 to 12% in developed countries, and 50 to 80% in developing countries (Hallett & O'Rourke, 2003). As in the adult population, early childhood caries is socially patterned by ethnicity and deprivation (Kawashita, Kitamura, & Saito, 2011; Vargas & Ronzio, 2006). In New Zealand, there is limited data on oral health, especially in preschoolers. This has meant the results are often presented on in wide age groups and often include children over the age of five.

New Zealand preschoolers are impacted by early childhood caries (Bach & Manton, 2014). While four in five (79.7%) children aged two to four-years of age are caries-free (Ministry of Health, 2010), one in five (20.3%) have experienced dental caries and almost one in seven (15%) have untreated tooth decay (Ministry of Health, 2010). The mean dmft for two to four-year olds is 0.8.

Findings from the 2009 NZOHS showed that Māori and Pacific children, aged two to 11-years, are significantly less likely to be caries-free in their primary teeth (RR 0.8 and 0.7, respectively) and significantly more likely to have untreated tooth decay (RR 2.0 and 1.7, respectively) than non-Māori and non-Pacific children, respectively. Māori children were seen to have a dmft index 1.5 times higher than non-Māori children. Further, children aged two to 11 living in the most deprived areas of New Zealand are almost six (RR 5.8) times as likely as children from the least deprived areas to have a primary tooth missing due to tooth decay (Ministry of Health, 2010). While differences were seen in measures discussed above, there were no differences in mean dmft between Pacific and non-Pacific children, or by deprivation level (Ministry of Health, 2010).

Such patterns are supported by self-reported data from the 2015/16 NZHS, which shows that Māori and Pacific children have the highest rate of tooth extraction out of all children aged one to 14 years (Ministry of Health, 2016). Māori children are 1.7 times as likely as non-Māori children, and Pacific children 2.5 times as likely as non-Pacific children (Ministry of Health, 2016) to have required an extraction due to dental caries in the previous year. Similar disparities were also seen by deprivation, with the most deprived children 2.4 times as likely to require an extraction as their least deprived peers (Ministry of Health, 2016).

1.5 Consequences of early childhood caries

Early childhood caries can substantially impact a preschooler's health, well-being and quality of life. Further, early childhood caries is expensive to treat, proving costly for both individuals and for society (Colak et al., 2013; Harris, Nicoll, Adair, & Pine, 2004). This section outlines the physical, psychological and economic consequences, both short and long-term, of early childhood caries for children, their families and society.

1.5.1 Physical

Oral health is strongly correlated with general health (de Castilho, Mialhe, de Souza Barbosa, & Puppim-Rontani, 2013; Petersen, 2003). The short-term consequences of untreated early childhood caries includes pain and infection (Kagihara, Niederhauser, & Stark, 2009; Kilpatrick, Neumann, Lucas, Chapman, & Nicholson, 2012; Plutzer & Spencer, 2008), which can negatively affect a preschooler's ability to eat, sleep and socialise (Acs, Lodolini, Kaminsky, & Cisneros, 1992; Kagihara et al., 2009, 2009; Sheiham, 2006; Watt, Stillman-

Lowe, Munday, Plimley, & Fuller, 2001). For example, due to difficulties with eating, preschoolers with early childhood caries have been found to grow at a slower pace than their caries-free peers and may be severely underweight and undernourished (Acs et al., 1992; Caufield, Li, & Dasanayake, 2005; Kagihara et al., 2009; Kawashita et al., 2011). Untreated early childhood caries has also been associated with iron deficiency, which can have long lasting consequences on a preschooler's neural development, concentration and ability to learn (Bach & Manton, 2014; Filstrup et al., 2003; Kawashita et al., 2011; Riter, Maier, & Grossman, 2008).

The pain of early childhood caries and associated interruption to sleep and daily schedules may also impact a preschooler's social ability (Fung, Wong, Lo, & Chu, 2013), resulting in the preschooler experiencing emotional stress, including anger and instability. Aesthetic or speech problems may lead to teasing, which negatively affects a child's self-esteem (Fung et al., 2013; Kagihara et al., 2009) and in turn, a child may begin to avoid talking, laughing and smiling (Fung et al., 2013). Ultimately, young children with untreated early childhood caries are at risk of having a poorer quality of life.

A person's oral health status in childhood is a significant predictor of their oral health status in adulthood (Van den Branden, Van den Broucke, Leroy, Declerck, & Hoppenbrouwers, 2013). Preschoolers who have experienced early childhood caries are more likely to experience dental caries in both their primary and secondary teeth (Declerck et al., 2008; Kawashita et al., 2011; Peretz, Ram, Azo, & Efrat, 2003; Riter et al., 2008; Van den Branden et al., 2013; Vanobbergen, Martens, Lesaffre, Bogaerts, & Declerck, 2001). Premature loss of primary teeth, such as through extraction due to disease, is also likely to result in future orthodontic problems including misalignment of the secondary teeth (Colak et al., 2013).

In more severe cases of early childhood caries, general anesthesia is used to assist with rehabilitative treatment (Schroth, Quiñonez, Shwart, & Wagar, 2016). Such action is a last resort given the risks associated with general anaesthesia, including death. While there are many negative consequences to using general anesthetic on a child, it is often used out of necessity to ensure the treatment can go ahead and in order to improve the child's quality of life. However, the fact that children require this level of treatment for an avoidable disease indicates an unmet need.

1.5.2 Psychological

Visits to a dental professional for dental treatment may be scary for a young child and can be associated with considerable psychological trauma, especially if the child has had a bad experience (Peres & Heilmann, 2015). Short and long-term dental anxiety can be attributed to traumatic dental experiences in childhood (Milgrom, Sutherland, Shirtcliff, Ludwig, & Smolen, 2010). A cross-sectional survey of 150 adult participants residing in London has shown that the participants were seven times as likely to have dental anxiety if they had had a bad dental experience in the past, compared to their peers (Milgrom, Newton, Boyle, Heaton, & Donaldson, 2010). Dental anxiety has been shown as a cause for people to avoid visiting a dental professional (Milgrom, Newton, et al., 2010; Schuller, Willumsen, & Holst, 2003). Avoidance of dental care has been linked with significant oral health problems, including toothache and a higher number of missing teeth (Schuller et al., 2003; Skaret, Espelid, Skeie, & Haugejorden, 2008). Thus, having a bad dental experience during childhood may impact an individual's oral health experience and the likelihood that that individual will seek regular dental care later in life (Milgrom, Sutherland, et al., 2010).

1.5.3 Economic

Early childhood caries has economic consequences for both the individual and society (Casamassimo, Thikkurissy, Edelstein, & Maiorini, 2009). New Zealand offers free dental treatment for children under the age of 18, meaning in New Zealand, there is no immediate treatment cost for the preschooler's family (Ministry of Health, 2006). However, this cost falls on the government (and ultimately tax-payers), and a significant amount is spent each year treating avoidable dental caries, including early childhood caries. For severe cases of early childhood caries, teeth are often extracted under general anesthetic, making the experience less traumatic for the child. Approximately 5000 New Zealand children every year are placed under general anesthetic for dental treatment (Thomson, 2016). This is a large cost for the New Zealand government, with each case estimated to cost NZD\$2,400 (Thomson, 2016).

While parents of preschoolers are typically not impacted by the treatment costs (given it is publically-funded), there is a time cost associated with parents taking their child to a dental clinic for treatment (Schroth et al., 2016). The 2009 NZOHS found that almost 6% of parents with a two to four year old child took time off work due to their child having problems with their teeth. Such time off work contributes to a loss of productivity (Ministry of Health, 2010).

In addition, given the association between early childhood caries in young children and dental caries in adulthood, there are likely to be substantial financial costs associated with on-going treatment and management of dental caries throughout the individual's lifetime, some of which may be met by the public system (Sheiham, 2006).

1.6 Dental caries aetiology and prevention

Dental caries development is multifactorial (Selwitz, Ismail, & Pitts, 2007). Fundamentally it requires the presence of two types of oral bacteria, most commonly *Streptococci mutans* (*S. mutans*), and *Lactobacilli*, a susceptible tooth surface and fermentable carbohydrate, typically dietary sugars (American Academy of Pediatric Dentistry et al., 2005; Harris et al., 2004). Acid by-products from bacterial metabolism of dietary sugars dissolve or demineralise tooth enamel. With these conditions, over time, the tooth surface eventually cavitates and the disease progresses.

Saliva has a protective role in the development of dental caries, by neutralising the acid by-product and also by having a cleaning effect on the teeth (Irish Oral Health Services Guideline Initiative, 2009). Also, the minerals present in saliva (calcium and phosphate) remineralise the tooth surface (remineralisation) (Featherstone, 2000; Irish Oral Health Services Guideline Initiative, 2009; Lenander-Lumikari & Loimaranta, 2000). Dental caries develops when demineralisation is greater than remineralisation, (Irish Oral Health Services Guideline Initiative, 2009). The dental caries development process is the same for all ages, including preschoolers (Selwitz et al., 2007). The literature on the specific aetiological factors for early childhood caries is reviewed in Chapter 2.

Dental caries is a preventable chronic disease (Selwitz et al., 2007). Common preventive measures include individual hygiene behaviours such as brushing twice a day with fluoridated toothpaste, reducing day-time snacking and reducing sugar intake, and regular dental care; through to broader population-based interventions such as fluoridation of water supplies, addressing the availability and marketing of high-sugar foods and beverages through regulation and policy, and providing oral health services (Marinho, Higgins, Logan, & Sheiham, 2003a; Selwitz et al., 2007). In addition to these general measures, there are specific preventative actions for early childhood caries, which are discussed in Chapter 2.

1.7 Socio-ecological models

There are a substantial number of models of health. Each of the models are unique and are designed to identify influences on health. Oral health has a strong health behaviour component, as well as being impacted by social and ecological factors. The following section discusses the Social Determinants of Health and the Fisher-Owens Conceptual Model of Oral Health (Fisher-Owens Model). The Fisher-Owens Model underpins this thesis and this is discussed in section 1.7.2.

Socio-ecological models consider the complex interactions between different factors that determine health; these factors include individual, community, environmental and societal factors. They provide an understanding of the range of factors that contribute to an individual's health status.

1.7.1 The Social Determinants of Health Model

The Dahlgren and Whitehead Model (*Figure 1*), known as The Social Determinants of Health, considers that an individual's health-related behaviour, and in turn their health, are determined by the environmental factors driving those behaviours, such as social and community influences, healthcare, housing, employment, and general environmental conditions (Dahlgren & Whitehead, 1991). The WHO has adopted a similar definition for the social determinants of health being:

The conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems (World Health Organization, n.d.).

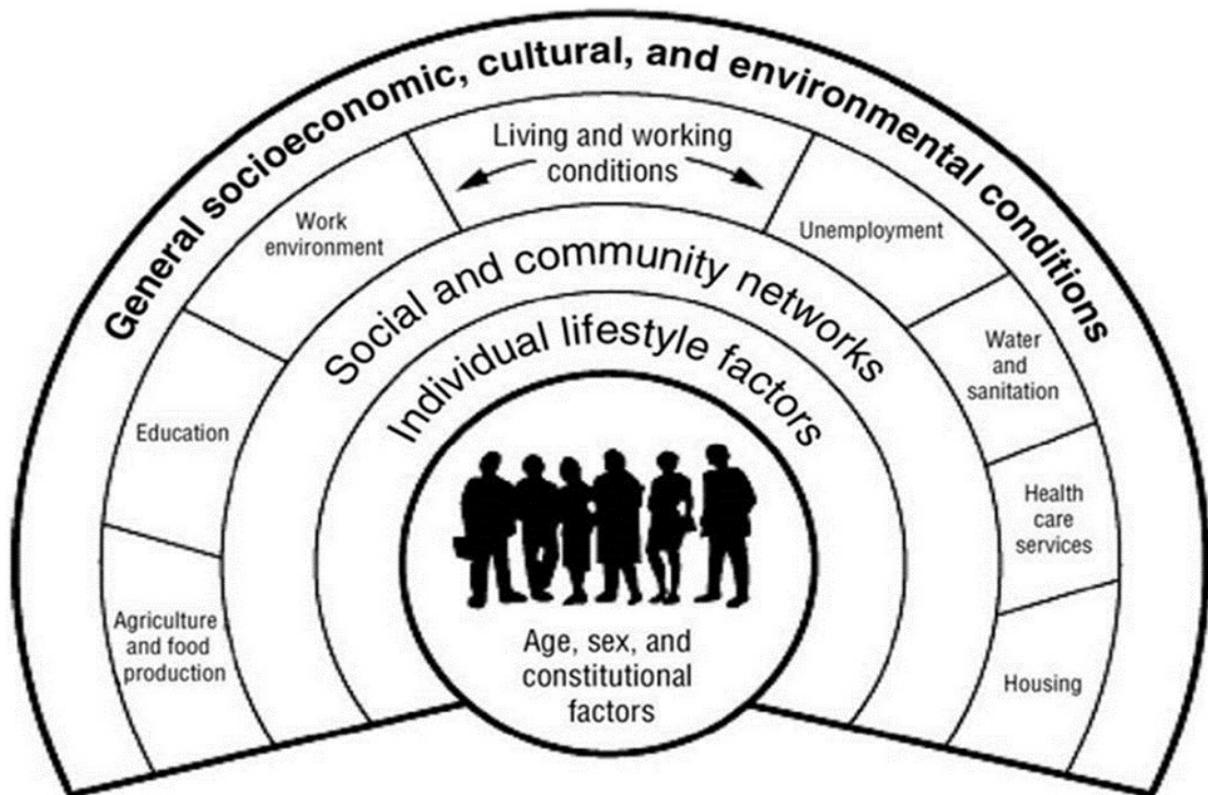


Figure 1. Social Determinants of Health (Dahlgren & Whitehead, 1991).

1.7.2 Fisher-Owens Model of the Social Determinants of Oral Health

Fisher-Owens et al. (2007) adapted the the work of Dahlgreen and Whitehead, to create a model specific to oral health (Figure 2). The Conceptual Model of the Social Determinants of Oral Health (Fisher-Owens Model) demonstrates that oral health conditions, including dental caries, develops from a complex interaction between multiple factors (Ashkanani & Al-Sane, 2012; Fisher-Owens et al., 2007; Selwitz et al., 2007; Sheiham, 2006).

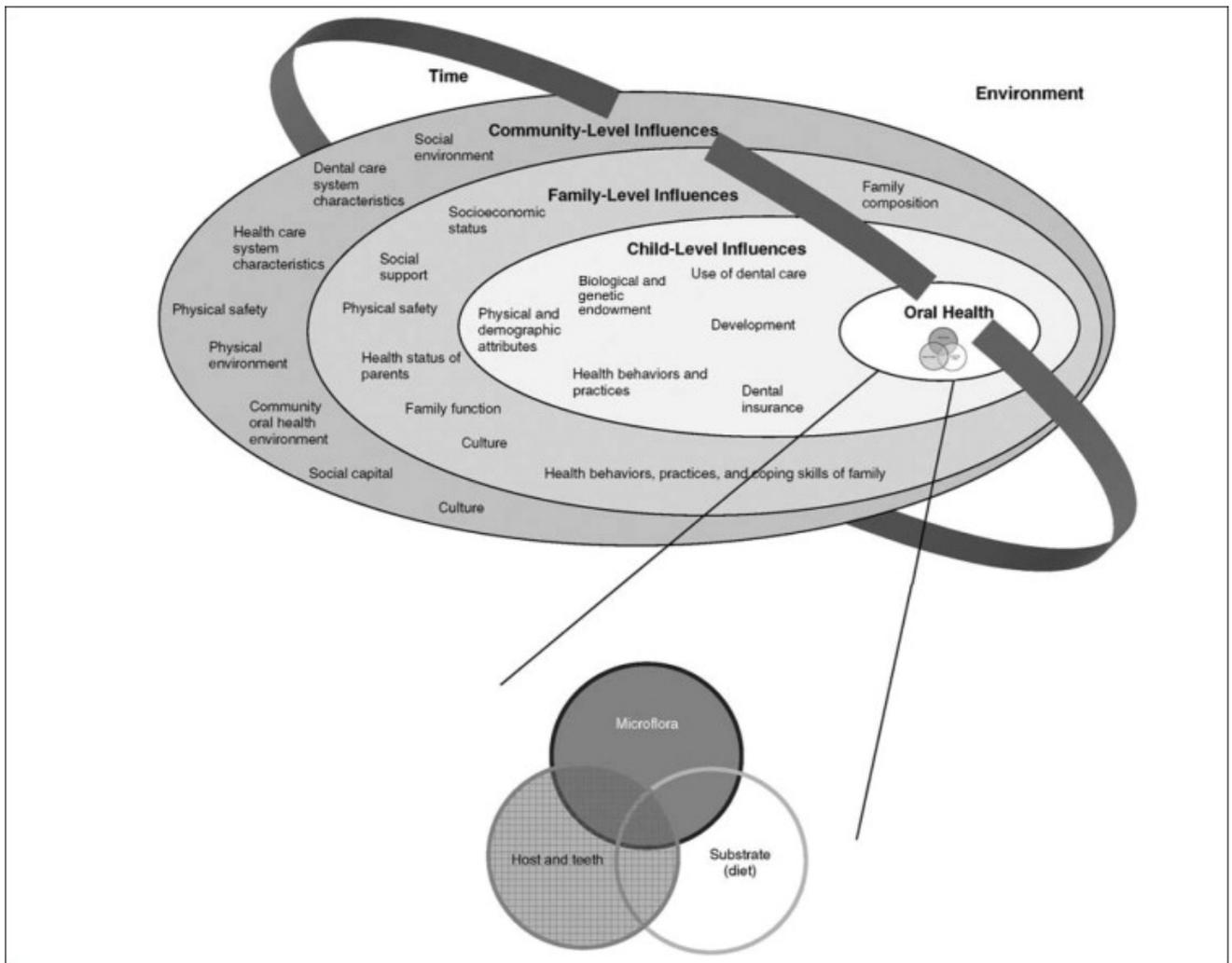


Figure 2. Fisher-Owens Conceptual Model of Oral Health (Fisher-Owens et al., 2007).

The Fisher-Owens Model incorporates the key determinants of oral health identified in the literature, including factors relating to an individual such as genetic and biological factors (child-level influences), the social environment (family-level influences), and the physical environment including, and dental and medical care (community-level influences) (Fisher-Owens et al., 2007). The Fisher-Owens Model demonstrates that the environment around a person has an impact on an individual’s oral health but does not go into detail of what these factors are. While it is not a determinant of health, the Fisher-Owens Model also incorporates the concept of time, acknowledging that these factors take time to have an effect (Fisher-Owens et al., 2007).

1.8 Conclusion

Dental caries development (including early childhood caries development) is multifactorial and this is illustrated in the Fisher-Owens Model.

Early childhood caries is a substantial public health issue in New Zealand and internationally. A considerable proportion of New Zealand children have early childhood caries, with ethnic and socioeconomic disparities evident. While early childhood caries has many physical, functional and psychological consequences for a preschooler, it also has direct and indirect health outcomes for the individual later in life. There are also significant economic consequences for both the individual and society.

Early childhood caries is largely preventable and it is important to understand the factors that drive the development of early childhood caries so that appropriate preventive measures can be implemented. Such factors are discussed in Chapter 2.

Chapter 2 - Determinants of Preschoolers' Oral Health

2.1 Introduction

As outlined in Chapter 1, the development and prevalence of dental caries, including early childhood caries, is multifactorial. Given the key role that parents have on young children's oral health, there are additional factors to consider when understanding the development and prevention of early childhood caries. Guided by the Fisher-Owens Model, this chapter presents a review of the literature on the specific factors that influence preschoolers' oral health. The child-level influences are discussed first, followed by the family, community and environmental factors.

In May 2015, I was working at the New Zealand Health Promotion Agency (HPA). While at the HPA I completed a literature review in early childhood caries, which preceded a study in this area. The focus of this 2015 literature review was on young children's oral health and effective health promotion methods to improve it; it can be found on the HPA website.¹ Some of the literature included in the HPA review is directly relevant to this thesis and is presented in this chapter. However, this review in this thesis goes broader than the HPA review and also incorporates further literature that reflects the research questions of this thesis.

2.1.1 Chapter outline

This chapter begins with Section 2.2, which discusses child-level influences. Section 2.3 discusses the family-level influences, and Section 2.4 the community and environmental factors. Section 2.5 then concludes the chapter.

2.2 Child-level influences

2.2.1 Microbiological factors

Young children are particularly susceptible to dental caries. Tooth enamel on newly-erupted teeth is immature and, as such, the teeth are more susceptible to cavitation (Gussy, Waters, Walsh, & Kilpatrick, 2006). Early childhood caries can occur at any time, with the risk increasing between the time a child's primary teeth have erupted through to approximately 24

¹ <https://www.hpa.org.nz/sites/default/files/Literature%20review%20oral%20health.pdf>

months of age (Colak et al., 2013). Two systematic reviews have shown that the presence and early infection of *S. mutans* in preschooler children is significantly associated with an increased risk of early childhood caries (Harris et al., 2004; Thenisch, Bachmann, Imfeld, Leisebach Minder, & Steurer, 2006). Harris and colleagues (2004) also showed that a child's risk is related to the levels of *S. mutans* in their mouth, with a higher level increasing an individual's risk (Harris et al., 2004). The age at which *S. mutans* are introduced into the mouth also influences overall oral health. If infection of *S. mutans* is delayed until later in life the prevalence of early childhood caries has the potential to be reduced, or avoided completely (Colak et al., 2013).

2.2.2 Visiting a dental professional

Early visits to a dental professional are an important preventative mechanism in reducing the development of early childhood caries (Colak et al., 2013; Schluter, Durward, Cartwright, & Paterson, 2007). Visiting a dental professional early in life allows children who are at a high-risk of developing early childhood caries to be identified early (Colak et al., 2013). This in turn allows an individual oral health plan to be developed that meets the child and their family's needs.

In New Zealand, children enrol in the Community Oral Health Service (COHS) which allows them to visit a dental professional. When visiting a COHS it is most frequently a dental therapist that provides a majority of the care. The recommended age to enrol in the COHS is determined by the child's perceived risk of having oral health problems (Ministry of Health, 2006). The MoH recommends that Māori, Pacific and new migrant children, and children living in low socioeconomic areas enrol in the COHS by the age of one and all other children enrol in the service by their third birthday (Ministry of Health, 2006). This advice is different to that recommended by other developed countries. For example, the American Dental Association and the Canadian Dental Association recommends that a child's first dental visit should occur within six months of eruption of their first tooth which is typically around six months of age, but no later than their first birthday (American Dental Association, 2013; Canadian Dental Association, 2017).

The level that New Zealand children visit a dental professional attendance varies by ethnicity and deprivation. The 2009 NZOHS shows that most children aged two to 17 years have visited a dental professional. When broken down by ethnicity there are only small differences in the rates of attendance. Pacific children had the lowest attendance rate with 71% and

European/other had the highest rate with 83% (Ministry of Health, 2010). The difference in attendance rate was much larger when broken down by neighbourhood deprivation (as determined by NZDep2006).² The highest rate of attendance was seen in children from neighbourhoods of medium deprivation (ranking of 3), with 91% of children aged two to 17 years having attended the dentist. This was followed by those in an area with a neighbourhood deprivation ranking of 4 (83%), a neighbourhood deprivation ranking of 2 (80%). Those from least deprived neighbourhoods (ranking of 1) had an attendance rate of 79%, and those from most deprived neighbourhoods (ranking of 5), had an attendance rate of 72% (Ministry of Health, 2010). While there are only small differences between some of the groups, there is a large difference in attendance rate between those who have the highest attendance rate and those who have the lowest.

The 2015/16 NZHS found that in the previous 12 months, preschoolers were less likely to have visited a dental health care worker (60%) when compared to the previous year (62%) (Ministry of Health, 2016). By contrast, attendance levels among older children was higher, with just over four in five children (83%) aged five to 17 years visiting a dental professional in 2015/16 (Ministry of Health, 2016). In 2015, HPA conducted a study on early childhood caries (thereafter known as the HPA study) this thesis builds on the work of the HPA study. The HPA study assessed whether preschoolers had visited a dental professional or not (Kaitiaki Research and Evaluation, 2015). The results showed that overall 74% of preschoolers had visited the dentist; the HPA study did not go on and assess the difference in attendance by demographic characteristics.

2.2.3 Oral hygiene practices

Oral hygiene plays a significant role in the aetiology of dental caries (Jiang, Lo, Chu, & Wong, 2014; Petersen, 2003). One aspect of oral hygiene includes regular tooth brushing with fluoridated toothpaste (Twetman, 2009). Tooth brushing has multiple functions including removing plaque, bacteria and food from the tooth surfaces. When combined with the use of fluoridated toothpaste it is the most widely used mechanism of applying fluoride to tooth surfaces (Twetman, 2009). Fluoride has been shown to be highly effective in preventing dental

² <http://www.otago.ac.nz/wellington/otago020348.pdf>

caries (Jones, Burt, Petersen, & Lennon, 2005; Marinho et al., 2003a; Petersen & Lennon, 2004).

The role of fluoride in preventing early childhood caries is well documented (Colak et al., 2013; Harris et al., 2004; Jones et al., 2005; Kawashita et al., 2011; Petersen & Lennon, 2004). This relationship is seen in a large body of research, including systematic reviews, that confirms the positive effect fluoride has on the prevalence of early childhood caries (Hallett & O'Rourke, 2003; Marinho et al., 2003a; Marinho, Higgins, Logan, & Sheiham, 2003b; McDonagh et al., 2000; Petersen & Lennon, 2004; Satur, Gussy, Morgan, Calache, & Wright, 2010; Yeung, 2008). The positive impact of fluoride is also emphasised by the WHO, which advocates for both the positive effects of fluoridated water supplies and the use of fluoridated toothpaste (Petersen & Lennon, 2004). A child's tooth brushing habit, including the use of fluoridated toothpaste and the frequency of brushing, impact the development of early childhood caries (Vanobbergen et al., 2001). Two factors determine the effectiveness of fluoride: the frequency of its use and its concentration (Marthaler, 2004; Twetman, 2008).

Brushing twice daily with fluoridated toothpaste has been shown in many studies to be effective at reducing the prevalence of early childhood caries (Gibson & Williams, 1999; Jain et al., 2015; Marinho et al., 2003a; Twetman, 2008; Vanobbergen et al., 2001). A systematic review of 70 studies found the effectiveness of fluoridated toothpaste increases by 14% when teeth are brushed twice per day, compared to once daily (Marinho et al., 2003a). A New Zealand study investigating a mother's self-reported oral health of four-year old Pacific children (n = 1048) found children who have their teeth brushed once a day or less have a 1.4 times greater chance of having a filling or a tooth extracted than children whose teeth are brushed more than once a day (Schluter et al., 2007). Several factors could impact tooth brushing frequency, including the cost of a toothbrush and toothpaste, particularly for low income families, and a parent's knowledge of when to begin oral hygiene practices in their preschoolers (Sgan-Cohen & Mann, 2007; Twetman, 2008).

In New Zealand, parent-reported findings from the 2009 NZOHS found that two-thirds (66%) of two to four-year olds brushed their teeth twice daily, a similar proportion to that of all children (two to 17 years) (64%) (Ministry of Health, 2010). The proportion of Māori (52%) and Pacific (64%) children who brushed their teeth twice a day was lower than the average proportion. Almost three-quarters (72%) of Asian children in New Zealand brushed their teeth

twice a day (Ministry of Health, 2010). The survey findings also showed that a greater proportion of children from higher socioeconomic areas (78%) brushed their teeth twice a day than those from the most deprived areas (55%) (Ministry of Health, 2010). Two further non-population based studies looked at brushing frequency in preschool-aged New Zealand children. The study by the HPA found that over half (58%) of parents brush their preschooler's teeth twice a day or more (Kaitiaki Research and Evaluation, 2015). However, a study by Schluter et al (2007) which looked the frequency of tooth brushing in a cohort of four-year old Pacific children, found that less than half (47%) of parents brushed their children's teeth once a day or more (Schluter et al., 2007).

The age that tooth brushing with fluoridated toothpaste is initiated is also an important factor in the prevention of early childhood caries. In developed countries, including New Zealand, the recommendation is to begin brushing primary teeth when they first erupt, if not before (New Zealand Dental Association, 2015). A study with 2515 children by Hallett and O'Rourke (2003), found that preschoolers who have had their teeth regularly brushed before the age of 12 months have a significantly lower prevalence of early childhood caries than preschoolers whose parents commenced tooth brushing when the child was older than 13 months of age (Hallett & O'Rourke, 2003). A study by the HPA looked at the age parents began to brush their preschooler's teeth. It found that, in line with the recommendations, 77% of the parents started brushing their preschoolers teeth before their first birthday (Kaitiaki Research and Evaluation, 2015).

The concentration of fluoride in toothpaste has also been shown to have an impact on a child developing early childhood caries (Davies et al., 2002; Twetman, 2008, 2009). A systematic review of 70 studies by Twetman (2009), on the effectiveness of fluoridated toothpaste found strong evidence that the use of toothpaste with a fluoride concentration of 1500 parts per million (ppm) or more, was protective against early childhood caries in preschool children, and more so than toothpaste with a lower concentration of fluoride (Twetman, 2009). The 2009 NZOHS assessed the proportion of children who used fluoridated toothpaste when brushing their teeth and found amongst all children aged two to 17 years the use of fluoridated toothpaste was on average 43%. While this is far from ideal, it is substantially higher than the two to four-year old population who were significantly less likely (with only 15.3% doing so) than school-aged children (aged five to 11-years (40.4%) and 12 to 17 years (57.1%)) to brush their teeth twice a day with fluoridated toothpaste (Ministry of Health, 2010). Māori children were also

significantly less likely to brush twice a day with fluoridated toothpaste than non-Māori children (Ministry of Health, 2010). The HPA study asked parents about their use of toothpaste when brushing their preschool children's teeth (Kaitiaki Research and Evaluation, 2015). The results showed that 95% of parents always use toothpaste when brushing (Kaitiaki Research and Evaluation, 2015). However, this question was not asked in reference to using fluoridated toothpaste. As seen in the studies above this is an important distinction and the concentration of fluoride in toothpaste has also been shown to have an impact on the development of early childhood caries (Davies et al., 2002; Twetman, 2008, 2009).

2.2.4 Resisting tooth brushing

Studies have shown that preschoolers themselves are often a barrier to achieving good oral health, especially if they resist tooth brushing. A quantitative study by Spitz and colleagues (n=629) found that preschoolers who resisted tooth brushing were at higher risk of early childhood caries than their peers who did not (Spitz, Weber-Gasparoni, Kanellis, & Qian, 2006). Such differences are possibly attributable to the likelihood that children who did not resist brushing were more likely to have their teeth brushed twice a day (Spitz et al., 2006).

Several studies reveal that parents found when the child resisted tooth brushing the task was difficult to enforce and consequently they would let their child away with not brushing their teeth (Amin & Harrison, 2009; Virgo-Milton et al., 2016). While some parents developed strategies to overcome this barrier, such as making the experience positive or giving the child no alternative, others decided the effort was not worth it and stopped trying (Virgo-Milton et al., 2016).

2.2.5 Diet

Diet is a well-documented factor that plays a key role in the development of dental caries. The association is strong, especially where high levels of sugar are involved, with research demonstrating that the risk of early childhood caries increases with increasing amounts, frequency, and timing of sugar consumed (Colak et al., 2013; Gussy et al., 2006; Harris et al., 2004; Kawashita et al., 2011; Parisotto, Steiner-Oliveira, Silva, Rodrigues, & Nobre-dos-Santos, 2010). Certain dietary patterns and behaviours also increase the risk of early childhood caries, including frequent night-time bottle feeding, a relationship that is strengthened if the

bottle contains a sugary beverage, repeated use of a 'sippy cup',³ and frequent snacking between meals (American Academy of Pediatric Dentistry et al., 2005; Colak et al., 2013; Lingström et al., 2003; Pieper et al., 2012; Shahar, Shai, Vardi, Shahar, & Fraser, 2005). The risk of early childhood caries associated with snacking increases if the foods and beverages consumed contain sugars (Jain et al., 2015; Vanobbergen et al., 2001). This occurs because the increased and/or prolonged consumption of sugars provides *S. mutans* bacteria with regular or high levels of fermentable carbohydrate (Colak et al., 2013; Tinanoff & Palmer, 2000).

A cross-sectional study (n=1450) conducted in the United Kingdom with preschool-aged children investigated the relationship between tooth brushing, sugar intake, social class and early childhood caries experience (Gibson & Williams, 1999). Consistent with other research (Colak et al., 2013), this study demonstrated an association between children experiencing early childhood caries and the amount of sugar the preschooler consumed. However, the relationship existed only in children whose teeth were brushed once a day or less (Colak et al., 2013; Gibson & Williams, 1999). The authors therefore concluded that twice daily tooth brushing with fluoride toothpaste is likely to have a greater positive effect on early childhood caries experience in young children, than limiting sugar-sweetened foods and beverages (Gibson & Williams, 1999).

Strong associations in longitudinal and cross-sectional studies have also been observed between the consumption of sugar-sweetened beverages and dental caries in both primary and secondary teeth (Dye et al., 2004; Touger-Decker & Van Loveren, 2003; Vanobbergen et al., 2001).

2.3 Family-level influences

2.3.1 Parents

Young children do not have the ability to optimally perform oral hygiene tasks and visit the dentist, largely relying on those responsible for their care to undertake such actions. Thus, parents play a key role in children's oral health status (Vargas & Ronzio, 2006), and therefore are a key target group for health promotion interventions. Understanding parents'

³ Sippy cup: is a training cup for a preschooler that usually has a screw on lid and spout that enables the child to drink without spilling the contents.

characteristics and their knowledge of, and attitudes to, preschoolers' oral health care is essential in developing health promotion actions. However, before this is explored other parental factors demonstrated in the literature as influencing preschool oral health are discussed.

Transmission of S. mutans by parents

The transfer of *S. mutans* from parents to preschool-aged children is common and easily achieved through salivary contact (Kawashita et al., 2011). Transmission can occur directly through kissing the child on the mouth, or indirectly via an object, such as a spoon or pacifier carrying the parent's saliva (Kawashita et al., 2011; Selwitz et al., 2007). The transmission of *S. mutans* from parent to preschooler is determined by the frequency of contact and the concentration of *S. mutans* in the caregiver's saliva (amount of exposure). The risk of transmission from parent to preschooler increases if the parent has high levels of *S. mutans* in their saliva, which is likely to be a result of the parent having untreated dental caries themselves (Berkowitz, 2003; Warren et al., 2008). The impact of sharing saliva is lessened if parents have an improved oral health status (as they generally have less *S. mutans*). Therefore, preschoolers are at greater risk of developing early childhood caries if their parents have poorer oral health status (Kawashita et al., 2011).

Parents own oral hygiene practices

Related to the parent's level of *S. mutans*, the literature reveals a strong relationship between a parent's oral health behaviour and their preschooler's oral health status (Rahbari & Gold, 2015). Preschoolers whose parents brush and floss their teeth twice a day are more likely to have a better oral health status. Multiple studies support the finding that preschoolers of parents with regular oral hygiene practices are less likely to have early childhood caries than preschoolers whose parents brush and floss their own teeth less often (Akpabio, Klausner, & Inglehart, 2008; Mattila, Rautava, Sillanpää, & Paunio, 2000; Rahbari & Gold, 2015).

Mothers who rate their own oral health as 'good' or 'excellent' have also been shown to brush their preschooler's teeth more frequently (Rahbari & Gold, 2015). A survey of 103 mothers in the US found that mothers who rate their oral health status as 'fair' or 'poor' were less likely to brush their preschooler's teeth frequently than mothers who rated their oral health status as 'good' or 'excellent' (Rahbari & Gold, 2015).

A study investigated the existence of a similar relationship in New Zealand (Schluter et al., 2007). Over 1000 Pacific mothers with a four-year old child, were interviewed about their own, and their preschooler's, oral health-related behaviours and status (Schluter et al., 2007). In agreement with previous literature, the study found that parents' tooth brushing behaviours influenced their children's tooth brushing behaviours. The researchers did not explore the reason why this relationship occurred. The study also found other oral health-related behaviours were associated with a mother's rating of their preschooler's oral health status. Mothers who reported brushing their own teeth less than twice a day were 1.7 times more likely to report that their child had a filling or a tooth extraction (Schluter et al., 2007).

Parent's age

The age of a parent was found to have an impact on a preschooler's oral health status. An inverse correlation has been shown between the prevalence of early childhood caries and the age of a child's parent. A mixed method study (n=105) from the US, and a quantitative study (n=2515) study from Australia found that preschoolers born to younger mothers (24-years of age or less at delivery) had a higher rate of early childhood caries than preschoolers whose mothers are aged over 25-years (Akpabio et al., 2008; Hallett & O'Rourke, 2003).

First time mother

Preschoolers who are the mother's first child have a higher risk of developing early childhood caries. Akpabio and colleagues (n=105) found that first time mothers had a lower level of knowledge of preschool oral health than mothers who had experience in raising a child before (Akpabio et al., 2008). The results showed that the more knowledge the participants had about oral health the more often they brushed and flossed (Akpabio et al., 2008).

Sole parents

A large quantitative study (n=2515) found that the prevalence of early childhood caries was 15% higher in children who were raised by a sole parent than preschoolers who were raised by two parents, this difference was significant (Hallett & O'Rourke, 2003). This same result was also observed in a randomised control trial in 2011 by Plutzer and Keirse (n=649) who found that preschoolers who were raised by a sole parent were twice as likely to develop early childhood caries (RR 2.3) than preschoolers from two-parent families (Plutzer & Keirse, 2011).

Siblings

Children whose siblings have had severe dental caries are at an increased risk of developing early childhood caries (Kawashita et al., 2011). A qualitative study (n=26) conducted in Canada involving parents of children who required extensive dental treatment further explored this relationship (Amin & Harrison, 2009). The authors of that study found that a preschooler's siblings became a role model for tooth brushing, either positively or negatively (Amin & Harrison, 2009). If the preschooler's older siblings did not want their teeth brushed, then often the younger sibling copied the behaviour and made the tooth brushing practice difficult. However, if the older sibling willingly had their teeth brushed they became a positive role model for their younger sibling (Amin & Harrison, 2009).

Parents' level of education

Multiple quantitative studies have found an inverse association between a preschooler's rate of early childhood caries and their parents' education level (Colak et al., 2013; Edelstein, 2002, 2002; Hallett & O'Rourke, 2003; Ismail & Sohn, 2001; Ismail, Tanzer, & Dingle, 1997; Jain et al., 2015; Keeney, McKenna, Fleming, & McIlpatrick, 2009; Ramos-Gomez, 2012; Skeie, Riordan, Klock, & Espelid, 2006; Van den Branden et al., 2013; Vann, Lee, Baker, & Divaris, 2010; Wierzbicka, Petersen, Szatko, Dybizbanska, & Kalo, 2002). In addition, it has been observed that preschoolers whose mothers have a lower education level tend to brush their preschooler's teeth less frequently and delay their visit to a dental professional than preschoolers' whose mothers have a higher education level (Edelstein, 2002; Van den Branden et al., 2013).

Researchers have identified a number of reasons for such an association, including parents' levels of knowledge and skills with which to promote oral health in their preschoolers; the opportunities to be exposed to oral health promotion messages; and the use of, or access to, preventive services (Chan, Tsai, & King, 2002; Passalacqua et al., 2012; Vann et al., 2010; Williams, Whittle, & Gatrell, 2002).

Parents' knowledge, attitudes and behaviours concerning preschoolers' oral health

Parents' knowledge, attitudes and behaviours concerning preschoolers' oral health are often influenced by several variables, including the environment in which a person lives, their socioeconomic status and their education level (Amin & Harrison, 2009; Rahbari & Gold,

2015; Skeie et al., 2006). Evidence shows that preschoolers whose parents do not value primary teeth, or fully understand their importance, were at risk of having a higher prevalence of early childhood caries (Amin & Harrison, 2009; Ayhan, Suskan, & Yildirim, 1996; de Castilho et al., 2013; Finlayson, Siefert, Ismail, Delva, & Sohn, 2005; Hochstetter, Lombardo, D'eraimo, Piovano, & Bordoni, 2006; Ismail, 1998; Prowse et al., 2014). To this end, the Surgeon General of America has spoken of the importance of ensuring that parents have positive attitudes towards, and appropriate and sufficient knowledge about, the care of their preschooler's teeth (Tinanoff & Reisine, 2009). It is thought without such understanding, parents are unlikely to undertake the practices required to prevent early childhood caries (Vann et al., 2010).

Research suggests an increase in a parent's knowledge of preschool oral health could have a corresponding positive impact on the prevalence of early childhood caries in their preschooler. Parent's knowledge of preschool oral health is now discussed. This is followed by discussing the social factors that impact preschooler's oral health.

2.3.1.1 Parents' knowledge of primary teeth

Parents knowledge on the importance of healthy primary teeth

Many studies have investigated parental knowledge regarding the importance of healthy primary teeth. An American qualitative study interviewed parents (n=20) of preschool children and found they often viewed oral health as having an absence of disease rather than considering oral health in a broader context (Amin & Harrison, 2009). In two qualitative studies (n=20; n=32) mothers thought genetics were the main reason for their children developing early childhood caries, and saw early childhood caries as normal and inevitable (Amin & Harrison, 2009; Virgo-Milton et al., 2016).

Research has shown that preschoolers whose parents regarded primary teeth as important have significantly fewer decayed teeth than preschoolers whose parents did not place importance on keeping primary teeth healthy (Perez & Amin, 2014; Schroth, Brothwell, & Moffatt, 2007). Further, parents of caries-free preschoolers were more likely than parents whose preschool children had early childhood caries to believe that early childhood caries has the potential to affect their child's health in general (Schroth et al., 2007).

Parents knowledge of the relationship between primary and secondary teeth

Studies have assessed whether parents understand the relationship between primary teeth and secondary teeth (Baginska & Rodakowska, 2012; Kaitiaki Research and Evaluation, 2015). It appears that parents have a mixed level of knowledge. A Polish study, that surveyed 140 mothers of three to four-year old children, found that 87% of the participants knew the primary teeth should be treated the same as secondary teeth (Baginska & Rodakowska, 2012). However, only two-thirds (66%) of participants knew that there was a direct relationship between the condition of primary teeth and secondary teeth (Baginska & Rodakowska, 2012). When parents were asked about the relationship of primary and secondary teeth in the HPA study, it was seen that 80% answered in line with the recommendations (Kaitiaki Research and Evaluation, 2015).

In three large studies parents acknowledged the relationship with primary teeth and thought that caring for primary teeth would be beneficial for secondary teeth; this belief was especially seen in parents who thought sugary drinks were the cause of early childhood caries (Amin & Harrison, 2009; Chestnutt, Murdoch, & Robson, 2003; López del Valle, Riedy, & Weinstein, 2005). A Polish study of 1114 parents of three-year olds by Szatko et al (2004) found that approximately two-thirds (66%) of mothers thought that care of primary teeth was not needed as they will fall out eventually anyway (Szatko, Wierzbicka, Dybizbanska, Struzycka, & Iwanicka-Frankowska, 2004). By contrast, two international studies, one mixed methods (n=294) and one cross sectional (n=408) found that almost all (87% and 100% respectively) parents recognise that primary teeth are important and require care (Gussy, Waters, Riggs, Lo, & Kilpatrick, 2008; Schroth et al., 2007).

2.3.1.2 Parents' knowledge of dental visits

Parents knowledge on when the first dental visit should occur

Parents' knowledge about the importance of visiting a dental professional and when a child should first visit a dental professional was found to be important. A cross-sectional study, which interviewed 408 parents from Canada, found that 74% of the parents thought that their child should visit a dental professional before the age of one (this is the age recommended for an initial dental visit in Canada) (Schroth et al., 2007). By contrast, Akpabio and colleagues surveyed 105 parents of preschool children in the US and found that only a quarter (26%) were aware of the recommended age that a child should have their first visit to a dental professional (Akpabio et al., 2008). While the reason for differences between countries was unclear it may

be due to differences in educational messaging or health promotion between the countries. It is also not helpful that the recommended age for an initial dental visit differs both between and within countries.

Parents knowledge on the importance of dental visits

Many parents believe that unless primary teeth are causing the child pain or discomfort, regular care or treatment is not required (Mofidi et al., 2009; Perez & Amin, 2014). Dental professionals are often viewed as a means of treatment, rather than as a preventative measure, even for preschool-aged children (Perez & Amin, 2014). This mindset towards dental professionals can act as a barrier for a preschooler staying early childhood caries free (Van den Branden et al., 2013). When the HPA study assessed whether parents thought holes in primary teeth needed to be restored, only 71% answered according to recommendations (Kaitiaki Research and Evaluation, 2015). However, a small number of studies have reported positively on parents' knowledge regarding the importance of dental visits for preschoolers. A Polish survey (n=140) found that a majority (89%) of parents of preschool-aged children knew that regular visits to a dental professional were important to achieving a good oral health status (Baginska & Rodakowska, 2012).

2.3.1.3 Knowledge of tooth brushing

Parents' knowledge on the benefits of tooth brushing

Knowledge of the benefits of tooth brushing appears to vary among parents. Studies have shown that over two-thirds to all (71% to 100%) of parents knew that regular tooth brushing in their preschool-aged child is important as a method to control for dental plaque (Baginska & Rodakowska, 2012; Berkowitz, 2003; Wierzbicka et al., 2002). However, in an Australian study, in which 294 parents of preschoolers residing in a rural area completed a self-reported questionnaire, it was found that only 40% of the participants identified 'not brushing everyday' as one of the main risk factors for early childhood caries (Gussy et al., 2008).

Parents' knowledge on the age brushing should begin

Research findings on what age to commence tooth brushing in their preschool children differ. An American study (n=100) found that over half of parents (54%) knew that it is important to begin brushing their preschooler's teeth when the first tooth erupts (Febres, Echeverri, & Keene, 1997). However, contradicting these findings, an American mixed methods study

(n=105) found that just under one-third (32%) of the participants identified the recommended age to begin brushing their preschooler's teeth (Akpabio et al., 2008). In New Zealand, the HPA study found that 74% of parents knew the recommendation age that brushing should begin (Kaitiaki Research and Evaluation, 2015). These differences in findings could be due to the population groups that were surveyed, or may result from how the question was framed.

Parents' knowledge on the recommended times per day preschoolers' teeth should be brushed

Several studies have investigated the frequency that tooth brushing occurs in preschool-aged children. The results vary between countries and demographic groups. For example, a large US national health study that analysed three waves of data collected between 1988 and 1994, found that 65% of children residing in rural areas had their teeth brushed by their parents more than once a day (Vargas & Ronzio, 2006). Another large US study (n=719) that examined tooth brushing frequency in low income African-American preschoolers found that, on average parents reported brushing their preschooler's teeth just nine times a week (Finlayson et al., 2005). These results were similar to those seen in a Polish survey (n=140), which found that 40% of children were having their teeth brushed twice a day and a further 35% were having their teeth brushed once a day (Baginska & Rodakowska, 2012). In the same study, 15% of children were only having their teeth brushed one to three times per week, with 4% having their teeth brushed less than this (Baginska & Rodakowska, 2012). Lack of time, and prioritising other activities such as getting to bed on time, were the main reasons reported as being a barrier to parents providing their preschooler with recommended oral health care (Virgo-Milton et al., 2016). This could mean that some parents view other everyday routines for preschoolers as more important than oral health activities.

Parents' confidence in brushing their children's teeth (self-efficacy)

An Australian study that surveyed 294 parents of a preschool-aged child who reside rurally, found that a parents' level of confidence in brushing their preschooler's teeth affected the rate of tooth brushing (Gussy et al., 2008). It was found that while 75% of parents reported cleaning their child's teeth regularly, only 44% reported being confident in their ability to do so (Gussy et al., 2008). A quantitative British study (n=268) found that many of the mothers did not know the recommended brushing technique or duration to clean their children's teeth (Blinkhorn, Wainwright-Stringer, & Holloway, 2001). Both qualitative and quantitative studies have demonstrated that the frequency that a parent brushes their children's teeth was directly

associated with the degree of confidence that parents had; parents who were more confident in successfully carrying out brushing their preschooler's teeth, brushed their preschoolers teeth more often and maintained the brushing over time (Amin & Harrison, 2009; Gussy et al., 2008). Blinkhorn and colleagues also found that 40% of participants thought their preschooler acted as a barrier to achieving good oral hygiene, as they did not allow the parent to brush their teeth (Blinkhorn et al., 2001). Many parents were unsure on how to overcome this barrier (Blinkhorn et al., 2001).

Parents' knowledge on the use of fluoridated toothpaste

Studies demonstrate a mixed level of parental knowledge on the use of fluoridated toothpaste to prevent tooth decay in preschool children, ranging as high as 86% in some studies, to under half (46%) in others (Baginska & Rodakowska, 2012; Blinkhorn et al., 2001; Gussy et al., 2008; Schroth et al., 2007; Szatko et al., 2004; Wierzbicka et al., 2002). In an Australian study (n=294), there was confusion around the use of fluoride, as most parents knew that fluoridated toothpaste reduced the risk of dental caries (74%). However over half of the parents (55%) were unsure about whether they should use fluoridated toothpaste with preschoolers, and 30% of parents believing it should not be used (Gussy et al., 2008).

2.3.2 Social factors

Social support

A family's social support such as social cohesion, networks and relationships can have an impact on people's oral health (Peres & Heilmann, 2015). Thus, health-related behaviours are not completely determined by free-choice (Kagihara et al., 2009). The factors that make up an individual's social environment include an individual's support, social relationships, and family values, belief and culture (de Castilho et al., 2013).

Other adults, including family members, who care for children could be a barrier to young children achieving good oral health. In a qualitative study by Amin and Harrison (2009), parents spoke of the challenges that arose when friends and family were caring for their children (Amin & Harrison, 2009). The greatest challenge was restricting the amount of sugary foods other parents, particularly grandparents, gave to the preschoolers as a treat or simply to calm the child (Amin & Harrison, 2009). Given the detrimental impact of diet on an individual's oral health status, such influences are likely to have significant consequences on a

preschooler's early childhood caries experience. Therefore, this was a concern for many parents as they felt a loss of control of their child's oral health (Amin & Harrison, 2009). This concern was also seen in the qualitative findings of the HPA study (Kaitiaki Research and Evaluation, 2015).

Socioeconomic status

An association between socioeconomic status and health is widely recognised (Hernandez & Blazer, 2006). It has been well documented that individuals living in areas of high deprivation are at greater risk of developing dental caries than those people living in less deprived areas (Peres & Heilmann, 2015). This association is also seen in preschoolers (Harris et al., 2004; Kawashita et al., 2011; Thomson et al., 2004). Similarly, the prevalence of early childhood caries is higher in children whose parents had a lower annual income than those whose parents had a higher annual income (Hallett & O'Rourke, 2003; Reisine, Tellez, Willem, Sohn, & Ismail, 2008). Research demonstrates that children from lower socioeconomic households are likely to begin brushing their teeth at a later age, brush their teeth less frequently, and more likely to only visit a dental professional when there is a problem with their teeth, than children from higher socioeconomic status households (Bach & Manton, 2014; Pieper et al., 2012; Pine et al., 2000; Skeie et al., 2006; Van den Branden et al., 2013)

Differences between socioeconomic status groups may be attributed to differences in access to resources that impact an individual's ability to achieve good health (Gordon-Larsen, Nelson, Page, & Popkin, 2006; Peres & Heilmann, 2015). Evidence suggests that individuals living in higher socio-demographic areas have better access to health resources, including health knowledge, preventative services, and more nutritious food and beverages (Peres & Heilmann, 2015). Factors that contribute to this relationship include social deprivation, neighbourhood deprivation, income inequality, poor social cohesion and, easier access to foods and beverages that promote dental caries (Peres & Heilmann, 2015).

2.4 Community and environmental-level influences

Community-level influences are important upstream determinants of health and drivers of health-related behaviours (Peres & Heilmann, 2015). Such factors include access to healthcare services, the food environment, community water fluoridation, and culture in relation to the impact on oral health. Typically, such factors are out of parents' control.

2.4.1 Access to oral health care services

Access to quality health care is a factor that influences the health of an individual (Hernandez & Blazer, 2006). Barriers to people accessing oral health care include geographic location, service availability, a lack of skilled and culturally competent work force, associated financial costs, and lack of health care coverage such as insurance (Butani, Weintraub, & Barker, 2008; Hernandez & Blazer, 2006; Robson B et al., 2011). In New Zealand, the Government funds dental care for all people under 18. This means that financial barriers should not be a consideration for young New Zealanders; however, many of the other barriers remain. For example, accessing dental surgeries and clinics in rural communities may be challenging due to the distance required to travel. For parents who work full-time, they may have to take time off work to take the child to the dentist. Most of the research in this area has focused on not being able to access dental services due to financial costs, this was especially seen in the United States (Edelstein, 2002). As this barrier has been removed in New Zealand this was not reported on in this review of the literature, however other barriers to accessing dental services are discussed.

2.4.2 Food environment

The food environment is a key determinant of an individual's health (Gordon-Larsen et al., 2006). Food and beverages that are high in sugar, particularly sugar-sweetened beverages and confectionery, are readily available and accessible (Maliderou, Reeves, & Noble, 2006). Such environments are key drivers of people's dietary practices and as previously discussed, diets high in sugars increase the risk of dental caries (Gordon-Larsen et al., 2006). Consequently, the current food environment promotes the development of dental caries.

The dietary behaviours discussed previously are likely driven by social factors related to the individual (Harris et al., 2004; Jamieson, Bailie, Beneforti, Koster, & Spencer, 2006; Lingström et al., 2003; Shahar et al., 2005; Tinanoff & Palmer, 2000). There is a substantial amount of evidence showing that preschoolers living in low socioeconomic areas have an increased consumption of sugar-containing food and beverages, mostly due to the low cost of these foods (Burt & Pai, 2001; Gibson & Williams, 1999; Inchley, Todd, Bryce, & Currie, 2001; Ismail et al., 1997; Jamieson et al., 2006; Lingström et al., 2003; Shahar et al., 2005; Tinanoff & Palmer, 2000). It is likely that differences in diet, more notably the level of sugar

in the diet, contribute somewhat to the variation in oral health status between population groups (Maliderou et al., 2006). This is concerning as low socioeconomic groups also have the highest prevalence of dental caries (Shahar et al., 2005).

Children are often the target of marketing and advertising of unhealthy foods (Cairns, Angus, Hastings, & Caraher, 2013; Story & French, 2004). Multiple avenues are used to reach children including television adverts, internet sites and through children's sport (Story & French, 2004). This marketing often has a major impact on the food being consumed by children and therefore contributes to children's unhealthy eating habits, including an increased consumption of sugar (Cairns et al., 2013). As discussed previously, this has an impact on an individual's oral health. Amin and Harrison (2009) interviewed 26 parents whose children had just undergone extensive dental treatment due to early childhood caries. The authors found that parents thought it was difficult to avoid sugary foods because they were widely advertised and available (Amin & Harrison, 2009).

2.4.3 Community water fluoridation

At a population level, community water fluoridation has been proven to be effective at reducing dental caries (Lewis & Ismail, 1995; Petersen et al., 2005). Fluoride assists the remineralisation process and is protective against dental caries (Featherstone, 2000). However, not all water supplies in New Zealand (or elsewhere around the world) are fluoridated. This creates inequalities in the prevalence of dental caries among geographic locations and communities (McDonagh et al., 2000). Systematic reviews have shown that fluoridating the community water is successful in reducing the prevalence of dental caries within a population (Davies et al., 2002; Jones et al., 2005; McDonagh et al., 2000; Petersen & Lennon, 2004; Yeung, 2008). A cross-sectional study from Ireland has shown that five-year old children from fluoridated areas have a significantly lower dmft and significantly higher rate of being caries free, than children from non-fluoridated areas (Whelton et al., 2006).

Findings from New Zealand studies are consistent with those from international studies (Davies et al., 2002; Ministry of Health, 2010; Petersen & Lennon, 2004; Whelton et al., 2006). The 2009 NZOHS found that children and adolescents living in fluoridated areas had, on average, 40% less tooth decay than peers living in non-fluoridated areas (Ministry of Health, 2010). In New Zealand, it is estimated that just over half (52%) of the population does not have access

to fluoridated water supplies that meet the recommendations of the MoH (New Zealand Guidelines Group, 2009). This means that a large proportion of the population do not have adequate levels of fluoride in their water supplies. This contributes to the inequalities between geographical locations (Koopu & Keefe-Ormsby, 2000; Ministry of Health, 2006; Moore & Poynton, 2015).

Fluoridation of local water supplies in New Zealand is currently controlled by local authorities.⁴ Many urban water supplies are fluoridated; however, many rural areas rely on sources such as rain water and therefore have unfluoridated water supplies (Ministry of Health, 2006). This has a flow on impact meaning that children living in urban areas often have a lower prevalence of dental caries than those in rural areas. In New Zealand, many Māori and Pacific people live in areas with non-fluoridated water supplies, such as Northland, Rotorua and South Auckland. There are higher concentrations of Māori and Pacific families in these areas and this lack of fluoridation is likely to contribute to the higher prevalence of dental caries that Māori and Pacific children have when compared to non-Māori, non-Pacific children (Koopu & Keefe-Ormsby, 2000).

2.4.4 Culture

Culture is thought of as shared patterns of actions or beliefs, specific to a group of individuals, that often define behavioural norms and often determine how people live (Butani et al., 2008). Such beliefs have an impact on attitudes to, and practices, in different aspects of life which. In relation to health, culture can act as either a facilitator or barrier (Butani et al., 2008; Sobo & Loustaunau, 2010).

There is a growing body of literature that reports the association between people's cultural factors and their health (Hernandez & Blazer, 2006). The evidence demonstrates that a person's culture influences their attitudes, which in turn impacts upon their actual health behaviours (Popay, Williams, Thomas, & Gatrell, 1998). There is also a connection between the values and health beliefs and practices. In oral health, underlying cultural beliefs could influence a number of aspects including, the condition of the teeth and mouth, diet, health care behaviours, and the value placed on the loss of a tooth, or the value of having healthy teeth compared to

⁴ This arrangement is currently under political review.

other competing priorities (Butani et al., 2008). In New Zealand, there is little evidence on what impact the beliefs, attitudes and values placed on oral health by different cultural groups have on the status of preschoolers' oral health.

2.4.5 Role of the government

Healthy environments enable healthy behaviours (Lobstein, Baur, & Uauy, 2004). The State can play an important role in ensuring environments are health-promoting and enable positive health behaviours. Effective public health policy in economic, cultural and environmental areas are needed to ensure individuals, families and communities have access to resources that allow them to achieve good health (Peres & Heilmann, 2015). This is not specific to oral health care policies but applies to health across the board.

The development of early childhood caries is multifactorial. Therefore, focusing policy on social determinants, such as improved housing, raising the minimum wage, or improved regulations in the food environment, all have the potential to have a positive impact on oral health. However, there is limited knowledge regarding the specific impact that each factor has on a person's overall oral health. These community-level factors will be explored further in this research with an aim to address this knowledge gap.

2.4.6 Oral Health Policy

The WHO provides overall guidance on prevention and management of diseases. Their focus is on diseases that are common and preventable, and those that are linked to lifestyle factors such as obesity and oral health. The emphasis is on disadvantaged populations, and community programmes for improved oral health, with elderly and children a high priority. The four strategic directions of WHO's Global Oral Health Programme (World Health Organization, 2015) are:

1. reduce oral disease burden and disability, especially in poor and marginalised populations;
2. promote healthy lifestyles and reduce risk factors to oral health that arise from environmental, economic, social and behavioural causes;
3. develop oral health systems that equitably improve oral health outcomes, respond to people's legitimate demands, and are finally fair; and

4. framing policies in oral health, based on integration of oral health into national and community health programmes, and promoting oral health as an effective dimension for development policy of society.

In New Zealand, the MoH recognises the importance of good oral health, and has an approach Good Oral Health for All where the government has a focus on improving the oral health of the population. New Zealand has emphasised a preventive approach. An example of this is, as previously mentioned, the New Zealand Government fully funds dental care for all children under the age of 18-years living in New Zealand. The purpose of this policy is to remove one of the most significant barriers to dental care (cost) for children and adolescents with a long-term aim of ensuring New Zealander's enjoy an improved oral health status over their lifetime.

2.5 Conclusion

There are a substantial number of multilevel influences that impact oral health. Examples include low socioeconomic status, limited parental education, parental oral health and dental check-up status, low fluoride exposure, dietary practices, poor oral hygiene, poor oral health knowledge by the parent regarding preschool oral health, and preschoolers not accessing dental services. For a preschooler, there is the added reliance on an adult to provide the oral health care. The Fisher-Owens Model indicates that a plethora of community and environmental factors impact how a parent cares for their children's oral health (Fisher-Owens et al., 2007).

There is a deficiency in our understanding of preschool oral health and the factors that impact parent's ability to provide the care needed, especially in New Zealand. The next chapter outlines the methodology that was employed to further investigate parents' knowledge of preschool oral health, as well as the individual, family, community and environmental factors that influence how parents care for their preschooler's oral health.

Chapter 3 – Methods

3.1 Introduction

This chapter presents the research methods used in this thesis to explore the factors that potentially influence how a parent cares for their preschoolers' oral health. This research adopted a mixed methods approach. First, a secondary analysis of an existing dataset was undertaken investigating parents' knowledge and oral behaviours on preschool oral health to determine the relationship between knowledge and behaviour and differences between population demographics and characteristics. Secondly, qualitative research was conducted consisting of individual interviews with parents of preschoolers to understand how they provide oral health care for their preschooler as well as broader factors that influence their preschooler's oral health care; with a focus on community and environmental factors.

3.2 My role in the development of the survey and data collection

This thesis uses secondary data from a survey I was involved in creating and implementing whilst working at the HPA. In 2015, the New Zealand HPA undertook a survey to assess parents' knowledge, attitudes and behaviours associated with preschool oral health. At that time, I was employed by the HPA and had a substantial role in the development of the survey. Below describes how the survey was developed, and my role in the process.

Initially, national and international academic and grey literature on preschool oral health was reviewed. The findings of the review informed the base of the survey questionnaire. Along with other members of the oral health team at HPA, I met with key stakeholders working in the oral health sector in New Zealand, and with those working to improve the health of Māori. These consultations further informed the questionnaire development. Where relevant, questions were taken from previous surveys, including the 2009 NZOHS Child Questionnaire, and the Infant Oral Health Survey undertaken in the US (Graham-Montaque, 2012; Mason, 2010). The questions were adapted from those surveys as they had been previously tested.⁵

⁵ The full questionnaire can be found by contacting the Health Promotion Agency.

Fieldwork was conducted by a private research company who recruited the participants, coded the survey and cleaned the data. The questionnaire was developed to ensure it would add value to the New Zealand oral health literature, and to ensure that the survey was logical. Overall, I had a lead role in the development of the survey and the implementation of the survey.

The data from the HPA survey has formed the basis of the data set for this thesis. The analysis I performed whilst at HPA was a descriptive analysis between participant characteristics and the child's oral health status; high level findings were produced to inform future research were developed. Thus, I have taken the HPA data set and analysed this further to produce the results and findings presented in this study. The analysis performed for this thesis looks at the inter-relationships between variables and is significantly more complex than the analysis performed by the HPA. It would not be possible to derive the findings in this thesis from the published results of the HPA study. The data analysis is discussed further in Section 3.5 below.

3.3 Research methodology

A research approach is largely guided by a study's purpose of enquiry and by the research questions (Creswell, Plano Clark, utmann, & Hanson, 2003). This study aimed to gain an understanding of the factors that enable a parent to care for their preschooler's oral health.

It was recognised that there are a number of factors that influence how parents care for their preschooler's oral health. The international literature identifies that a parent's knowledge of preschool oral health is one component that is thought to have a large impact on how parents care for their children's oral health. The research also shows that there is a plethora of factors other than knowledge that also influence how parents care for their preschooler's oral health. The Fisher-Owens Model, which is the theoretical framework that underpins this thesis, builds on the international literature and demonstrates a number of factors that impact a child's oral health. These factors are demonstrated to occur at a child-, family- and community- level. Based off international literature, there are ideas of what factors are associated with how parents care for their preschooler's oral health in New Zealand; however these ideas have not been fully explored. This research seeks to fill these research gaps in New Zealand with the following research questions.

The over-arching research question:

What factors influence the oral health care parents provide for their preschooler?

To guide this process, two sub-questions have been set. The sub-questions have been chosen to help answer the over-arching research question:

i. *Does a parent's knowledge of preschool oral health have an association with the oral health care they provide for their preschooler?*

- This has been examined by looking at whether a parent's level of oral health knowledge differs by child and respondent characteristics?

ii. *What factors other than knowledge influence the oral health care that a parent provides for their preschooler?*

This has been examined by looking at whether:

- there are differences in how parents care for their preschooler's oral health, by population characteristics?
- differences in population characteristics impact how parents care for their preschooler's oral health?
- there are community and environmental factors that impact how parents care for their preschooler's oral health?

To answer the research questions, a mixed methods approach was adopted, which will now be discussed.

3.4 Mixed method approach

3.4.1 Definition

Mixed methods research has evolved from discussions of social paradigms and methods in social science. After much early debate within academia, a largely accepted definition of mixed methods research has arisen, this is:

Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Johnson et al, 2007, p.123).

Thus, mixed methods research is when researchers use multiple methods of research, combining them into a single study (Bazeley, 2003; Greene & Caracelli, 2003; Johnson & Onwuegbuzie, 2004; Maxcy, 2003; Teddlie & Tashakkori, 2003). Using different methods to examine the same question(s) is referred to as mixed methods triangulation. Triangulation is broadly defined as ‘the combination of methodologies in the study of the same phenomenon’ (Denzin, 1978: pg.291). The advantages of using two or more methods is that it gives confidence about the validity of the results when two or more of the findings are complimentary to each other (Brewer & Hunter, 2006). Over recent decades mixed methods research has become more popular, especially in the social and health sciences (Ivankova, Creswell, & Stick, 2006). The strengths and limitations of mixed methods research has been widely discussed in the literature and is now discussed (Creswell & Creswell, 2005; Creswell et al., 2003; Greene & Caracelli, 2003; Moghaddam, Walker, & Harre, 2003).

Strengths of mixed methods research

The strengths of combining research methods is grounded in the notion that no method alone is sufficient to fully explore all aspects of a research topic (Creswell et al., 2003; Doyle, Brady, & Byrne, 2009). That is, all data collection methods have limitations. Alone, one method may not provide comprehensive insight into a complex issue, such as those that this thesis aims to answer (Doyle et al., 2009). Therefore, by combining methods, the limitations of one method can be partially offset, as the strength of another method compensates for the limitations in the initial one (Brewer & Hunter, 2006; Creswell et al., 2003; Ivankova et al., 2006). Due to social issues often being complex, different methods are often needed to make sense of the findings (Creswell & Clark, 2007; Greene & Caracelli, 2003). Tariq and Woodman (2013) argue that areas of research that are complex and have multiple factors benefit most from using a mixed method design (Tariq & Woodman, 2013). Obtaining evidence from a variety of methods helps to achieve a fuller and more complete picture by combining information and data from multiple sources (Collins, Onwuegbuzie, & Jiao, 2006; Pansiri, 2005).

The research questions in this thesis are addressed using a mixed methods approach. The mixture of methods was chosen were quantitative and qualitative research. They were chosen because these research types produce different types of information which allows a broad range of ideas to be explored. Quantitative research often measures observations and associations,

whereas qualitative research produces information about experiences (Curry, Nembhard, & Bradley, 2009).

Limitations of mixed methods research

Despite the many advantages of using mixed methods research, there are limitations (Creswell & Creswell, 2005; Creswell et al., 2003; Tariq & Woodman, 2013). The expertise needed to collect data and analyse two different datasets is much greater than that for a single method project. Combining two datasets involves integrating two sets of results in a way that represents the findings from each of the methods (Tariq & Woodman, 2013). Other issues include deciding on the priority given to the data when combining the two datasets and if the two datasets produce conflicting results, especially if there is no explanation for the differences (Creswell et al., 2003; Tariq & Woodman, 2013).

3.4.4 The rationale for using mixed methods research

A quantitative approach was initially chosen as there was an opportunity to access a dataset for secondary analysis that had not been thoroughly analysed. However, on analysis of the data, there was information missing which meant the research questions in this thesis could not be answered in full. Therefore, the decision was made to include the qualitative component to help provide a more robust answer to the research questions. The qualitative component was designed to complement and fill the gaps in the quantitative results, and provided the potential to strengthen the validity of the results by combining the two methods. The advantages and limitations of quantitative and qualitative research are now discussed.

3.4.5 Advantages and limitations of quantitative and qualitative research

Quantitative and qualitative methods each have their advantages and limitations. An advantage of a quantitative approach is that it can give an overview of the research topic as it is useful to produce general results and trends from the data set (Kelle, 2006). Providing the sample is representative the research findings of a sample can be applied to predict occurrences in larger populations. However, while relationships can be observed, a limitation of quantitative research is that it does not allow further questions to be asked and as a result it is not possible to explore why a certain relationship might be occurring (Bryman, 2008; D. L. Morgan, 2007).

An advantage of a qualitative method is that it allows the researcher to explore the meaning and understanding of the participants' experience. Qualitative research can allow the researcher to explore the reasons behind the headline figures that quantitative research produces. A limitation of qualitative research is that you cannot find out the extent that something is occurring, or the spread of occurrences (Greene & Caracelli, 2003). Adopting a mixed methods approach has the potential to strengthen a study by exploring the extent that a relationship exists and why the relationship exists, within the same study.

3.5 Methods

This section describes the study design for each phase of the quantitative and qualitative research.

Phase one - quantitative research

3.5.1 Quantitative research approach

The quantitative component of this thesis sought to answer the following sub-questions:

- i. *Does a parent's knowledge of preschool oral health have an association with the oral health care they provide for their preschooler?*
 - This has been examined by looking at whether a parent's level of oral health knowledge differs by child and respondent characteristics?
- ii. *What factors other than knowledge influence the oral health care that a parent provides for their preschooler?*
 - This has been examined by examining whether there are differences in parents' level of oral health knowledge by population characteristics?

Expansion on the HPA report

As previously outlined, a secondary analysis of data from the HPA survey was conducted. Questions regarding knowledge and behaviour were used within this thesis, as well as respondent characteristics and demographics. The high-level findings of these variables were reported on by the HPA, and can be found in the '*Oral Health in Pre-schoolers*' report

produced by the HPA (Kaitiaki Research and Evaluation, 2015). The findings of the HPA research that are relevant to the data analysis in this thesis are discussed below.

3.5.2 Sample

Inclusion criteria

To qualify for the survey, participants needed to have access to the internet and have enrolled on the Colmar Brunton Panel. The respondents needed to be aged 18-years of age or older, and a parent or main caregiver of a preschool-aged child aged between six months and four-years 11 months. If participants completing the survey had more than one preschooler, participants were asked to answer the questions regarding the child who had the most recent birthday.

Ethical approval

Further ethical approval was not needed from the secondary analysis of this data. However, initially ethical approval was obtained for the survey from the New Zealand Ethics Committee in 2015 (ref: NZEC 15 #23) by the research company that collected the data. No further ethical approval was required.

The distribution of respondent characteristics

Of the 1056 respondents, nearly half had a Bachelor's Degree or higher, and most were of a medium to high socioeconomic position. Parents were evenly distributed between those who were aged 34-years and over those who were 35-years or older. The majority of respondents had only one child, and brushed their own teeth at least twice a day. The results are described in full in *Table 1*.

Table 1. Respondent characteristics by number of participants and by percentage (n=1056).

Respondent characteristics	N (1056)	%
Age		
18 to 34-years of age	485	46
35 + years of age	571	54
Highest level of education		
Secondary school qualification	304	29
Trade, Diploma, Professional qualification	254	24
Degree	305	29
Postgraduate Degree or Diploma	189	18
Household income		
<\$40,000	63	7
\$40,001 to \$70,000	254	27
\$70,001 to \$100,000	276	29
\$100,001 +	360	38
Employment		
Homemaker/other	398	38
Part time employment	258	25
Full time employment	396	38
Number of children in care		
1	639	61
2	384	36
3 +	33	3
Respondents tooth brushing habits		
Once a day or less	290	28
Twice a day or more	757	72

Source: (Kaitiaki Research and Evaluation, 2015).

The distribution of child characteristics

More than twice as many parents who completed the survey had children two years of age or older. Children were evenly distributed by first or subsequent child. The majority of children were non-Māori. The distribution of characteristics are described in full in *Table 2*.

Table 2. Child characteristics by number and percentage (n=1056).

Child characteristics	N	%
Age		
Under two-years of age	320	30
Two-years of age or older	736	70
Ethnicity (prioritised)		
Māori	138	13
non-Māori	918	87
First or subsequent child		
First	474	47
Subsequent	532	53

Source: (Kaitiaki Research and Evaluation, 2015).

3.5.3 Research tools

The HPA survey used an online self-completion, closed-ended questionnaire, delivered via the internet. The questionnaire was divided into six sections and covered a range of topics including the child's oral health status and care, as well as the parent's knowledge of preschool oral health, and their own oral health status and oral health self-care.

The knowledge questions that were used to represent parent's knowledge of preschool oral health were: (a) knowledge that tooth brushing should begin before the child's first birthday, (b) knowledge that primary teeth need filling, and (c) knowledge that there is a relationship between primary and secondary teeth. Further information about the questions is outlined below in *Table 3*.

Table 3. Description of the knowledge variable questions and the categorised answers.

Knowledge	Question	Categorised answers	n
Knowledge that brushing should begin before a child's first birthday.	<i>To the best of your knowledge, at what age do you think children should begin to have their teeth brushed every day?</i>	'under-one' and 'older than one'	1056
Knowledge that it is important to restore primary teeth	<i>To the best of your knowledge, cavities or holes in baby teeth do not need to be filled?</i>	'agree/don't know' and 'disagree'	1056
Knowledge of the relationship between primary teeth and secondary teeth	<i>To the best of your knowledge, there is no relationship between the health of baby teeth and adult teeth?</i>	'agree/don't know' and 'disagree'	1056

Source: (Kaitiaki Research and Evaluation, 2015).

The questions that were used to represent a parent’s behaviour in relation to their preschooler’s oral health were: (a) brushing began before the child’s first birthday, (b) tooth brushing occurs twice a day or more, (c) toothpaste is always used when brushing the child’s teeth, and (d) whether the child has visited a dental professional before. Further information about the questions is outlined below in *Table 4*.

Table 4. Description of parent’s engaging in oral health care behaviours for their children and the categorised answers.

Behaviour	Question	Categorised answers	n
Brushing began before the child’s first birthday	<i>How old was your child when they started having their teeth brushed?</i>	‘under-one’ and ‘older than one’	990 – question was only asked if child had their first tooth
Tooth brushing occurs twice or more a day	<i>How often are your child’s teeth brushed?</i>	‘twice a day or more’ or ‘once a day or less’	990 – question was only asked if child had their first tooth
Toothpaste is always used when the child’s teeth are brushed	<i>When your child’s teeth are brushed, how often is toothpaste used?</i>	‘always use toothpaste’ or ‘use toothpaste less frequently’	990 – question was only asked if child had their first tooth
The child has visited a dental professional	<i>Thinking about the first time that your child visited a dental professional, how old were they?</i>	‘been to a dental professional’ or ‘never visited a dental professional’	1056 – question was asked to all respondents

Source: (Kaitiaki Research and Evaluation, 2015).

3.6.4 Data collection procedure

Recruitment

Survey respondents were recruited through ConsumerLink, a company with an online database that has access to over 250,000 New Zealanders. One wave of emails was sent to potential respondents on 18 June 2015, inviting them to complete a survey. Potential respondents were given a week to complete the survey, during which time two reminder emails were sent. This was considered acceptable as the invitation to participate was sent to a large sample size. It also was intended to over-sample Māori and Pacific participants as they are identified in the literature as high-risk groups. To achieve this, a higher proportion of invitations were emailed to potential participants who identified as Māori or Pacific. Before beginning the survey,

potential participants were informed that participation was voluntary and informed consent was gained by selecting a tick box before taking part. On completion of the survey, respondents received *Fly Buys* points, an online reward system where points are accumulated and can be redeemed for a range of products. Surveys were to be sent to potential respondents, with reminders sent, until the quota of 1000 completed surveys had been reached. The sample size was set by the HPA. As there were no changes made from the pilot survey to the final questionnaire the data collected in the pilot survey (n=56) was included in the final analyses. As a result, the total sample size was n=1056.

Pilot

The HPA questionnaire was initially piloted online by ten HPA personnel. Other than some wording changes no substantial amendments were required. An online pilot was then conducted using the same recruitment method as planned for the survey. Potential participants, from a pre-existing panel, were sent an email inviting them to take part in a survey. Fifty-six participants took part in the pilot survey. No changes were made to the questionnaire or the method following the pilot study, so their results were included in the main sample.

3.6.5 Quantitative analysis

I performed a secondary analysis on the data set using STATA IC 13.1. To provide an understanding of the quantitative data being analysed in this thesis, an initial descriptive analysis was undertaken. The means, proportions, ranges and variances were calculated, as appropriate, for all variables. In this section the univariate and multivariate logistic regression models that were run are discussed, but first the variables that were used and why they were chosen are discussed.

I categorised the questions used in the HPA survey into four groups: child characteristics, respondent characteristics, knowledge variables and behaviour variables. All child and respondent characteristics were chosen based on theory, including their presence in the Fisher-Owens Model and on literature review findings. These variables, which are outlined further below, were chosen for this thesis as they would contribute to answering the over-arching research question:

What factors influence the oral health care parents provide for their preschooler?

3.6.5.1 Risk factors - respondent characteristics

The distribution of respondent characteristics can be seen in *Table 1* above. Respondents were asked questions about themselves and their own oral health condition and practices. Listed below are the characteristics of the respondent and demographic factors that from hereafter will be categorised as ‘respondent characteristics’. The respondent characteristics are used to assess and adjust for any specific characteristics that have an impact on a parent’s level of knowledge, or are likely to impact whether parents perform the recommended behaviours. The respondent characteristics are used to adjust the data to help better understand the potential relationship between respondent’s oral health knowledge and oral health care for their preschoolers.

Parent’s age

The literature showed that a preschooler’s oral health is associated with the age of the parent (Akpabio et al., 2008; Hallett & O’Rourke, 2003). To assess this relationship, respondents were categorised into two age groups, between 18 and 34-years of age and over 35-years of age. The age 34 was chosen as this aligns with many international studies of preschool oral health.

Parent’s education level

The literature showed a correlation between a parent’s level of educational qualification and the presence of early childhood caries in their preschooler (Colak et al., 2013; Hallett & O’Rourke, 2003; Skeie et al., 2006; Van den Branden et al., 2013; Vann et al., 2010). In the initial study the respondent’s education level was categorised into four categories: secondary school qualification, trade or diploma, a bachelor degree and postgraduate qualification. This categorisation was replicated for the secondary analysis. Due to low numbers of respondents with no formal qualification, the respondents with no formal qualifications were combined with respondents who had a secondary school qualification.

Household income

Household income is used as a proxy for a family’s socioeconomic status. Families with a low socioeconomic status have been identified as a high priority group for oral health, as children from low socioeconomic families have a higher prevalence of early childhood caries (Fisher-Owens et al., 2007; Hallett & O’Rourke, 2003; Reisine et al., 2008). Household income was used as one of the proxies for the socioeconomic status of the household (other more indirect proxies include the parent’s level of education and the parent’s level of employment). Respondents were asked about their total household income per year using a standardised question from the 2013 New Zealand Census. Total household income is calculated based on

the total income of all members in a household over 15-years of age (Statistics New Zealand, n.d.). To allow alignment with other research, the household income was grouped into four categories, 'under \$40,000', '\$40,001 to \$70,000', '\$70,001 to \$100,000', and '\$100,001 and over'.

Parent's employment

The respondent's employment commitment was simplified to the categories: 'homemaker', 'part-time', and 'full-time'. There was no research that could be identified that demonstrated there is an association between the employment level of parents and the care and or knowledge they provide for their preschooler. However, it was thought that this might have an influence and therefore was included in the analysis.

Parent's tooth brushing frequency

A parent's own oral health care and status has been identified as having a relationship with their child's oral health status (Fisher-Owens et al., 2007; Isong et al., 2010). Identifying the oral hygiene characteristics of parents helps to understand the level of importance they place on their own oral health. Each respondent was asked about the frequency with which they brush their teeth. Responses were categorised into 'once a day or less', and 'twice a day or more'.

3.6.5.2 Risk factors - child characteristics

The child characteristics refer to the variables associated with the preschooler of the respondent. These variables are used to assess if there are any specific characteristics, in relation to the child, that may be associated with the parents having a lower level of knowledge, or be less likely to perform the recommended behaviours. Similarly, to the respondent characteristics, the child characteristics are used to adjust the data to help better understand the potential relationship between a respondent's oral health knowledge and the oral health care they provide for their preschoolers. The variables that were chosen for use in this research are now described in further detail below, and hereafter are categorised as 'child characteristics'.

Child age

Based on the review of the literature, children's oral health differed between children of different ages (Skaret et al., 2008). Respondents were asked the age of their child; children were categorised for analysis in this study as younger than two or two-years of age or older.

Child ethnicity

Māori are a high priority group for oral health in New Zealand as they have a high prevalence of early childhood caries (Ministry of Health, 2010, 2016). Child ethnicity was categorised by the child's ethnicity, rather than the ethnicity of either of the child's parents. This option was chosen as it removed potential inconsistencies if parents were different nationalities.

A standardised question used in the New Zealand 2013 census was used to gain information of the child's ethnicity (Statistics New Zealand, 2013). Respondents could choose multiple options and then responses were prioritised. Due to the sample size of ethnic groups, children were categorised as 'Māori' or 'non-Māori'. While ethnicity is not a risk factor for early childhood caries, it was included as Māori is a priority group for public health interventions.

First or subsequent child

The literature showed differences in a child's oral health status depending on whether they are the first or a subsequent child (Akpabio et al., 2008). A child was classified as a subsequent child if the child had an older sibling or child in the family that the parent had been the main caregiver for. Children were classified as a first or subsequent child.

3.6.5.3 Independent variables - knowledge

Knowledge is hypothesised as being predicative of oral health care. However, to identify target population groups, differences in knowledge by population characteristics were also assessed. This meant that knowledge was used at different times in the analysis as a dependent and independent variable. *Table 5.* presents the knowledge variables as the questions were asked and how the answers were categorised (Kaitiaki Research and Evaluation, 2015).

A response of 'don't know' was combined with the incorrect response. This was based on the rationale that a large percentage of participants answered don't know. Don't know is indicative of not having knowledge therefore it is a potential risk of poorer oral health care resulting for children. Due to the large number of responses, the decision was made to include don't know responses with the negative response.

The distribution of knowledge variables are presented in *Table 5.* below. All of the variables had more than 70% of the parents answer in line with what is recommended, with the most parents having knowledge of the relationship between primary and secondary teeth.

Table 5. Number and percentage of respondents who accurately answered the knowledge based questions (n=1056).

Knowledge	n	%
Knowledge that brushing should begin before the child's first birthday (n=1056)	786	74 (71.7 – 77.0)
Knowledge that holes in baby teeth need filling (n=1056)	754	71 (68.6 – 74.0)
Knowledge that there is a relationship between primary and secondary teeth (n=1056)	842	80 (77.2 – 82.1)

Source: (Kaitiaki Research and Evaluation, 2015).

3.6.5.4 Dependent variables - behaviour

This section explains the behaviour variables used in the analysis of the study. The behaviour variables were treated as a dependent variable in both the univariate and multivariate analysis. The distribution of behaviour variables are presented in *Table 6*. below (Kaitiaki Research and Evaluation, 2015). All of the variables had more than half of the parents respond in line with the recommended behaviour, with nearly all participants using toothpaste when they brush their preschooler's teeth.

Table 6. Number and percentage of respondents who perform the recommended oral health behaviours for their preschooler.

Behaviour	n	%
Parents began brushing their children's teeth before their first birthday (n=990)	766	77 (75.4 – 79.1)

Parents brush their child's teeth twice or more a day (n=990)	571	58 (55.9 – 62.0)
Parents use toothpaste when brushing their child's teeth (n=990)	945	95 (94.0 – 96.6)
The child has been seen by a dental professional (n=1056)	770	74 (71.0 – 76.4)

Source: (Kaitiaki Research and Evaluation, 2015).

3.6.5.5 Univariate analysis

Univariate analysis was conducted using logistic regression. Univariate models were conducted between the following variables:

1. Knowledge based questions with behaviour variables; this analysis was conducted to identify differences in behaviour by the respondent's oral health knowledge.
2. Respondent characteristics and knowledge variables; this analysis was conducted to identify differences in knowledge by characteristics and demographic factors of the respondent.
3. Child characteristics and knowledge variables; this analysis was conducted to identify differences in knowledge by characteristics of the respondent's child.
4. Respondent characteristics and behaviour variables; this analysis was conducted to identify differences in behaviour by characteristics and demographic factors of the respondent.
5. Child characteristics and behaviour variables; this analysis was conducted to identify differences in behaviour by characteristics of the respondent's child.

3.6.5.6 Multivariate logistic regression models

Four logistic regression models were built, with each of the behaviour variables. Therefore, the behaviour variables were all dependent variables; each a dichotomous variable. The knowledge variables were treated as the independent variable; child characteristics and respondent characteristics were treated as potential risk factors. All child, respondent and knowledge variables were included in the multivariate analysis together, with one behaviour variable for each model. Logistic regression analysis was used as it is a method that shows associations between variables, and this approach best allowed the research questions to be answered.

Phase two - qualitative research

3.6.9 Qualitative research approach

This section describes the design of the qualitative component of this study. The aim of the qualitative research was to look at what parents' believe influences how they care for their preschooler's oral health and aimed to answer the following research questions:

- i. *Does a parent's knowledge of preschool oral health have an association with the oral health care they provide for their preschooler?*
- ii. *What factors other than knowledge influence the oral health care that a parent provides for their preschooler?*

Data collection involved semi-structured interviews with six (n=6) parents of preschoolers who lived in areas of high deprivation. The development of the semi-structured interview schedule was guided by: (a) the Fisher-Owens Model (Fisher-Owens et al., 2007), (b) key topics identified in the literature review, and (c) findings from the quantitative survey.

Individual interviews

Individual interviews typically consist of a question-and-answer approach between an interviewer and an interviewee. The questions can be discussed following a semi-structured schedule or can be conversational in nature.

There are many advantages to collecting data by interviewing individuals, compared to conducting interviews with groups of people (focus groups). These advantages include, that interviews are useful for gathering information on emotions, experiences and feelings (Curry et al., 2009). Individual interviews often produce a wider range of themes as individuals talk about different topics, while also allowing data to be gathered easily on sensitive issues (Curry et al., 2009). Interviewing individuals on a one-on-one basis means there is an increased time available so the interviewee can share more information, whereas in a group interview the total time is split amongst all interviewees (Morgan, 1997). While group interviews potentially allow for rich data due to a discussion of topics between group members, they are more likely to produce statements in line with group norms, as opposed to individual feelings and opinions, these statements might not necessarily be shared by the wider group. Group conversations also have the risk of being dominated or strongly influenced by assertive interviewees. Ultimately

the choice of method depends on the purpose of the study. Due to the reasons discussed above, it was decided to conduct individual interviews for the qualitative component of this study.

Semi-structured interviews

In this research, semi-structured interviews were used. Semi-structured interviews allow the interviewer to adapt the questioning based on what the interviewee contributes, but still allows the interviewer to prepare certain questions or themes ahead of time (Bryman, 2008). This style can complement the rigidity of quantitative questioning.

3.6.10 Sample

Participants were selected using purposive sampling, a commonly used sampling strategy in qualitative research. Purposive sampling is a non-random sampling technique, in which a participant is purposefully chosen because they have certain qualities (Etikan, 2016). In this research, purposive sampling was used by targeting low socioeconomic groups, as this was identified in the literature review as a high-risk group and they were also under represented in the quantitative aspect. The aim was to complete six interviews, as this would give the potential for themes to emerge, but still be completed within the tight time pressures, if themes had not developed after six interviews a consideration would have been given to whether more interviews needed to occur.

Inclusion criteria

To be included in the qualitative research, participants needed to be a parent of a preschooler (six months to four-years 11 months) and 18-years of age or over. As discussed above participants were recruited from low socioeconomic areas. Communities were chosen based on the decile of the schools in the area.

The inclusion criterion for study participants was outlined in the participant information sheet (Appendix 2). As discussed previously, low socioeconomic communities were chosen to recruit participants for this phase of the research as they were identified in the literature review as having a higher risk of developing early childhood caries. One of the main reasons that the qualitative study was undertaken was that parents from low socioeconomic communities were underrepresented in the quantitative survey sample. Due to the higher risk of early childhood caries within this group it was decided low socioeconomic groups would be a focus of the

qualitative phase to ensure their views were represented and to explore in detail issues that impact this demographic.

Māori are a further high priority group for oral health. By targeting low socioeconomic areas, it was thought the sample would consist of a high proportion of Māori participants, as Māori are over represented in low socioeconomic areas. Also, areas around Wellington that are known to have a high portion of Māori residing, such as Wainuiomata and Porirua, were targeted when distributing the information leaflets. While it was recognised that it was important to hear from Māori participants (as they are a high-risk group), the authors of this study were aware that it is not their ethnicity that is putting them at a higher risk, and therefore it was thought that targeting lower income families would be more beneficial and allow for low socioeconomic participants that were not Māori to also be heard.

Participant characteristics

Six parents, four mothers and two fathers, with a preschooler participated in the study. Half of the participants had two or more children, of which one was a preschooler. Four of the participant's preschoolers were three-years old; the other preschoolers were aged two and four-years. Two participants identified as Māori, three as New Zealand European, and one as New Zealand European and Samoan. All participants resided in Wellington City and the Hutt Valley, and were from areas of low deprivation. Most of the participants had a sociodemographic score of 2 or 3 (range of 1 to 3), which was calculated by the standardised New Zealand Individual Deprivation Index (NZiDep) (Salmond, 2006), and all participants were aged 30 to 35-years old. One parent shared custody of the child with the child living across the separate households. *Table 7.* presents the participants characteristics.

Table 7. Qualitative participant characteristics (n=6) by percentage.

Variable	N (6)
Participant gender	
Female	4
Male	2
Participant ethnicity	
New Zealand European/ other	4
Māori	2
Participant age	
30 to 35-years of age	100%
Number of children	
1	3
2	2
3	0
4	1
Number of preschoolers	
1	6
Sociodemographic factors (based on a calculated score from the NZiDep Index)	
1	1
2	3
3	2
Preschoolers age (years)	
2	1
3	4
4	1
Preschoolers gender	
Female	4
Male	2

Ethical approval and consultation with Ngāi Tahu

Ethical approval was granted by the University of Otago Human Ethics Committee (Category B) in March 2017 for the qualitative component of the study. In addition, consultation with Ngāi Tahu Research Consultation Committee was undertaken in April 2017 as required as part of a Memorandum of Understanding between the University of Otago and Te Runanga o Ngāi Tahu.

3.6.11 Research tools

The interview schedule was made up of a range of topics. These topics include, oral hygiene care routines and factors that influence a parents' ability to care for their preschooler's oral health such as tooth brushing routines and taking their child to the dentist.

Pilot

Prior to data collection, the interview schedule was piloted to test the process and to trial the interview schedule. The pilot was conducted with a parent of a preschooler who lives in the Wellington region. Following the pilot interview, feedback was sought from the participant on the interview schedule and on the overall process. Minor changes were made to the interview schedule, including wording changes and further prompts. The pilot interview was not included in the results.

Data collection instruments

A semi-structured open ended interview schedule was developed to aid discussion and to ensure consistency in data collection between participants. The aims of the study guided the development of the interview schedule, along with the Fisher-Owens Model. As the interview guide was developed after the quantitative results were analysed, it allowed for the gaps in the data (with regard to answering the research questions) to be identified and guide the development of the qualitative research. An example of this was targeting lower socioeconomic parents as they were underrepresented in the quantitative study.

To help determine the characteristics of the sample, participants were asked to fill in a form with questions regarding their age, ethnicity, the number of children they care for, and on their children's oral hygiene. Ethnicity was determined using the standardised ethnicity question from the 2013 New Zealand Census, which was also used in the quantitative study. There was also a set of standardised questions, the NZiDep questionnaire, which was used help determine the individual's level of deprivation. Participants' individual socioeconomic deprivation level was derived using the NZiDep (Salmond, 2006). The NZiDep Index is a standardised survey, where participants answer eight yes or no questions. The number of 'yes' responses are added together and recoded to one of five categories. The categories range from a score of one which equates to no deprivation characteristics to five, which means a person has five or more

deprivation characteristics, and is therefore considered to be highly deprived (Salmond, Crampton, King, & Waldegrave, 2006).

3.6.12 Data collection procedure

Recruitment

During February and March 2017, an information sheet describing the study, as well as consent forms were distributed among low socioeconomic communities in the Wellington region and surrounding areas. Community contacts helped to distribute the information at a local church and doctor's practices, including Evolve Youth Service and Ora Toa Ponake Medical Centre. Information was also distributed to four early childhood centres in Wainuiomata and Porirua, and a further early childhood centre in Newtown. Wellington and its surrounding region was chosen primarily due to the location of the researcher. Wellington has a range of socioeconomic areas ranging from low socioeconomic, through to high socioeconomic. Interviewees were recruited from low socioeconomic areas, which were identified by the school decile of the area. The school decile reflects the percentage of students at a school who live in low socio-economic communities. It was decided to use this figure as it is one of the measures available that is representative of the area people live in, with a positive being that the participant wasn't required to give details of their address.

Upon expressing interest in participating, participants were contacted via telephone. In this conversation, more detail was given about the research project, and it was explained to the potential participant that consent would need to be given. In this conversation, the participant was further screened to ensure they met the criteria and were asked if they were willing to participate in the project. Upon agreeing, a time and location was arranged for the interview to take place that was convenient for the participant. The interviews mostly occurred in the participant's home or in a local meeting room.

Interviews were conducted between April 2017 and June 2017. Interviews ranged from 28 minutes to 46 minutes in length. On arrival, participants were given an information sheet about the study, a participant information form to fill in and a consent form to complete before the interview started.

It was made clear that the interviews were confidential. Upon obtaining verbal and written consent from participants, the interviews were recorded using a Dictaphone. On conclusion of the interview, participants were asked if they could be contacted again if the researcher had any further questions. Participants were offered the opportunity to receive a copy of the findings. On conclusion of the interview, fact sheets containing information about caring for young children's oral health were offered to the participants. Following the interview, the recordings were transcribed.

Data security

The interviews were recorded and transcribed (with the participant's permission) to be analysed at a later point. Once the recordings had been transcribed, they were erased. To maintain privacy, the transcripts were anonymised and stored in a locked drawer and on a password-protected computer. In line with ethical approval, data will be retained for at least five-years in secure storage. Only nominated people will have access to this data. On completion of the research, participant's personal information was destroyed.

3.6.12 Qualitative analysis

The data was analysed using thematic analysis, a commonly used analytical method for qualitative research (Braun & Clarke, 2006). Thematic analysis provides for extraction of meanings and concepts from the data and allows patterns or themes to be identified, examined and recorded (Javadi & Zarea, 2016). Braun and Clarke (2006) classify a theme as a reoccurring element within responses that has some direct relevance to the research question (Braun & Clarke, 2006). Using thematic analysis allowed flexibility to find patterns in the data when analysing this research; the primary focus during this exercise is on patterns that are not related to the structured research questions (noting that the interviews were semi-structured for the purpose of eliciting comments on those specific areas). The approach that was adopted is described below.

Initially, themes were structured based on the topic areas of the interview schedule. The transcripts were then reviewed several times to identify the themes that occurred frequently and the initial topic areas were modified. These themes were numbered throughout the transcripts and relevant quotes highlighted. These themes were aligned with factors identified in the Fisher-Owens model; child-level, family-level and community- and environmental-level

influences. This allowed for common themes to be recognised. Similarity and differences of themes were then investigated further within and across sociodemographic groups to identify any differences. The findings are presented in accordance with elements of the Fisher-Owens Model.

3.7 Conclusion

This chapter has outlined the research methods used in this study to help understand what factors influence how a parent cares for their preschooler's oral health. Both quantitative and qualitative research methods were used to create a mixed methods research design. This allowed for investigation into the differences in oral health promotion behaviours between population groups and why the differences occur. The survey and interviews were conducted with parents of preschool-aged children, parents were questioned on their own oral health, their preschooler's oral health and the impact that the environment has on oral health. The following chapter presents the findings of the quantitative and qualitative results.

Chapter 4 - Results

4.1 Introduction

This chapter presents the findings from the quantitative and qualitative data, sourced from the HPA survey and individual interview transcripts. Data has been collated to answer the overarching research question posed in the previous chapters, *what factors influence the oral health care parents provide for their preschooler?* with the quantitative findings addressing the research sub-questions:

- i. *Does a parent's knowledge of preschool oral health have an association with the oral health care they provide for their preschooler?*
 - This has been examined by looking at whether a parent's level of oral health knowledge differs by child and respondent characteristics?
- ii. *What factors other than knowledge influence the oral health care that a parent provides for their preschooler?*

This has been examined by looking at whether:

- there are differences in how parents care for their preschooler's oral health, by population characteristics?
- differences in population characteristics impact how parents care for their preschooler's oral health?
- there are community and environmental factors that impact how parents care for their preschooler's oral health?

Both the quantitative and qualitative findings aim to answer these questions. The quantitative findings are presented first (Section 4.2), followed by findings from the analysis of the qualitative data (Section 4.3). Each section has been summarised, and the chapter is then concluded in Section 4.4.

4.2 Quantitative analysis

The section presents the results of the quantitative data. Logistic regression was used to analyse the results with an aim of looking at the relationship between parent's oral health knowledge

and behaviour. While also looking at the associations between respondent and child characteristics with both the sets of knowledge and behaviour variables.

The qualitative research results are presented below. To categorise the findings, the results are then presented in line with the research questions that this section of the study aims to answer. The findings are then summarised in Section 4.2.4.

4.2.1 Does a parent's knowledge of oral health impact how they care for their preschooler's teeth?

4.2.1.1 Parents' knowledge by behaviour variables

Brushing teeth twice or more a day

The univariate analysis showed respondents who knew they should begin brushing their children's teeth before the child's first birthday had a higher likelihood of brushing their children's teeth twice or more a day (OR 1.46, 95% CI 1.05 – 2.04). However, once adjusted for all other variables, including other knowledge variables, child characteristics and respondent characteristics, the difference was no longer significant. There were no other differences seen in this behaviour when compared with the knowledge variables.

Always use toothpaste when brushing

In both the univariate and multivariate analysis, the likelihood of respondents always using toothpaste when brushing their children's teeth varied a lot depending on a respondent's knowledge. In the univariate analysis, there were significant differences seen in the use of toothpaste if parent had knowledge that a preschooler's teeth should begin to be brushed before their first birthday (OR 2.28, 95% CI 1.24 – 4.2) and this relationship was strengthened when adjusted for other variables (AOR 2.47, 95% CI 1.23 – 4.94). Respondents who knew the importance of restoring primary teeth were also more likely to always use toothpaste when brushing their preschooler's teeth (OR 3.14, 95% CI 1.72 – 5.74), this relationship was still seen when other variables were adjusted for (AOR 2.25, 95% CI 1.18 – 4.30). The univariate analysis showed a significant relationship between knowledge of the relationship of primary and secondary teeth, and the use of toothpaste (OR 3.20, 95% CI 1.73 – 5.90). However, when adjusted for other variables (AOR 1.94, 95% CI 0.99 - 3.79), the findings show there is not a significant difference between the groups, though it is worth noting that the confidence interval is close to significant.

Preschooler has seen a dental professional

The behaviour variable ‘whether a preschooler has visited a dental professional’ was analysed and only one difference between population groups was found. The difference came from parents who knew cavities in primary teeth needed to be filled, and they were more likely to take their child to see a dental professional (OR 1.36, 95% CI 1.01 – 1.83), than parents who did not have this knowledge. When other factors were adjusted for there was little change in the values (AOR 1.2, 95% CI 0.83 – 1.75).

Age brushing teeth began

The univariate analysis showed that there was an increased likelihood of a preschooler having their teeth brushed before the age of one if their caregiver had knowledge of the relationship between primary and secondary teeth (OR 1.71, 95% CI 1.20 – 2.42). Knowledge of the relationship between primary and secondary teeth was still significant when other factors were adjusted for in the multivariate analysis (AOR 1.78, 95% CI 1.18 – 2.68). A significant difference in the age tooth brushing was initiated was also seen if the caregiver knew that cavities in primary teeth needed to be restored (OR 1.75, 95% CI 1.27 – 2.39), with an adjusted odds ratio of (AOR 1.72, 95% CI 1.19 – 2.52). If the parent knew that brushing should begin before the age of one, it was significantly more likely that a child’s teeth would be brushed (OR 24.80, 95% CI 17.0 – 36.20). Once adjusted for all other variables this relationship was still significant (AOR 19.80, 95% CI 13.5 – 34.7). While it is apparent there is a strong relationship with this variable, this result needs to be interpreted with caution, given the large confidence intervals.

Table 8. The impact parent's knowledge of oral health has on behaviour variables.

Knowledge variables	Child's teeth are brushed twice a day or more			Toothpaste is always used when brushing child's teeth			Child has visited a dental professional			Brushing of the child's teeth began before their first birthday		
	%	OR	AOR	%	OR	AOR	%	OR	AOR	%	OR	AOR
What age tooth brushing should begin												
After one year of age	53%	1	1	90%	1	1	73%	1	1	56%	1	1
Before one-year of age	62%	1.46 (1.05 - 1.87)	1.30 (0.92 - 1.84)	98%	2.28 (1.24 - 4.20)	2.47 (1.23 - 4.94)	74%	1.01 (0.76 - 1.39)	0.94 (0.71 - 1.43)	99%	24.8 (17.0 - 36.2)	19.8 (13.5 - 34.70)
Filling holes in primary teeth												
Yes	59%	1	1	89%	1	1	70%	1	1	70%	1	1
No	58%	0.97 (0.74 - 1.29)	1.08 (0.82 - 1.43)	98%	3.14 (1.72- 5.74)	2.25 (1.18 - 4.30)	79%	1.36 (1.01 - 1.83)	1.20 (0.83 - 1.75)	83%	1.75 (1.27 - 2.39)	1.72 (1.19 - 2.52)
Relationship between primary and secondary teeth												
Agree/don't know	50%	1		90%	1	1	72%	1	1	72%	1	1

	Child's teeth are brushed twice a day or more			Toothpaste is always used when brushing child's teeth			Child has visited a dental professional			Brushing of the child's teeth began before their first birthday		
Knowledge variables	%	OR	AOR	%	OR	AOR	%	OR	AOR	%	OR	AOR
\$40,001-\$70,000 (n=254)	65%	1.77 (1.29 - 2.43)	1.38 (0.96 – 1.98)	99%	3.20 (1.73 – 5.90)	1.94 (0.99 – 3.79)	76%	1.31 (0.94 – 1.83)	0.96 (0.63 – 1.46)	81%	1.71 (1.20 – 2.42)	1.78 (1.20 – 2.48)

4.2.2 What are the differences in a parent's oral health knowledge by population characteristics?

4.2.3.1 Knowledge variables by respondent variables

Knowledge that tooth brushing should begin before the child's first birthday

Parents' knowledge that tooth brushing should commence before a child's first birthday differs by respondent characteristics. Parents who were 'younger' (aged 18 to 34) were more likely to know that they should be brushing their child's teeth before their first birthday (OR 1.47, 95% CI 1.11 – 1.95), compared to parents over the age of 35. Similarly, parents who brushed their own teeth twice or more a day (OR 1.66, 95% CI 1.23 – 2.23) and who had two children in their care (OR 1.67, 95% CI 1.22 – 2.26) also knew that brushing should begin before their child was one-year old. However, there was no significant difference seen between respondents who had one child or three or more children.

Differences in knowledge were also seen when assessed by a respondent's work status, with homemakers being significantly more likely to know that tooth brushing should occur before the child was one-year of age than those parents working part-time (OR 0.61, 95% CI 0.41 – 0.91), and full-time (OR 0.37, 95% CI 0.26 – 0.51). This trend indicates that the greater amount of time worked the less likely parents knew that brushing needs to begin before the child's first birthday. A difference in knowledge by parent's income was also seen. Those parents whose household income was between \$40,001 - \$70,000 were significantly more likely to know to begin brushing their children's teeth before their first birthday (OR 1.99, 95% CI 1.09 – 3.62), than caregivers whose household income was under \$40,000. There were no significant differences among remaining income brackets. However, the wide confidence intervals make it difficult to conclude with any level of certainty whether a relationship exists or not.

Knowledge that holes in primary teeth need filling

The univariate logistic regression model showed that parents who brushed their teeth more than twice a day (OR 1.39, 95% CI 1.04 – 1.86), and parents whose household income was over \$100,001 (OR 1.84, 95% CI 1.05 - 3.20) were more likely to know the importance of restoring primary teeth, than parents who did not brush their teeth twice a day or whose household income was less than \$40,000, respectively. There were no other significant differences by level of income; however, there was an incremental increase in the likelihood that respondents

would have the knowledge based on income. This was the only trend seen with this knowledge variable.

Knowledge of a relationship between primary and secondary teeth

The results showed that parents who brushed their own teeth twice a day or more were more likely to know that there is a relationship between primary and secondary teeth than parents who did not brush their teeth twice a day or more (OR 1.92, 95% 1.39 – 2.64). A similar result was observed if the parent was in part-time employment (OR 1.67, 95% CI 1.09 – 2.54), compared to parents who were homemakers, respectively. This means that parents working part-time had a higher level of knowledge of the relationship than parents that were homemakers. There was no difference between parents who classified themselves as homemakers and those who worked full-time, although, some of the confidence intervals are close to being significant and therefore cannot be ruled out as small changes in data could make a difference to the result.

Table 9. Parent's knowledge of preschool oral health, respondent characteristics by percentage and odds ratio.

	Parents knew that brushing should begin before age one		Parents knew that holes in primary teeth need filling		Parents knew there is relationship between primary and secondary teeth	
Respondent characteristics	% of correct answers	OR	% of correct answers	OR	% of correct answers	OR
Age						
35+ years of age (n=571)	71	1	70	1	80	1
18 to 34-years of age (n=485)	78	1.47 (1.11 - 1.95)	73	1.13 (0.87 - 1.48)	79	0.94 (0.69 - 1.27)
Highest level of education						
Secondary school (n=304)	74	1	71	1	79	1
Trade, Diploma, Professional qualification (n=254)	74	1.0 (0.68 - 1.45)	68	0.85 (0.60 - 1.27)	80	1.06 (0.70 - 1.59)
Degree (n=305)	77	1.20 (0.83 - 1.73)	73	1.13 (0.80 - 1.61)	81	1.16 (0.78 - 1.72)
Postgraduate degree or diploma (n=189)	73	0.97 (0.64 - 1.46)	74	1.16 (0.77 - 1.75)	80	1.12 (0.71 - 1.76)
Household income						
<\$40,000 (n=63)	65	1	76	1	76	1
\$40,001-\$70,000 (n=254)	79	1.99 (1.09 - 3.62)	76	1.63 (0.92 - 2.90)	76	0.99 (0.52 - 1.89)
\$70,001-\$100,000 (n=276)	75	1.64 (0.91 - 2.95)	80	1.67 (0.94 - 2.94)	80	1.22 (0.64 - 2.35)

	Parents knew that brushing should begin before age one		Parents knew that holes in primary teeth need filling		Parents knew there is relationship between primary and secondary teeth	
Respondent characteristics	% of correct answers	OR	% of correct answers	OR	% of correct answers	OR
\$100,001+ (n=360)	72	1.37 (0.78 - 2.42)	84	1.84 (1.05 - 3.20)	84	1.66 (0.87 - 3.17)
Employment						
Homemaker/other (n=398)	83	1	72	1	78	1
Part-time employment (n=258)	75	0.61 (0.41 - 0.91)	74	1.14 (0.80 - 1.62)	86	1.67 (1.09 - 2.54)
Full-time employment (n=396)	65	0.37 (0.26 - 0.51)	69	0.87 (0.64 - 1.18)	77	0.95 (0.68 - 1.32)
Number of children in care						
1 (n=639)	71	1	71	1	61	1
2 (n=384)	80	1.67 (1.22 - 2.26)	72	1.03 (0.77 - 1.36)	79	0.90 (0.66 - 1.23)
3 + (n=33)	67	0.81 (0.38 - 1.70)	67	0.80 (0.38 - 1.69)	73	0.64 (0.29 - 1.41)
Tooth brushing habits of adult						
Once a day or less (n=290)	67	1	66	1	72	1
Twice a day or more (n=757)	77	1.66 (1.23 - 2.23)	73	1.39 (1.04 - 1.86)	83	1.92 (1.39 - 2.64)

4.2.2.2 Knowledge variables by child characteristics

This section presents the results of univariate analysis of child and parent characteristics (independent variables) by knowledge variable (dependent variable). Only univariate analysis was carried out between these variables. The results are presented by respondent characteristics (*Table 9*) and then by child characteristics (*Table 10*); details of these characteristics were presented in Chapter 3.

Knowledge that tooth brushing should begin before the child's first birthday

Significant differences were seen between the parents' knowledge based on the child's age and whether or not the respondent was answering about their first child. Respondents were significantly less likely to know that tooth brushing should begin before one-year of age if their child was over two-years of age (OR 0.46, 95% CI 0.33 – 0.64) and if that child was their first child (OR 0.56, 95% CI 0.42 – 0.76), than if the child was under two-years-of-age or the subsequent child of the parent, respectively.

Knowledge that holes in primary teeth need filling

The univariate logistic regression model showed that parents of children two-years of age or older were more likely to understand the importance of having decayed primary teeth treated and restored (OR 1.58, 95% CI 1.19 – 2.09) than those parents for whom their child was younger than two-years of age. Respondents for whom this was their first child were less likely to know that primary teeth need restoring if the child has a cavity (OR 0.56, 95% CI 0.42 – 0.76) than if the parent has a subsequent child.

Knowledge of a relationship between primary and secondary teeth

There were differences in parents' knowledge of a relationship between primary and secondary teeth depending on whether their child was over the age of two or not. Parents of children aged two-years and older were more likely to know that there is a relationship between primary and secondary teeth than parents whose child was younger than two-years of age (OR 1.74, 95% CI 1.28 – 2.39). No other significant differences were seen between demographics and this can be seen in *Table 9*.

Other trends

A trend was seen with parents of Māori children tending to have a higher level of knowledge across the knowledge variables. However, this result was not significant and as the confidence intervals are large it is difficult to determine whether there are any differences in the level of knowledge between Māori and non-Māori respondents.

Table 10. The proportion and odds ratios (OR) of parents' knowledge of preschool oral health, by child characteristics.

	Parents knew the brushing should begin before age one		Parents knew that holes in primary teeth need filling		Parents knew there is relationship between primary and secondary teeth	
Child characteristics	% of correct answers	OR	% of correct answers	OR	% of correct answers	OR
Age						
Under 2-years of age (n=320)	84	1	73	1	73	1
Over 2-years of age (n=736)	70	0.46 (0.33 - 0.64)	83	1.58 (1.19 - 2.09)	83	1.74 (1.28 - 2.39)
Child ethnicity (prioritised)						
non-Māori (n=918)	74	1	71	1	83	1
Māori (n=138)	75	1.06 (0.70 - 1.60)	74	1.16 (0.77 - 1.73)	79	1.31 (0.82 - 2.11)
First or subsequent child						
Subsequent (n=474)	82	1	75	1	78	1
First (n=532)	71	0.56 (0.42 - 0.76)	69	0.74 (0.56 - 0.97)	81	1.18 (0.87 - 1.61)

4.2.3 What are the differences in the oral health care parents provide for their preschoolers by population characteristics?

This section presents the results of univariate analysis of child and respondent characteristics (independent variables) by behaviour variable (dependent variable). Both univariate and multivariate analysis was carried out between these variables. The results are presented by respondent characteristics (*Table 11*) and then by child characteristics (*Table 12*); details of these characteristics were presented in Chapter 3.

4.2.3.1 Behaviour variables by respondent characteristics

Brushing teeth twice a day or more

The univariate and multivariate analysis (*Table 12*) revealed that parents who brushed their own teeth twice a day or more, were more likely to brush their child's teeth two or more times a day (OR 6.40, 95% CI 4.68 – 8.76) when compared to those preschoolers whose parents brushed their own teeth once a day or less. This finding remained significant after adjusting for all other variables (AOR 6.20, 95% CI 4.50 – 8.54). The findings also showed that preschoolers with younger parents (aged 18 to 34-years of age) were less likely (OR 0.61, 95% CI 0.47 - 0.78) to have their teeth brushed twice a day than preschoolers whose parents were aged 35-years or older. This association remained when all other variables were adjusted for (AOR 0.71, 95% CI 0.53 – 0.94).

No other variables showed significant differences, however there were trends seen between some of these groups. The trends suggested that with an increase in hours spent working, parents were less likely to brush their children's teeth twice a day. This same trend was seen in larger families, with it being less likely the parents brushed their preschooler's teeth twice a day the more children there were in the family. There were not significant differences seen between these groups.

Always use toothpaste when brushing

There were limited differences seen between respondent characteristics regarding whether toothpaste is used when brushing their child's teeth. In the univariate analysis, there was an increased likelihood of respondents always using toothpaste when brushing their preschooler's teeth if they themselves brushed their own teeth at least twice a day (OR 2.20, 95% CI 1.19 – 4.10). However, when adjusted for other variables including the child characteristics,

knowledge variables and other respondent characteristics, the difference between the two groups became insignificant. In the analysis, a trend was seen in, with the more children a respondent had, the less likely they were to always use toothpaste when brushing their children's teeth. However, this finding was not significant. No other characteristics displayed trends in the results or had significant findings. It is noted that, overall, the proportion of parents who use toothpaste when brushing their preschooler's teeth was high.

Preschooler has seen a dental professional

The univariate analysis showed that children were more likely to have been to a dental professional if their parent brushed their own teeth twice a day or more (OR 1.47, 95% CI 1.09 – 1.99 and AOR 1.61, 95% CI 1.13 - 2.30) and if their parent worked part-time (OR 1.56, 95% CI 1.08-2.27 and AOR 1.60, 95% CI 1.02 – 2.52) than children whose parents brushed their own teeth once a day or less, and to parents who were homemakers, respectively. There was no significant difference found between homemakers and caregivers who worked full-time, however, the trend shows that caregivers who were working full-time were more likely than homemakers to have taken their child to see a dental professional (AOR 1.05, 95% CI 0.71 - 1.57), but still not as likely as respondents who worked part-time. There was also no significant difference between those who had a trade or a diploma compared to those who had no further qualification after secondary school. However, an inverse trend was seen in relation to external qualifications, with the more qualified the respondents were, the less likely they were to have taken their child to the dentist.

Preschoolers who had younger parents (aged 18 to 34-years) were less likely to have been to visit a dental professional (OR 0.63, 95% CI 0.48 – 0.84) than preschoolers whose caregiver was 35-years old or older; however, this difference was not significant when adjusted for all other variables (AOR 0.80, 95% CI 0.57 – 1.13).

Age brushing began

The univariate analysis indicated an increased likelihood of preschoolers beginning to have their teeth brushed before one-year of age if their parent was categorised as 'younger' (OR 1.52, 95% CI 1.12 – 2.06); if their parent brushed their own teeth twice or more a day (OR 1.57, 95% CI 1.14 – 2.16); if their parent had two children in their care (OR 1.75, 95% CI 1.26 – 2.45). There was a decreased likelihood of the preschooler beginning to have their teeth

brushed before one-year of age if the child's caregiver worked part-time (OR 0.58, 95% CI 0.37 – 0.89), or full-time (OR 0.32, 95% CI 0.22 – 0.46), than if the child's parent was a homemaker. The multivariate analysis showed that if the caregiver had two children they were more likely to have begun brushing their preschooler's teeth before the age of one (AOR 1.67, 95% CI 1.15 – 2.43) compared to parents who had only one child. There were no significant differences seen if the respondent had three children compared with those who had just one.

There was a significant difference seen in behaviour in respondents whose household income was \$40,001 to \$70,000 (AOR 2.18, 95% CI 1.05 - 4.54), but no significant differences or trends were seen between other levels of income in the univariate or multivariate analysis. There was a significantly lower chance of respondents who worked in part-time employment (AOR 0.59, 95% CI 0.36 – 0.90) or full-time employment (AOR 0.36, 95% CI 0.24 – 0.55) brushing their children's teeth, compared with caregivers who were homemakers. There was also a significantly higher chance of parents who brush their own teeth twice a day or more to begin brushing their children's teeth before their first birthday (OR 1.57, 95% CI 1.14-2.16 and AOR 1.47, 95% CI 1.02 – 2.13) than parents who brush their own teeth less frequently than twice a day.

Table 11. Univariate (OR) and multivariate (AOR) analysis of preschool oral health behaviour variables of parents, by respondent characteristics.

Respondent characteristics	Child's teeth are brushed twice a day or more			Toothpaste is always used when brushing child's teeth			Child has visited a dental professional			Brushing of the child's teeth began before their first birthday		
	%	OR	AOR	%	OR	AOR	%	OR	AOR	%	OR	AOR
Age												
35+ years of age (n=571)	64%	1	1	95%	1	1	78%	1	1	81%	1	1
18 to 34-years of age (n=485)	52%	0.61 (0.47 - 0.78)	0.71 (0.53 - 0.94)	96%	1.12 (0.61-2.06)	1.08 (0.57 – 2.08)	69%	0.63 (0.48 - 0.84)	0.80 (0.57 – 1.13)	64%	1.52 (1.12- 2.06)	1.36 (0.93 – 1.98)
Highest level of education												
Secondary school qualification (n=304)	54%	1	1	95%	1	1	78%	1	1	81%	1	1
Trade, Diploma, Professional qualification (n=254)	63%	1.41 (0.99 - 2.00)	1.18 (0.79 – 1.76)	97%	1.59 (0.66- 3.83)	1.21 (0.56 – 3.72)	75%	0.84 (0.57 - 1.25)	0.77 (0.49 - 1.21)	70%	0.81 (0.54 - 1.22)	0.83 (0.55 – 1.18)
Degree (n=305)	62%	1.38 (0.99 - 1.92)	0.89 (0.61 – 1.31)	96%	1.35 (0.61- 2.99)	1.08 (0.50 – 2.87)	72%	0.71 (0.49 - 1.03)	0.69 (0.44 – 1.08)	69%	0.82 (0.55 - 1.22)	0.72 (0.49 – 1.17)
Postgraduate degree or diploma (n=189)	57%	1.12 (0.77 - 1.64)	0.72 (0.47 – 1.12)	94%	0.83 (0.37 - 1.85)	0.80 (0.33 - 1.76)	70%	0.68 (0.45- 1.03)	0.61 (0.36 – 1.02)	70%	0.84 (0.53 - 1.31)	0.80 (0.51 – 1.29)
Household income												

	Child's teeth are brushed twice a day or more			Toothpaste is always used when brushing child's teeth			Child has visited a dental professional			Brushing of the child's teeth began before their first birthday		
Respondent characteristics	%	OR	AOR	%	OR	AOR	%	OR	AOR	%	OR	AOR
<\$40,000 (n=63)	60%	1		91%	1	1	69%	1	1	71%	1	1
\$40,001-\$70,000 (n=254)	54%	0.80 (0.44 - 1.43)	0.89 (0.48 - 1.46)	96%	2.16 (0.71 - 6.60)	1.56 (0.46 - 5.3)	77%	1.50 (0.81 - 2.77)	1.37 (0.67 - 2.78)	81%	1.85 (0.95 - 3.60)	2.18 (1.05 - 4.54)
\$70,001-\$100,000 (n=276)	59%	0.99 (0.55 - 1.77)	1.03 (0.59 - 1.80)	94%	1.58 (0.55 - 4.53)	1.15 (0.46 - 5.3)	74%	1.24 (0.68 - 2.28)	0.98 (0.46 - 1.98)	78%	1.31 (0.69 - 2.49)	1.70 (0.83 - 3.51)
\$100,001+ (n=360)	59%	0.99 (0.56 - 1.76)	0.92 (0.49 - 1.71)	96%	2.40 (0.82 - 7.02)	1.52 (0.45 - 5.07)	71%	1.09 (0.61 - 1.97)	0.76 (0.38 - 1.54)	76%	1.16 (0.62 - 2.18)	1.85 (0.90 - 3.82)
Employment												
Homemaker/other (n=398)	63%	1	1	96%	1	1	71%	1	1	87%	1	1
Part-time employment (n=258)	59%	0.85 (0.61- 1.18)	0.82 (0.56 - 1.19)	96%	1.22 (0.53- 2.82)	1.08 (0.50 - 2.76)	79%	1.56 (1.08- 2.27)	1.60 (1.02 - 2.52)	62%	0.58 (0.37- 0.89)	0.57 (0.36 - 0.90)
Full-time employment (n=396)	56%	0.77 (0.57- 1.03)	0.83 (0.59 - 1.16)	95%	0.83 (0.42- 1.63)	0.80 (0.57 - 1.09)	73%	1.09 (0.80- 1.49)	1.05 (0.71 - 1.57)	58%	0.32 (0.22- 0.46)	0.36 (0.24 - 0.55)
Number of children in care												
One (n=639)	59%	1	1	96%	1	1	73%	1	1	70%	1	1

Respondent characteristics	Child's teeth are brushed twice a day or more			Toothpaste is always used when brushing child's teeth			Child has visited a dental professional			Brushing of the child's teeth began before their first birthday		
	%	OR	AOR	%	OR	AOR	%	OR	AOR	%	OR	AOR
Two (n=384)	60%	1.04 (0.79-1.36)	0.94 (0.84 - 1.51)	95%	0.84 (0.44-1.57)	0.87 (0.43 - 1.75)	76%	1.13 (0.84-1.51)	1.16 (0.86 - 1.58)	83%	1.75 (1.26-2.45)	1.67 (1.14 - 2.45)
Three or more (n=33)	56%	0.89 (0.40-2.00)	0.83 (0.38 - 2.02)	88%	0.31 (0.09 - 1.11)	0.43 (0.10 - 1.8)	64%	0.64 (0.31-1.32)	0.71 (0.28 - 1.43)	79%	1.41 (0.52-3.83)	0.82 (0.28 - 2.38)
Tooth brushing habits of parent												
Once a day or less (n=290)	27%	1	1	93%	1	1	68%	1	1	69%	1	1
Twice a day or more (n=757)	71%	6.40 (4.68 - 8.76)	6.20 (4.5 - 8.54)	97%	2.20 (1.19-4.10)	1.71 (0.90 - 3.25)	76%	1.47 (1.09-1.99)	1.61 (1.13 - 2.30)	81%	1.57 (1.14-2.16)	1.47 (1.02 - 2.13)

4.2.3.2 Behaviour variables by child characteristics

Brushing twice or more a day

The univariate analysis revealed that preschoolers who were two-years of age or older were nearly twice as likely (OR 1.95, 95% CI 1.46 - 2.60), as preschooler's younger than two, to have their teeth brushed twice a day or more. This result was also seen when adjusted for the child and respondent characteristics in the multivariate analysis (AOR 2.15, 95% CI 1.56 – 2.96). There were no significant differences seen between the ethnicity of the child, nor whether it was the respondent's first child.

Always use toothpaste when brushing

Children two-years of age or older were more likely to have toothpaste applied when they brush their teeth, than children under the age of two (OR 2.94, 95% CI 1.61 – 5.37). When adjusted for other factors including knowledge variables, respondent characteristics and other child characteristics, the association between the age of the child and whether toothpaste was used remained, if the child was two-years old or older they were more likely to use toothpaste (AOR 3.28, 95% CI 1.67 - 6.45). There were no significant differences seen between the ethnicity of the child and whether or not the child was the first child.

Preschooler has seen a dental professional

The univariate analysis showed that children older than two-years were more likely to have been to see a dental professional (OR 9.58, 95% CI 7.00 – 13.10) than their younger counterparts. This same association was seen when adjusting for the other variables in the multivariate analysis (AOR 8.35, 95% CI 5.94 – 11.74). There were no significant differences or trends seen between whether it was the respondent's first child, nor between ethnicities.

Age brushing began

The univariate analysis (*Table 11*) indicated that preschoolers of Māori ethnicity were less likely to begin having their teeth brushed before the age of one-year of age (OR 0.20, 95% CI 0.12 – 0.36), compared to non-Māori children; or if the child was the first child of the parent (OR 0.71, 95% CI 0.52 – 0.98) compared to children who have siblings. However, once adjusted for, there were no longer significant differences.

In the multivariate analysis, there was a significant difference seen based on the age of the child, if the child was two-years of age or older they were less likely to have had their teeth

brushed before the age of one (AOR 0.18, 95% CI 0.10 – 0.30). However, in the univariate analysis there was no significant difference seen by the age of the child.

Table 12. Univariate (OR) and multivariate (AOR) analysis of preschool oral health behaviour variables of parents, by child characteristic.

	Child's teeth are brushed twice a day or more			Toothpaste is always used when brushing child's teeth			Child has visited a dental professional			Brushing of the child's teeth began before their first birthday		
Child characteristics	%	OR	AOR	%	OR	AOR	%	OR	AOR	%	OR	AOR
Age												
Under two-years of age (n=320)	47%	1	1	91%	1	1	42%	1	1	65%	1	1
Two-years of age and over (n=736)	63%	1.95 (1.46 - 2.60)	2.15 (1.56 - 2.98)	97%	2.94 (1.61 - 5.37)	3.28 (1.67 - 6.45)	88%	9.58 (7.00 - 13.10)	8.35 (5.95 - 11.74)	79%	1.39 (0.86 - 2.24)	0.18 (0.10 - 0.30)
Child ethnicity (prioritised)												
non-Māori (n=918)	59%	1	1	95%	1	1	73%	1	1	79%	1	1
Māori (n=138)	57%	0.91 (0.62 - 1.33)	0.83 (0.56 - 1.24)	97%	1.55 (0.55 - 4.40)	1.78 (0.56 - 4.82)	76%	1.19 (0.78 - 1.81)	1.08 (0.62 - 1.65)	62%	0.20 (0.12 - 0.36)	1.35 (0.77 - 2.46)
First or subsequent child												
Subsequent (n=474)	58%	1	1	96%	1	1	74%	1	1	80%	1	1
First (n=532)	60%	0.94 (0.72 - 1.21)	0.90 (0.69 - 1.16)	96%	1.07 (0.57 - 2.01)	0.94 (0.43 - 1.78)	74%	1.03 (0.78 - 1.37)	0.94 (0.68 - 1.24)	69%	0.71 (0.52 - 0.98)	0.77 (0.63 - 1.65)

4.2.4 Summary of quantitative results

Overall, the findings show an association between a parent's knowledge of oral health and performing oral health behaviours. In each of the knowledge variables, having more oral health knowledge led to the parent being more likely to perform the oral health behaviours on their preschooler. However, this relationship was not consistent, with some of the associations very strong, while others becoming insignificant when adjusted for other variables.

Associations were also seen between certain child and respondent characteristics and the knowledge variables. This indicates that there are likely to be differences in oral health knowledge depending on a child and respondent characteristics. Most notably, parents seemed to have a higher level of preschool oral health knowledge if their child was two-years of age or older, and/or if the parent brushed their own teeth twice a day or more.

Trends were also observed in the results; however, these findings were insignificant. The trends indicated that parents of Māori children have a higher level of knowledge. Further findings show first-time parents, and parents who were in full-time employment overall had a lower level of knowledge regarding preschool oral health.

The findings showed differences in oral health behaviours between child and respondent characteristics. Overall, parents with a child two-years of age or older, and parents that brush their own teeth twice a day or more, were more likely to provide the recommended oral health care for their preschoolers. However, parents were less likely to perform the recommended oral health behaviours if it was their first child, or if they were in full-time employment.

Overall, it was apparent that differences in oral health knowledge had an impact on the oral health care (the behaviours) that parents provided for their preschooler. Differences in oral health knowledge were seen between the child and respondent characteristics. However, knowledge was not the only factor that was associated with behaviour, with differences seen in the findings by child and respondent characteristics, once adjusted for parent's knowledge. This is in line with the theoretical framework of this thesis, the Fisher-Owens Model, which suggests there are a number of factors that all have an impact on early childhood caries. Next the results of the qualitative analysis are described, the interviews looked at the factors parents' believe impact their ability to care for their preschooler's teeth.

4.3 Qualitative analysis

The section presents the results of the qualitative data. Thematic analysis was used to analyse the results with an aim of looking at whether a parent's knowledge influences the care they provide for their preschooler's oral health, and to look at the community and environmental factors that parents believe impacts their ability to care for their preschooler's oral health.

The qualitative research results are presented below. To categorise the findings, the results are then presented in line with the Fisher-Owens Model, previously described in Chapter 1: child-level (Section 4.3.1), family-level (Section 4.3.2), and community and environmental-level influences (Section 4.3.3). The findings are then summarised in Section 4.3.4.

4.3.1 Child-level influences

There were a range of questions that prompted parents to talk about child-level factors that have an impact on how they care for their preschooler's oral health. These questions included, *'How confident do you feel about being able to brush your child's teeth?'* And *'Thinking about your own everyday routines and past experiences with your teeth, how do you think they may have influenced how you brush and care for your children's teeth?'*

Child-level influences that the participants discussed as having an impact on their preschool child's oral health were the child's genetics and the child's attitude. These are now described in more detail.

Genetics

Genetics, or the biology of the children's teeth, was mentioned by most parents unprompted. These parent's thought that genetics was a substantial pre-determinant of the health of their children's teeth. For a few of the interviewees, genetics motivated them to take greater care in order to look after their children's teeth. For example, the mother of a four-year old said, *"I think genetically my family doesn't have good teeth and so I'm talking to the kids often about looking after their teeth"* (P3). However, for some of the other parents, their own poor oral health appeared to negatively impact on how they cared for their preschoolers' teeth. They viewed genetics as an insurmountable barrier, and felt there was little point in investing time to care for their preschooler's teeth.

I was always a bit like ah even if you do brush your teeth some people seem to get more cavities than others, you know. So, like my sister had hardly any cavities, we had the same upbringing, same routine, same food so I don't know. (P5)

Children resisting tooth brushing

All participants talked, unprompted, about difficulties they had when brushing their child's teeth. Most parents talked about their child wanting to brush their own teeth, which made the tooth brushing routine difficult *"Yea, it's just that she wants to do it herself I guess"* (P1). Most parents mentioned that their child gets angry if they could not do it themselves – *"when I try and get in there [with the tooth brush] she just gets really angry and she won't let me do it"* (P2). Parents talked about the need to form a routine and to have coping strategies to help overcome this difficulty. Routine is discussed as a family-level influence below.

4.3.2 Family-level influences

Routine

Most parents found a routine beneficial, and wanted to instill tooth brushing habits in their children. This was noted by one participant who said, *"I think getting into a good routine seems to be the thing to do"* (P5). Most parents talked about not brushing their children's teeth in the mornings as it was not part of their routine, but doing it as part of the bedtime routine. For example, when talking about not brushing their child's teeth in the morning a parent said *"I think it is probably that we kind of don't remember or we are in a rush and that it's not a routine"* (P2). All parents appeared to have a better routine with tooth brushing in the evening than in the mornings. This finding is reflected in comments from two parents, *"She actually has no morning routine for oral health"* (P5); and *"Yea in terms of [brushing] her teeth, the morning isn't as regular, it sort of happens sometimes but yea but not every morning"* (P2).

In addition to routine, most parents talked about the lack of time as a factor for not brushing their children's teeth in the morning,

It sounds bad but it's basically just a time thing, we are in such a rush to get out the door... we sort of run out of time for the teeth cleaning thing so we just do it at night (P1).

Such comments suggested that the parents' viewed tooth brushing as a once a day activity that could simply be performed at night time. A father talked about the hassle of brushing his child's teeth and considered that his laziness was the reason that his child's teeth did not get brushed

in the morning saying, *“I find it too much of a hassle, or I find it time pressured or in the weekends maybe not time pressured but generally lazier”* (P6).

Parents coping

The difficulty of brushing an unwilling preschooler’s teeth was mentioned by most parents. As a parent said, *“It’s kind of a hard balance between I guess wanting them to have really clean teeth but it being a battle every single day”* (P2). However, it seemed that despite their children’s protests parents found ways of brushing their children’s teeth; as a parent said *“I mean his teeth get cleaned just not always willingly”* (P4). The same parent continued, saying,

He is very definite about what he does and doesn’t want to do. So we’ve had a few battles recently while he sits on the sofa and he’ll just scream, and screaming is good because he opens his mouth and you can get the tooth brush in, but it is not an ideal way of brushing his teeth (P4).

Other parents said they managed by turning tooth brushing into a fun activity, such as combining it with bath time or making it a race. A few parents talked about how sometimes it just didn’t happen if it was too hard, saying *“It is difficult most days. Some days I push it [tooth brushing] harder than others, to be honest. Some days you are really busy and other days you have a bit more time for it”* (P2). One parent of a three-year old talked about how tooth brushing had become easier as their child got older and was more willing to brush their teeth, and had accepted that tooth brushing was part of the routine.

Knowledge – tooth brushing

With prompting, a few of the parents talked about being unsure about how to brush their children’s teeth and where to find information on how to do it correctly,

Being made more aware of how to brush their teeth, how often, when do you have to go to the dentist, like I am in the dark I am literally in the dark about I just try to make them brush their teeth like I do but like I said I don’t know anything about what should be happening and its funny thinking that there’s not really any way to find out (P5).

When asked about their confidence in brushing their children’s teeth, the majority of parents said they were unsure what actions they were meant to be performing, *“It’s a bit of a battle to be honest, I’m not that confident”* (P2). Another parent said that they were not sure if they were brushing their child’s teeth correctly, but were trying their best, *“You sort of feel like, I hope I’m doing it right but you just do the best you can do”* (P1). Another parent admitted not

really being sure of the recommended technique for brushing their children's teeth, but based what they were doing on how they brush their own teeth.

You don't really have a clear idea of how to brush the teeth, you know you just brush her teeth for a bit. I don't know whether what I am doing is in the ball park or that might lead to a bunch of cavities because I haven't spent two minutes on each side. I guess you just make it up as you go along based on your own experience and your child's willingness to open their mouth (P6).

When asked their views on the importance of brushing their child's teeth, most parents knew it was important, but a few were unsure of how important it was for a preschooler, especially as they thought they were already providing appropriate oral care. One parent thought she did not need to place importance on brushing her children's teeth as she had yet to take her child to a dental professional. For some parents a dental visit was a trigger for greater emphasis on oral health care.

I think not so much at this stage and part of the reason is we haven't been to the dentist yet. I think we are supposed to get a call up from the children's dentist soon, and once we get that and get a bit of assessment that might be a wakeup call for us (P2).

While others had similar perspectives on tooth brushing, the lack of importance most parents placed on brushing was mainly based on whether they were also taking other oral health-related behaviours into consideration, such as limiting sugar intake. Another parent who did not think brushing young children's teeth was important, said he routinely gave his preschooler a tooth brush with toothpaste on it, and felt he did not need to monitor how well his child was brushing their teeth, *"I don't really actively monitor how well they do or don't do it [tooth brushing], so for all I know they could just be washing the toothpaste off in the bath and not doing much"* (P5). He added that, based on genetics, the risk of decay in his preschooler's teeth was low, *"I haven't had any problems with their teeth so far, I mean she's three nearly four, what problems could you have?"* (P5).

Keeping children's teeth healthy

When asked about what makes parents want to keep their children's teeth healthy, most parents discussed the relationship between primary and secondary teeth. Such responses were typically unprompted. Most parents raised the point in relation to their own teeth, and talked about wanting to keep their children's teeth healthy so they had healthy teeth for life. A few parents also talked specifically about the association between the health of primary and secondary teeth. One of the participants said *"It's supposed to not be good for the adult teeth when they*

come through if they have had issues with the baby teeth” (P1). For another parent, it was a main motivator for her to look after her children’s teeth when the child was young, “I mean the key factor is so they have good strong teeth for their whole life” (P3).

Not all parents were aware of the relationship between primary and secondary teeth. The responses of some parents suggested they believed they did not need to care for their child’s teeth as well as adult teeth as they were going to fall out anyway. One parent realised the importance of brushing teeth due to his own experience, but did not place the same importance on brushing his child’s teeth, saying,

Well I know it is really important as an adult obviously cause I have had problems, well not big problems, with my teeth but I’ve had enough fillings and stuff to know it is expensive and it is better to have good teeth but at the same time I am not quite sure how important it is for young kids considering they are going to lose all their teeth anyway (P5).

Sources of dental knowledge

When parents were asked where they received information on how to care for their preschooler’s teeth, most parents cited Plunket as their main source (there are similar organisations to Plunket operating under Well Child/Tamarki Ora Services, however these were not mentioned by the parents interviewed). Most parents mentioned they got their ideas about dental care from their own experiences and own childhood that tooth brushing was something that you had to do in your daily life. However, most parents were unsure of the details about brushing their children’s teeth, including which age tooth brushing should begin.

Probably Plunket I suppose. I mean you just know what you grew up with so obviously brushing morning and night everyone knows but in terms of their teeth what they get at what ages and what toothpaste to use and how much to use that’s all from Plunket (P3).

One parent also said they had received oral health care products from Plunket when it was time to initiate tooth brushing for their child, *“Plunket were very good when he started getting teeth they gave us a tooth brush, toothpaste. That is probably where I got most of my information from” (P4).*

Some parents’ comments indicated that they felt they had not received enough information about tooth brushing, even from Plunket. While one participant with a two-year old child went to the internet to try and find out most of their information, others relied on their own tooth brushing experiences, such as a participant who said, *“Ah nowhere really, just knowing*

that I do brush my teeth and so it seems the thing to do but I have never been told what to do how to do it” (P5). The participant continued to say that as they lacked information on caring for their child’s teeth, they were also unsure about when they should take their child to the dentist,

I wouldn’t even know [if their child had been to the dentist or not], she is nearly four. I don’t know whether her teeth should have been checked once, twice, zero I don’t I actually don’t know what the right amount is, if I knew that it was really important to have your kid’s teeth checked by age three, I probably would have gone out of my way to organise it (P5).

When discussing the lack of information available, a parent suggested, unprompted, that the ‘Plunket book’ could be improved. They thought that it could contain information on when a child should start visiting the dentist and the frequency of subsequent visits. They compared the immunisation chart that documented the age at which a child needed to be vaccinated as an example of what they would find useful.

Knowledge of sugar’s affect

Unprompted, every parent mentioned sugar as being a substantial influencing factor on their children’s oral health. Their views were illustrated by a parent who commented, *“I guess I’m just conscious of reducing sugar because I know that that’s a problem” (P1).* The sugar content in food and the difficulty in getting their children to not eat sugar was a consistent theme in all the interviews, with a father saying *“it is very hard to avoid eating [sugar] you cannot, not eat sugar” (P5).*

Most parents talked about how they thought there was a greater awareness today of the impact that sugar has on dental health at all ages. They commented on how they thought it felt like everyone they encountered was talking much more about the negative impact of sugar. As a mother said, *“I think I grew up not ever thinking about sugar, it has become such a big thing lately I do feel like the knowledge of the dangers of sugar is increasing” (P3).*

Half of the participants attributed the oral health problems they have had as an adult back to their sugary diet they had as children. Such experiences appeared to make parents more aware of the foods they were providing for their children. For example, a parent talked about when growing up they had lots of sugary foods, *“So as a family we eat a lot less sugar I think than families did a few years ago” (P3).* Another participant talked about her and her husband’s diet

now, and how consuming a lot of sugary drinks and eating more sugar had impacted their teeth, which made her more aware of sugary food, *“He has a lot of fillings that he has had and I think that’s an indicator that I shouldn’t be feeding [my children] a lot of sugary drinks, anywhere near the amount that he consumes”* (P1). A few of the participants talked about documentaries on sugar they had watched on TV that had impacted their views on tooth decay. Their views were demonstrated by a parent saying,

We’ve watched some of those sugar movies, where they get the two-year olds, where they are doing big surgeries on their teeth, and they are all rotted out from drinking Coke at night and stuff and you’re like that’s awful. Yea so that is motivating (P6).

Most parents talked of ensuring their children avoided fizzy drinks and only had fruit juices occasionally, as a parent said,

We only have water in the house normally unless we have guests around we will have something else but they are not drinking a lot, and not letting the kids drink too many drinks and stuff at a time. They mostly just drink water and don’t eat much sugary food (P3).

Aside from sugary drinks, parents were also concerned about the sugar content in foods, with their comments indicating that sugar in food has become a large issue for parents. The extent of their concern was such that some parents tried to avoid giving their child sugar, and other parents only avoided the most obvious sugar, such as chocolate biscuits and carbonated soft drinks.

A few parents commented on their confusion about the impact of sugar in fruit, being aware that fruit had health benefits, but were concerned about its impact on teeth. This is demonstrated by a mother saying *“But fresh fruit you want them to eat it because it is healthy as well and it’s that balance between looking after their teeth and giving them decent food”* (P4). This view appeared to be founded on parents having being told to clean their teeth after eating fruit. Whereas, other parents were of the view that fruit meant sugar could not be avoided, and that parents needed to be aware of that. This is demonstrated by two separate quotes; one by a father who said,

I mean fruit has got just as much sugar as other sweets and stuff, well some fruit, so I guess knowing that you can’t really avoid cavity causing stuff then you’re best off brushing your teeth, it’s probably the number one thing (P5).

The other by a mother who said, *“You know even fruit has sugar in it, and being aware of that, and not just thinking that fruit is all good”* (P3).

A few of the parent's comments indicated that they felt more in control of the health of their child's teeth if they did not eat sugar and that, in turn, the need to take preventative actions such as tooth brushing was reduced. An example of this is a mother saying "*She doesn't eat a lot of sugar cane sugary type foods. I guess that makes me a little bit less anxious [about brushing her child's teeth]. It's not as high priority for us as it should be*" (P2).

Parents' own oral health

When asked if their own oral health impacted on how they cared for their preschoolers' oral health, most of the parent's responses indicated that their own dental experiences heightened their awareness of the importance of brushing their child's teeth. This is demonstrated by a parent who said, "*Yea and you know I've had a few fillings, sore teeth aren't good*" (P6). However, their experiences did not always have a positive impact on how they cared for their preschooler's teeth. A father did not see the benefit in tooth brushing, he said he had brushed his teeth frequently but nevertheless found that brushing had not had any benefits for his oral health as he still had decay, "*I'm a bit philosophical about my kid's teeth because it's like I know you should brush your teeth but that didn't help me very much*" (P5).

Parents' attitudes about primary teeth

As presented previously, some parents did not think caring for primary teeth was as important, given the children were going to lose these teeth anyway. Attitudes towards the importance of primary teeth among the parents were mixed. Some appeared to want to keep their children's teeth healthy for life, so they were of the view that they needed to begin brushing their teeth regularly when the child was young as it sets them up for life with good routines of brushing. Others wanted to keep their child's teeth healthy to prevent pain and avoid the financial consequences of dental care later in life. These attitudes were reflected by a parent's comment, "*you don't want your daughter to be in pain and annoying I've got a sore tooth oh there goes \$100. Yells and screams. It's never going to be a good time for anyone.*"

Parent's attitudes on early childhood caries

Throughout the interviews, it became apparent that parents had mixed views on the seriousness of children having cavities. Unprompted, a few parents talked about their concern that their child would get cavities in their teeth. For example a participant said, "*Occasionally you are*

like oh my God what if she has got these massive cavities, so every now and again I sort of check” (P6). A mother spoke about how she did not want her child to get a filling as she was worried it would cause her child pain,

It could be really traumatic to have to go through treatment on her, on any kid. And if they needed a filling in one of their teeth and they are so little, you would just feel like there is something that has gone wrong (P1).

However, one father mentioned that cavities were “not that bad” (P5), and had formed this view based on hearing of examples much worse than cavities. He said, “not that I think they are awful they are just cavities not like had any teeth pulled out or not as bad as some of those horror stories you hear about” (P5).

Number of children in the family

Some parents cared for more than one child. The comments of some of participants suggested that having an older sibling was beneficial for the younger child to observe the older child’s good oral health behaviours,

I think, well by the time she was old enough to start brushing her teeth she would see her older sister brushing her teeth so she kind of knew so that was a big prompting thing so that was her kind of wanting to do it (P5).

However, a parent who had four children revealed that they had less time to help her younger children brush their teeth saying, “I mean realistically as we have gotten more and more children they have had to take more of a responsibility for them self as they grow older” (P3).

Living across two households

One parent was from a family in which the children lived across two households. This situation brought about some difficulties for this parent in providing consistent oral health care for their child. He talked about how the differences between households might have an influence on the child’s oral health, although the parents had not specifically discussed it.

I don’t know whether [the other parent] makes them brush their teeth twice a day once a day not at all. I’m assuming that there is something going on there but that could be a factor [impacting the child’s oral health] having split households. Cause everything is slightly different, maybe in that other house they are eating other junk food, like it is probably not the case, but you could be trying really hard in one house and in the other house is just having sugar for three days and not brushing teeth (P5).

The father also talked about having a child who lived across two households made it harder to know what oral health behaviours have been performed, commenting,

The split house thing is interesting in terms of just knowing what is happening with like I wouldn't know if [the child] has been sent a something to say get her teeth checked, I wouldn't even know I actually do not know if she has been [to the dentist]. I mean her Mum might have taken her but I don't know personally (P5).

4.3.3 Community- and environmental-level influences

Food environment

When asked about what factors they thought influenced a child's oral health, all parents talked about the easy availability of sugary food, for example, "I think it's just that they [sugary foods] are convenient and readily available" (P1). Further, some parents suggested that there are so many sugary foods and hidden sugars in food that you cannot avoid eating it, as a parent said, there was "sugar in their [child's] diet that can't really be avoided" (P5).

A few parents mentioned the difference in price between unhealthy and healthy food, and the impact this had on people's food purchasing behaviours. For example, the high price of fruit and vegetables compared to unhealthy foods was commented on,

I really do [think cost is a big part of it]. I'm quite big on that. Like you go to the supermarket and there is always Twisties for \$1 and fruit and vegetables are more expensive. I feel it is more expensive to eat healthy for all of us than it is to buy junk food" (P3).

When prompted to talk about whether the government should do anything about the availability of unhealthy food, most participants agreed a sugar-sweetened beverage tax, or alternatively reduced G.S.T. on fruit and vegetables, would be beneficial. An example of this is seen with a parent saying,

...if they reduced the price of milk. Because I know a lot of lower income families say that it's cheaper to buy those \$1 fizzy drinks than milk so if they subsidised milk and added an extra tax on to fizzy drinks that might be beneficial for some people. Or you know if there was a subsidy for low income families because it's not affordable for some people (P1).

The same participant believed that reducing the cost of healthy food would enable more families to make healthier choices and allow lower income families to buy healthy food. Most participants alluded to the idea that reducing the cost of healthy food would positively impact

oral health, with some (such as P1 above) commenting that this reduction could be offset by increasing the cost of unhealthy food and drink, such as sugar-sweetened beverages.

The availability and marketing of unhealthy foods was discussed by some participants, especially the marketing of unhealthy foods in a supermarket. Their comments suggested that parents found that the supermarket were the most stressful environment in terms of the way unhealthy food is marketed. For example, a participant said of the availability of unhealthy food, “*so you know at the supermarket you go to the checkout and they have all the lollies there, it would be good if they didn’t have that*” (P1). Another participant commented on marketing unhealthy products to children and its negative impact,

You go to the supermarket and it’s all cereals and then the kids always want the colourful ones cause it’s marketed for children you know, cocoa puffs or those pretty coloured cereals, Frozen cereal, its normal cereal but it’s got Frozen on it” (P3).

The participants also commented that they often made a conscious choice not to take their child to the supermarket as a way of coping with the difficult environment.

Access to dental care

Upon discussion about accessing the dental care system, many parents, unprompted, identified barriers to accessing the dental care system. The comments arose as part of discussion on the frustrations with the system. One mother said,

Well they phoned me up just before he was two and said did I want to enrol him and I said yea, they said they would send me an appointment and he is now three and a half. They didn’t send an appointment (P4).

Another parent recalled having discussed the difficulty of getting a dental appointment with other parents, “*I know how hard it is to get an appointment. I never expected it to be easy to get an appointment which is probably why I haven’t tried quite as hard as I could have done*” (P4). Another parent talked about how she tried to get her child seen by a dental professional through the local service, but had trouble contacting it “*they don’t answer their phone, that’s one thing... I don’t know if that’s an under-funding or under staffing or something...*” (P3).

Those participants who had yet to take their child to the dentist were unsure about the process “*I think if it doesn’t come soon then we would probably contact them, I wasn’t sure what the process is*” (P2). Participants who had not taken their child to the dentist, but had registered

them in the service, were also unsure of the process if they moved house “*if you move you might end up getting sent a postcard to your old house and then I don’t know if you move house how it follows you*” (P5).

Parents raised, unprompted, the issue of the time commitment required to take their child to the dental clinic. They also commented on how they thought the service did not accommodate working parents. Their comments suggested that work commitments present a substantial barrier for a parent trying to get their children to the dentist,

I have been trying the last few months to get an appointment but their opening hours are not convenient. They close the office at 4.30 in the evening sharp so by the time I leave work and then I phone them they are already closed and when am I supposed to take him in? I can’t take time off work to do it as I need the money (P4).

Unprompted, one participant mentioned that without having family support it would have been difficult getting her child to the dentist,

I was working so my mum took her. Because I think you just get given a time...Yea, but I was working full time then so they probably don’t have many appointments out-of-hours kind of thing. So I can imagine it would be difficult for some people to access it if they were working [and didn’t have other family support] (P1).

While there was a consensus about the difficulties of navigating the local dental service, not all participants had negative experiences. One stay-at-home parent found the system much easier to navigate than the other parents, saying “*Yea it’s easy. There have been no problems. We even moved from Auckland to Wellington and everything we just got straight in the system*” (P3).

Government

All parents were asked about what they thought the Government could do to assist them in caring for their children’s teeth. Almost all echoed the sentiments of one participant who said, “*having free dental care up to 18 is amazing*” (P2). However, a common discussion point throughout the interviews was recognition that parents were struggling to provide adequate care for preschoolers’ teeth but were unsure what more the Government could do. This was demonstrated by a parent saying,

There is only so much they [the Government] can do, but they can do things to help as it is not fair on children if parents can’t access everything they need because of whatever barriers there are in the way (P1).

Parents' comments also indicated that dental services need to be funded more adequately with a proposed action from one participant being "[increased] *funding* [for] *the* [local dental service] *well so we can get an appointment basically*" (P4). This comment was made in relation to the availability and scope of the service.

The comments made by parents interviewed related to increased funding to allow the dental clinics to open later (after working hours) or in weekends to allow working parents to take their children. Most parents said they were keen to receive more information about their children's teeth and oral health. For example, a parent spoke of wanting more information from trusted sources, including the Government, "*It would be helpful if the... [local dental service] clinic advised people because that is a trusted source from the Government and people would trust that information*" (P1).

Health education

Parents were receptive to information that would benefit their child. Unprompted, the majority of participants indicated that the oral health advertising they had seen was very good, but that this needed to be more visible. One example was a father who, after discussing the recent HPA tooth fairy advertisement, said, "*apart from the advert I think it'll be the first thing I have seen about kids' oral health ever*" (P5). The lack of information was also mentioned by another participant: "*I think it's the parents' [responsibility], but in reality, that is not happening as there are multiple cases of bad teeth. I think there needs to be some more awareness or education and funds*" (P1). The participants that had seen oral health promotion messages had positive things to say "*I think the adverts are quite good I've seen bits of the adverts on TV and things*" (P4) and "*Oh you know that ad that's on TV, have you seen it with the Tooth Fairy? I think that's good because it is sending a positive message*" (P1). However, overall when prompted, most parents thought that more health promotion was needed and if provided this would be valuable.

Cost of tooth brushes and toothpaste

All parents were prompted about their views on the affordability of tooth brushes and toothpaste. Their responses indicated that parents could afford these items and were happy to do so, "*I am happy paying for toothpaste and tooth brushes and stuff*" (P6). Most of the parents thought that these items were affordable saying,

Yea I don't find it a problem. We got told to use a really small amount of toothpaste and so it lasts a really long time. And the cost of the tooth brush you can always get those \$1 ones at PAK'nSAVE or you can choose to get the more expensive ones (P1).

However, some parents realised that people who have less money than themselves might find the cost of tooth brushes and toothpaste challenging, for example

I've got enough money that I can afford to buy toothpaste and tooth brushes in the supermarket when we need them ... but I think if you don't have enough money it's probably something you are not going to prioritise (P4).

A few parents discussed financial commitment as an issue, and each thought a solution would be to supply tooth brushes and toothpaste to families in need, free of charge

I don't see why they couldn't provide children with tooth brushes and toothpaste more frequently. Like I say not everybody needs it, we don't need it but I think some people probably do (P4).

Fluoridated water supply

A few parents discussed having fluoride in the water supply. These parents all had strong views on the topic and were clear they wanted fluoride in the water. They recognised the substantial benefits that fluoride can have on the health of their children's teeth, and the difference it can make to oral health. A few participants thought the Government could do more "*Well they [the Government] could fluoridate the bloody water for the whole country consistently would be helpful*" (P4).

The benefits of fluoridated water for oral health were so important to one mother that it was a key factor in their political decision-making; she said, "*It absolutely is [an important factor]... I know when I was voting in the Council elections last year I was very wary of anyone from the DHB who was anti-fluoride in the water*" (P2).

4.3.4 Summary of qualitative results

Key child-level influences on oral health meant that parents felt somewhat out of control when it came to caring for their preschooler's teeth. One of the key influences mentioned by parents was the role that genetics played in the health of their preschooler's teeth. This was coupled with the preschoolers not wanting to have their teeth brushed for them and, while parents had their own coping mechanisms, all parents mentioned the child's willingness or otherwise as a factor that influenced oral health behaviours.

Time and being rushed were key family-level influences, which meant that tooth brushing often did not occur in the mornings. However, to combat this most parents thought that establishing a routine was helpful in ensuring that their children's teeth were brushed. For most of the parents, this routine happened at night when there was less time pressure.

It was apparent there were varying levels of knowledge on the importance of primary teeth among parents. While some had made a connection between the health of primary and secondary teeth, other parents had not. Most of the parents received information about how to care for primary teeth from their own oral care practices. Most parents had also had some contact with a health professional who had talked about how to care for their child's oral health. Parents who had this exposure found it very beneficial. Parents' own oral health experience played a key role in the oral health care they wanted to provide for their children, as they did not want their children to experience the pain or receive treatment.

Factors that could be controlled by the Government, such as, the accessibility and cost of foods that are high in sugar, fluoridated water supplies and local dental services were key community and environmental influences discussed by parents. All parents thought sugar was a significant factor that influenced oral health, with many parents believing that sugary foods and beverages were too easily accessible and were detrimental to their children's oral health. Some thought the Government could do more to alleviate the high-sugar situation, suggesting actions such as sugar taxes, restricting the advertising of food and beverages high in sugar to children, and the Government regulating the placement of such items in supermarkets. Parents also thought the Government could undertake more oral health promotion for children, with parents mentioning that they found the health promotion messages they had seen very helpful.

The quantitative and qualitative findings from this study are discussed further in the next chapter. The factors that potentially impact a parent's ability to care for their preschooler's oral health are also highlighted and commented on.

Chapter 5 – Discussion

5.1 Overview

This chapter answers the research questions by presenting the findings from the secondary analysis of the survey data and the thematic analysis of the interview transcripts.

This research aimed to address the following over-arching research question:

What factors influence the oral health care parents provide for their preschooler?

In order to address and help answer the primary question, a number of sub-questions were developed; these were:

- i. *Does a parent's knowledge of preschool oral health have an association with the oral health care they provide for their preschooler?*
 - This has been examined by looking at whether a parent's level of oral health knowledge differs by child and respondent characteristics?
- ii. *What factors other than knowledge influence the oral health care that a parent provides for their preschooler?*

This has been examined by looking at whether:

- there are differences in how parents care for their preschooler's oral health, by population characteristics?
- differences in population characteristics impact how parents care for their preschooler's oral health?
- there are community and environmental factors that impact how parents care for their preschooler's oral health?

5.2 Answering the research questions

5.2.1 Introduction

The focus of this thesis is on parents because day-to-day, they function as enablers and role models for their child by carrying out oral health promoting behaviours. This is important because having parents perform oral health prevention behaviours for their children from a young age can set the child up with good oral health promoting behaviours for life.

Currently there is a gap in the research regarding what factors influence how parents care for their preschooler's teeth in New Zealand. While there is an international body of research on this topic, oral health research has received little attention in New Zealand. As such, public health decisions about how to improve preschoolers' oral health are mainly based on overseas evidence. While the HPA report (Kaitiaki Research and Evaluation, 2015) begins to fill these gaps, there is still a large number of questions that remain unanswered as the HPA report only presents top line findings and does not present a substantive analysis of the data.

Establishing whether in the New Zealand context, certain factors influence how a parent cares for their preschooler's oral health will mean that informed decisions can be made in relation to preschool oral health promotion. Establishing a principled basis for preschool oral health advocacy was one of the key drivers underlying this research project. One key policy question this research sought to explore was how New Zealand can achieve better oral health for preschoolers. This study helps to fill gaps in New Zealand's research and in doing so, also further develops the international literature.

The theoretical framework underpinning this thesis was the Fisher-Owens Model (Fisher-Owens et al., 2007). The Fisher-Owens Model is a conceptual model that builds on international literature. It demonstrates that there are several layers of factors that all influence an individual's oral health status, and incorporates the five main domains that have been identified as influencing oral health. These domains are child-level influences, family-level influences, community-level influences, the environment and time. The model aims to build an understanding that the influences of oral health cannot be viewed in isolation, but instead occur through complex interactions. The Fisher-Owens Model provides a starting point for identifying the factors that impact a child's oral health. Later in this chapter, the Fisher-Owens Model is critiqued (Section 5.3).

This thesis aims to answer the over-arching question being '*what factors influence the oral health care parents provide for their preschooler?*' and in doing so, contribute to better oral health for young New Zealand children. To answer this research question, this chapter is split into four main sections. Initially, Section 5.2.2 examines whether a parent's knowledge of preschool oral health has an impact on the oral health care they provide for their preschooler. In Section 5.2.3, the differences in knowledge between respondent characteristics are

examined. In Section 5.2.4 the factors (other than knowledge) that impact oral health behaviour are discussed. These factors are identified from the quantitative analysis and by analysis of the qualitative interviews. The critique of the Fisher-Owens Model is discussed in Section 5.3, and the strengths and limitations of the thesis are discussed in Section 5.4. The implications for policy and practice, and future research are outlined in Section 5.5 and Section 5.6 respectively, and the thesis is concluded in Section 5.7.

5.2.2 Is a parent's knowledge of preschool oral health associated with the oral health care they provide for their preschooler?

Based on the associations seen in the international literature (Akpabio et al., 2008), this study sought to find out if a parent's knowledge of oral health was associated with how parent's cared for their preschooler's oral health. This was achieved by examining the results of both the quantitative and qualitative phases.

To answer the research question, *is a parent's knowledge of preschool oral health associated with the oral health care they provide for their preschooler?* this section discusses each of the knowledge variables and outlines their associations with the behaviour variables. The knowledge variables are: knowledge of what age tooth brushing should begin, knowledge of the relationship between primary and secondary teeth, and knowledge that holes in primary teeth need filling. These variables are now discussed.

Knowledge of what age tooth brushing should begin

Upon analysing this data, it was apparent a parent's oral health knowledge was associated with the oral health care provided for their preschooler. This statement can be made as differences in knowledge of when to commence tooth brushing had an impact on whether the preschooler had their teeth brushed twice a day, whether toothpaste was used, and the age that tooth brushing began. Therefore, parent's oral health knowledge had an association with how parents cared for their preschooler's teeth.

In the interviews, a mother verbally reported how surprised she had been when a Plunket nurse informed her how early tooth brushing needed to begin. These findings are in line with international literature, which shows that parents' often do not know when to begin brushing their preschooler's teeth. Two American studies found that only 54% and 32% of parents knew

the recommended age to begin brushing their preschooler's teeth, respectively (Akpabio et al., 2008; Febres et al., 1997). The literature also showed the importance of beginning to brush children's teeth early, with Hallett and O'Rourke (2003) finding that preschoolers who have had their teeth regularly brushed before their first birthday have a significantly lower prevalence of early childhood caries when compared to preschoolers whose parents commenced tooth brushing when the child was 13 months or older (Hallett & O'Rourke, 2003).

Knowledge of the relationship between primary and secondary teeth

The quantitative analysis showed that having knowledge of the relationship between primary and secondary teeth, was associated with whether parents brushed their preschooler's teeth twice a day, whether toothpaste was used when brushing, and on the age tooth brushing began. Therefore, this oral health-related knowledge was associated with the oral health care that parents provided for their preschooler.

In the qualitative interviews, approximately half of the parents interviewed for this study gave an indication that they did not believe primary teeth needed full care, as they were going to fall out anyway. The qualitative findings also showed that parents were less likely to care for their preschooler's teeth if they thought that care of primary teeth was not important (as the teeth were going to fall out anyway). This was seen in the qualitative interviews by a parent who did not actively monitor whether their child was cleaning their teeth or not but said they gave their three-year old child a tooth brush sometimes when they were in the bath in case they wanted to try and brush their teeth. This finding was also seen in the review of the literature where a Polish study (2004) found that approximately two-thirds (66%) of mothers thought that care of primary teeth was not needed as they will fall out eventually anyway (Szatko et al., 2004).

Knowing about the relationship between primary and secondary teeth is important and can represent the significance parents place on their child's primary teeth. International evidence has shown that preschoolers whose parents did not value primary teeth, or fully understand their importance, were at risk of having a higher prevalence of early childhood caries (Amin & Harrison, 2009; de Castilho, Mialhe, de Souza Barbosa, & Puppim-Rontani, 2013; Finlayson, Siefert, Ismail, Delva, & Sohn, 2005; Hochstetter, Lombardo, D'eramo, Piovano, & Bordoni, 2006; Ismail, 1998; Prowse et al., 2014). The results of this thesis go one step further, and show associations between specific pieces of knowledge and oral health behaviour, which

allows for more targeted health promotion messages. The research has also identified certain characteristics where parents are more at risk of having a lower level of preschool oral health knowledge and associations showing parents who are less likely to carry out certain oral health care for their preschooler. Examples seen in this study include young parents, first time parents and parents working full-time. These associations will be discussed in more detail in the following section, Section 5.2.3.

Knowledge that holes in primary teeth need filling

Upon analysing the secondary data for this study, it was found that having knowledge regarding the importance of restoring primary teeth was positively associated with some of the tested behaviour variables. Positive associations were seen with those parents who used toothpaste, who began brushing their preschooler's teeth at the right age, and being more likely to have taken their child to the dentist. Therefore, as with the previous knowledge-based questions, having this piece of oral health knowledge has a positive association with how parents' care for their preschooler's oral health. For example, if a parent did not think having cavities in the primary teeth had an impact on their child's teeth, and the cavity was not causing the child pain, then the parent might not see the point of restoring the primary teeth. This was seen in the qualitative phase, with some of the parents talking about primary teeth not needing full care as they were going to fall out anyway. This is in line with findings from the international literature, which showed that some parents think that unless primary teeth are causing the child pain or discomfort, regular care or treatment is not required (Mofidi et al., 2009; Perez & Amin, 2014).

In New Zealand, there is free dental care for people under 18-years of age and this means that the financial barriers for parents to have primary teeth restored have been largely removed. However, it is recognised there may be other costs such as transport to the dentist and the opportunity cost if parents need to take time off work. Therefore, if cavities in preschooler's teeth do not get filled, it is likely there are barriers, other than financial barriers, that are preventing parents from doing so, for example not having knowledge that aligns with recommendations.

Overall

Based on the three knowledge variables that were chosen as a proxy to represent parent's overall oral health knowledge, the research question posed at the start of this section can be

answered by saying there is a positive association between a parent's knowledge of preschool oral health and the oral health care a parent provides for their preschooler. This suggests that increasing a parent's oral health knowledge has the potential to have a positive impact on the oral health of their preschoolers. This is in line with the international literature which also demonstrates that children had an overall better oral health status if their parents had a higher level of oral health knowledge (Tinanoff & Reisine, 2009). Thus, emphasis needs to be placed on ensuring parents have the correct knowledge in relation to recommended oral health behaviours.

It is of concern that approximately half of the parents in the qualitative interviews talked about wanting more information on preschool oral health than they currently had. They felt they had limited knowledge, were often unsure about whether the knowledge they had was correct, and in certain situations felt as though they were making an educated guess of what the recommended practices were. As there is a desire for more knowledge, and because it has been shown that knowledge has a positive impact on behaviour, it is important to identify which groups of the population would benefit from further knowledge to allow targeted oral health education interventions.

5.2.3 Does a parent's level of oral health knowledge differ by characteristics of the parent?

So far, this thesis has shown that parents' knowledge of preschool oral health is associated with the oral health care parents provide for their preschoolers, which lends support for a direct relationship between knowledge and behaviour. Therefore, it is important that all parents have a reasonable level of oral health knowledge and education. However, currently some parents have less oral health knowledge than others, and would potentially benefit from further information. Identifying groups who would benefit from further information is the first step to allowing oral health educational interventions to be targeted. This is important, especially because in the interviews parents discussed the effectiveness of the current oral health promotion messaging, saying that it acted as a good reminder of the care they needed to provide for their preschooler's oral health.

This section answers the research question *does a parent's level of oral health knowledge differ by characteristics of the family?* Associations were seen between oral health knowledge and

the age of the child, whether it's the parent's first child, parents own oral health, the household income, and parent's employment, and will be discussed in this section.

Notably, the age of the child had a significant association with a parent's oral health knowledge. Generally, parents with children two-years of age or older had a higher level of knowledge regarding whether holes in primary teeth should be restored, and of the relationship between primary and secondary teeth. This is an important finding as it shows that parents may be receiving the information but possibly receiving it too late. Parents need knowledge regarding preschool oral health at an early stage in the child's life and sometime before they should be performing the specific behaviours. If this knowledge was imparted at an earlier stage, it may increase the likelihood of the behaviour being carried out at the recommended time.

In contrast, when looking at knowledge of what age tooth brushing should be initiated; parents with children older than two years of age were less likely to know the recommended age. There are several reasons why this result may have occurred. One reason is that in the last two years, the level of information given to parents may have changed and parents are now being told the recommended age that tooth brushing should begin (whereas previously this may not have been something that was specified). Alternatively, parents with a younger child have more recently had to begin tooth brushing, and therefore they could have had better memory recall. There is limited overseas evidence that demonstrates the relationship between the age a child begins having their teeth brushed and a parent's level of oral health knowledge. However, international literature has demonstrated the relationship between first time mothers having a lower level of knowledge of preschool oral health than mothers who had experience in raising a child (Akpabio et al., 2008). The findings of this study also demonstrate this relationship, with first time parents having a lower level of knowledge regarding what age brushing should begin and also a lower level of knowledge that cavities in primary teeth need to be restored. In line with this, the findings also demonstrate that parents with two children have a higher level of oral health knowledge. These findings, that both a child's age and having had a previous child, has an impact on parent's level of oral health knowledge, indicate that there would be benefit in ensuring that parents receive information early, especially if this is the parent's first child.

A potential solution for getting information to parents earlier in a child's life is to target the parent's own oral health. This research demonstrates that parents who brush their own teeth twice a day or more, have a higher level of oral health knowledge than parents who brush their own teeth less frequently. Twice daily brushers were seen to have higher levels of knowledge about when tooth brushing should be initiated, about the relationship between primary and secondary teeth, and that primary teeth need to be restored. This is in line with international literature, which shows a strong relationship between a parent's oral health behaviour and their preschooler's oral health status (Rahbari & Gold, 2015; Schluter et al., 2007). Educating parents on their own oral health, with the aim of also improving the oral health of their preschooler, could be achieved through targeting pregnant women. If pregnant women were given free oral health care it would provide an environment where they could be educated on caring for both their own and their child's oral health. Improving the mother's oral health would have further benefits as *S. mutans* are frequently passed from parent to child, with mothers often being found to be the first to infect their child with cariogenic bacteria which are necessary in the development of early childhood caries (de Castilho et al., 2013; Petersen, 2003). Improving the mother's oral health would emphasise a family approach to oral health.

There were also differences seen in parents' oral health knowledge by household income. This study found that parents with a lower household income were less likely to have oral health-related knowledge. The international literature also demonstrates that mothers with lower income had a lower level of knowledge regarding utilising health care services and what age tooth brushing should begin in children (Akpabio et al., 2008). This is a concern due to low socioeconomic children being recognised as a high priority group due to their higher prevalence of early childhood caries. The relationship between children's oral health status and socioeconomic status is seen both internationally and in New Zealand (Hallett & O'Rourke, 2003; Ministry of Health, 2010, 2016).

This study also found a relationship between level of employment and parent's oral health knowledge. Parents who were in fulltime employment were shown to have a lower level of oral health knowledge, compared to parents who were in part-time employment or who were homemakers. This finding is correlated with a parent's household income, as families who are in full-time employment are likely to have more money. Alternatively, parents who work fulltime may be less likely to have visited a dental professional with their child, instead a nanny or support person may take the child, and therefore the parent's themselves do not have access

to the same education sources as parents working less hours (who accompany their child when they visit the dental professional).

In summary, to answer the research question posed at the start of this section, there are differences in parent's oral health knowledge by characteristics. Differences in knowledge were seen by the child's age, household income, employment, whether the parent had a previous child, and parent's oral health brushing routine. As knowledge of preschool oral health is associated with behaviour, oral health education could be targeted to these higher risk groups in an attempt to improve New Zealand's oral health status.

5.2.4 What factors influence how a parent cares for their preschooler's oral health, and how do these factors impact oral health behaviours?

The findings of this study demonstrate that a parent's knowledge is associated with the care parents provide for their children's primary teeth, and that there are differences in parent's knowledge of preschool oral health by their characteristics. However, based on guidance from the Fisher-Owens Model, and international literature, it was thought that there are likely to be many other factors that also influence how a parent cares for their child's teeth. This section examines the factors (other than knowledge) that influence how a parent cares for their child's oral health by answering the two research questions: *what factors influence how a parent cares for their preschooler's oral health?* And, *how do these factors impact oral health behaviours?* As these two questions are closely linked the discussion of these two questions is tied together, and then is followed by a further discussion of factors that influence how a parent cares for their preschooler's oral health. It is important to gain this understanding so we have an overall view of the factors impacting preschool oral health and in order to develop initiatives and broader policies so parents can achieve the best oral health for their preschooler. These questions are answered by first discussing the factors in relation to the four behaviours. These four behaviours were: twice daily tooth brushing, have visited a dental professional, using toothpaste when brushing and if brushing had begun before the child's first birthday. And then the factors are discussed in line with the Fisher-Owens Model: child-, family-, community and environmental-level factors.

Twice daily tooth brushing

Brushing twice daily with fluoridated toothpaste has been shown in many studies to be effective at reducing the prevalence of early childhood caries (Gibson & Williams, 1999; Jain et al., 2015; Marinho et al., 2003a; Twetman, 2008; Vanobbergen et al., 2001). Most parents who were interviewed talked about only brushing their children's teeth once a day. This is concerning as brushing twice daily (with fluoridated toothpaste) has been shown in many studies to be effective at reducing the prevalence of early childhood caries (Gibson & Williams, 1999; Jain et al., 2015; Marinho et al., 2003a; Twetman, 2008; Vanobbergen et al., 2001). When probed for the reasons why brushing happened only one time per day (rather than twice) participants cited a lack of time as being a primary reason. Lack of time was often due to tight timeframes around work schedules and managing to get siblings to school. This is similar to the previous results, which showed fulltime work as being a potential risk factor for having less knowledge regarding preschool oral health.

Interviewees found the morning more time-restricted than the evening, mostly because there were hard deadlines that needed to be met (work, school etc.); whereas at night the main constraint was getting the child to bed at a reasonable time. For many of the parents interviewed, these time restrictions often took precedence over performing the recommended oral health behaviours. In research conducted by Virgo-Milton and colleagues (2016) prioritising other activities over oral health, such as getting to work, was also seen as a barrier by parents to achieving good oral health. Therefore, the fast paced lifestyle that is becoming more common could be considered a factor that influences how a parent cares for their preschooler's oral health.

Not being in a routine was another common reason that most of the participants in this study gave for not brushing their children's teeth twice a day, and therefore the data suggests that routine could have a large impact on oral health behaviour. In line with parents being in more of a rush in the morning (compared to the evening), it was the morning tooth brushing routine that often did not happen. Contradicting these findings, for approximately half of parents, setting their children up with a positive oral health routine for life was a main motivator for them to perform the recommended oral health behaviours.

Parents' perception around the importance of brushing primary teeth was seen in the interviews. Some examples that don't align with the recommendations included that baby teeth

did not need brushing twice a day as they would fall out soon anyway, or that their children were eating a healthy diet, so they shouldn't need brushed twice a day. The association of knowledge and parents brushing their preschooler's teeth is in line with the findings of the quantitative analysis, which showed that increased oral health knowledge was associated with the frequency that parents brushed their preschooler's teeth.

The quantitative analysis also showed that parents who brush their own teeth twice a day or more, and parents who had children two-years of age or older, were more likely to brush their preschooler's teeth twice daily. This finding contradicts the constant trend in the 2009 NZOHS which found that a similar number of children have their teeth brushed twice a day regardless of whether they are aged two to four-years or five to 18. However, this study is looking at different age groups than the 2009 NZOHS, and is suggesting that children under the age of two have their teeth brushed less frequently. There are a number of potential reasons that tooth brushing frequency was associated with a child's age, including the increased importance that parents placed on oral health as the child gets older. Alternatively, the older the child is, the easier it becomes to brush children's teeth, or the more likely parents would have received advice about brushing their children's teeth. Previous literature demonstrates that parents also found it harder to brush younger children's teeth as they are easily distracted and want independence, but by the time the child was three years of age it had become easier as brushing was (hopefully) part of the child's routine (Kaitiaki Research and Evaluation, 2015).

Visited a dental professional

On analysis of the quantitative data, it was seen that the number of children who had visited the dental professional was associated with the age of the child, with children being more likely to have seen a dental professional if they were two-years of age or older. This aligns with the recommended age that the New Zealand MoH have set, with the majority of children advised to visit the dentist before their third birthday (Ministry of Health, 2006). It is not surprising that children over the age of two are more likely to have visited the dentist. This is because parents have had a longer period of time in which to visit the dentist, as well as parents thinking it more necessary the older the child gets, which was demonstrated in the qualitative interviews. As identified in the Fisher-Owens Model, time is a factor involved in the development of early childhood caries.

In the literature, associations between health and socioeconomic status are widely recognised, the literature shows those with a lower household income are less likely to use dental services as a preventative service (Hernandez & Blazer, 2006; Van den Branden et al., 2013). However, this relationship was not seen in this research. This may be partially because the New Zealand Government funds dental care for all young people under 18-years of age (Ministry of Health, 2010). However, there were differences in whether the child had visited the dentist by characteristics of the family. These differences included younger parents being less likely to have taken their preschool child to the dentist; and parents who brush their teeth twice a day or more were more likely to have taken their child to the dentist. Therefore, these differences in behaviour show that different population characteristics influence how a parent cares for their preschooler's oral health.

The qualitative findings identified other factors that influenced whether a child had visited a dental professional. Interestingly most interviewees said that their child had not visited the dentist yet; however, those same parents mentioned having previous contact with another health professional who had talked to them about their child's oral health. For most parents this was a Plunket nurse. When the parents were asked where they had got most of their knowledge on children's oral health from, Plunket was the main source that was cited. This is an important finding, as it demonstrates the importance that Plunket (and the Well Child/Tamariki Ora Services) have on a child's oral health. This is emphasised further as Plunket services are often a parent's first contact with a health professional who talks about their child's oral health. Therefore, it is important that Plunket (and equivalent services) nurses have the correct information and appropriate educational material about preschool oral health and that the Plunket nurse discusses this information with parents so that parents understand how to care for their preschooler's teeth in the recommended way. Parents mentioned that they would appreciate receiving further information about preschool oral health from their Plunket nurse. To do this further funding may be required to ensure the nurses have the appropriate knowledge and skills (and more staff may be required the amount of information increases visits may take longer).

Most interviewees cited the inability to easily access health care professionals as a factor that influenced their ability to properly care for their child's oral health. Some interviewees talked of the struggle to get an appointment at the local dental service, finding it difficult to contact the service. Whereas others found the operating hours did not fit in with their work schedule

and meant that they were not able to take their child at the time allocated to them. Another parent talked about being unsure about what age they needed to take their child to the dentist. They suggested including a mapped-out timeline of oral health in the back of the Plunket book as an easy way to provide information on the recommended behaviours. As most parents felt they wanted more information on children's oral health the use of services, such as Plunket, could be an appropriate method and means to ensure parents received this information. This would have beneficial flow-on effects, as the results of this study have shown that having increased oral health knowledge has a positive influence on oral health behaviours.

Always using toothpaste when brushing

The only differences seen between population groups in the quantitative study and whether parents brush their children's teeth with toothpaste were based on the age of the child, how frequently the parent brushed their own teeth, and the parent's level of oral health knowledge. Parents with children two-years of age or older were more likely to use toothpaste and so were parents who brushed their own teeth twice a day. However, differences in the use of toothpaste were seen if a parent had a low level of oral health knowledge (their knowledge did not align with the recommendations). Associations between using toothpaste and knowledge included, what age to initiate tooth brushing, understanding that there is a relationship between primary and secondary teeth, and knowledge that primary teeth need restored. Without some of this knowledge, there is a risk that a parent may not brush their children's teeth with toothpaste (i.e. there is a difference in oral health behaviour). The findings indicate that if knowledge in the three areas mentioned above was increased, it would have a beneficial result of the number of children who have their teeth brushed with toothpaste.

Began brushing teeth before first birthday

On further analysis of the quantitative findings for this study, differences in behaviour were seen by population characteristics. Parents, who had a child younger than two, were found to be less likely to begin brushing their preschooler's teeth before their first birthday. This relationship was also seen in parents who are being questioned about their first child, and parents of children who are of Māori ethnicity. This indicates that these factors are associated with how parents care for their preschooler's oral health.

Differences in behaviour were also seen in the ages of parents, with younger parents being significantly more likely to brush their preschooler's teeth before their first birthday. A positive relationship was also seen with parents who have two children, and parents who brush their own teeth twice a day or more. However, parents who were employed and who had a higher education level were less likely to have begun brushing their preschooler's teeth before their first birthday. These results show that certain population characteristics may be at a greater risk of not beginning to brush their child's teeth by their first birthday and would benefit from being targeted with further oral health information.

Differences in oral health knowledge also had an impact on the age parents began brushing their preschooler's teeth. This emphasises the importance of ensuring parents have access to oral health knowledge.

These findings are important as, international literature has shown that preschoolers who have had their teeth regularly brushed before their first birthday have a significantly lower prevalence of early childhood caries when compared to preschoolers whose parents commenced tooth brushing when the child was 13 months or older (Hallett & O'Rourke, 2003). This shows the importance of beginning to brush a child's teeth at the appropriate developmental stage, or age.

Overall

Both the quantitative and qualitative results demonstrate that there are differences in how parents care for their preschooler's oral health by characteristics. These findings highlight that there are groups, such as young parents, parents who brush their teeth less than twice a day and respondents who are at risk of not performing the recommended oral health behaviours for their preschoolers. Children of these parents are at higher risk of potentially developing early childhood caries.

The literature and the Fisher-Owens Model indicate that there are a number of factors (other than knowledge) that impact a parent's ability to care for their preschoolers oral health, these are discussed in the following section which looks at child, family, and community and environmental level factors and the impact they have on oral health behaviour.

5.2.5 Child-level influences

The child resisting tooth brushing

All of the parents interviewed talked about how their preschoolers had a lack of willingness to have their teeth brushed, and this made it difficult for parents to brush their teeth. In a British study by Blinkhorn and colleagues, 40% of participants thought their preschooler acted as a barrier to caring for their teeth (Blinkhorn et al., 2001). The literature demonstrated that preschoolers who resisted tooth brushing were at a higher risk of developing early childhood caries (Spitz et al., 2006). This is likely to be because when a child is not resisting it is much easier to brush their teeth with the recommended action, and it is also more likely their teeth will be brushed.

Parents in this study verbally reported different coping methods to their child's difficult attitudes towards brushing. While some parents took more forceful approaches, others let the child brush their own teeth, while some just didn't brush the child's teeth if the child was being difficult. This is in line with the trends seen in the international literature (Virgo-Milton et al., 2016). The parents' responses when presented with a barrier from their child (in the form of the child's attitude) could be an indication of the importance the parents placed on oral health, and their confidence of how to deal with the situation in order to promote the recommended oral health behaviours. Overall, it can be summarised that a child resisting tooth brushing has an influence on how a parent cares for their preschooler's oral health.

Childs age

The age of a child has an influence on how a parent cares for their preschooler's oral health with parents more likely to perform the recommended oral health behaviours on older children. As discussed above, there are a number of reasons why this may occur. However, the important finding from this is the identification of an intervention group for oral health initiatives. Giving parents information earlier, when their child is younger has the potential to improve preschooler's oral health status. There could be the potential to do this through Plunket (or similar) Services.

Ethnicity

The 2009 NZOHS and the more recent 2015/16 NZHS demonstrate that Māori children have poorer oral health than non-Māori children, and therefore when developing this study Māori

were identified as a high priority group (Ministry of Health, 2016; Ministry of Health, 2010). The findings of this study demonstrate that Māori parents do not have a lower level of oral health knowledge, and in line with the findings showing a strong association between knowledge and behaviour, they are equally as likely to provide preventative oral health care for their preschooler as non-Māori parents. This finding alludes to the likelihood that other factors are involved in influencing how Māori parents care for their preschooler's teeth. This may also indicate that the community and environmental factors that surround children and their families have a large influence on a child's oral health outcomes; these factors are discussed below.

5.2.6 Family-level influences

Parents age

As discussed above, the quantitative findings showed that parents aged 33-years and over were more likely to carry out the recommended oral health care practices, including brushing their child's teeth twice a day and taking their child to visit a dental professional. This is in line with international findings, which has shown that children with younger parents have a higher rate of early childhood caries (Akpabio et al., 2008; Hallett & O'Rourke, 2003). However, these international studies compared parents under the age of 24-years to over 24-years and are therefore making the comparisons in a much younger population. This study has shown that this relationship may still exist even when the age threshold is set at much higher level (34-years-of-age and under). This finding is interesting because it implies that parents gather knowledge of the recommended oral health behaviours as they get older. It may be that older parents have more support in terms of other parents in their social group or that they have had longer to research and observe the recommended actions. Therefore, it seems the age of the parent is associated with how the parent cares for their preschooler's oral health. Being aware of this relationship provides an opportunity to target young families in oral health educational materials.

Parents own oral health

The quantitative results showed that a parent's own tooth brushing behaviour is associated with how a parent cares for their preschooler's teeth. The results showed that if a parent brushed their own teeth twice or more a day, they were more likely to begin brushing their preschooler's teeth at the right age, brush their preschooler's teeth twice a day, have taken their preschooler

to the dentist and use toothpaste when brushing their preschooler's teeth. This relationship is consistent with international literature which shows a strong association between a parent's oral health status and their child's oral health status (Rahbari & Gold, 2015). This relationship has also previously been looked at in a New Zealand study with four-year old Pacific children (Schluter et al., 2007). The findings in this research were in line with the previous New Zealand study, showing that a parent's tooth brushing behaviours influenced the oral health care they provided to their children (Schluter et al., 2007).

The key informant interviews conducted for this research supported this finding and parents commonly referred to their own oral health practices in relation to how they care for their preschooler. Most interviewees talked about their own oral health care and their experiences. For example, when a parent was aware of a deficiency in their own oral health practices while growing up, they were often more conscious of ensuring they do the right thing for their child.

Additionally, parents often believed they would have passed their bad genetics on to their child, and talked about their bad oral health as a motivator to keep their children's teeth healthy. A number of participants viewed oral health, including their child's oral health, as being pre-determined by their family oral health history, and, more specifically by their own oral health history. If a participant had poor oral health as a child, then they would often consider that this was a result of their genetic make-up. This had a positive impact on some parents, as they transferred that knowledge into wanting to take good care of their preschooler's teeth. For other parent's it was a limitation as they viewed genetics as trumping preventative health care saying, and believing, the recommended oral health care could only have a limited influence given this inherent limiting factor. This was demonstrated by a parent saying "*even if you do brush your teeth some people seem to get more cavities than others*" (P5). Some parents believe their child has bad genetics and that these bad genetics are a significant cause of the poor oral health status of their child. This belief evidences a fatalistic attitude towards having poor oral health, and it could potentially put the child at a higher risk of developing early childhood caries.

This finding also demonstrates a misconception around oral health knowledge. As we have seen in the literature, recommended oral health preventative measures reduce the prevalence of oral health caries. Therefore, this demonstrates the potential impact that having knowledge which does not align with recommendations, can have for preschoolers. A similar perception of the impact of genetics is seen in the literature; with international studies showing that some

parents believed it was the main reason their child had developed early childhood caries (Amin & Harrison, 2009; Virgo-Milton et al., 2016). Interestingly, no parent mentioned the possibility of passing on good genetics to their child, and no parent felt less need to worry about brushing due to good genetics. This might be indicative of the generation of parents, having bad teeth, or it may mean that parents believe good oral health comes from care of the teeth.

Parent's confidence

A parent's confidence in brushing their preschooler's teeth was mentioned by a majority of the parents in the qualitative research. Parents talked about being unsure of what they were doing, or if what they were doing was right. However, all parents believed that brushing their children's teeth was likely to be better than doing nothing. This was similar to a survey in Australia which found that 75% of parents reported cleaning their child's teeth regularly, but only 44% reported being confident in their ability to do so (Gussy et al., 2008).

The interviews showed that a parent's lack of confidence did not seem to impact how frequently parents brushed their preschooler's teeth. However, the qualitative study showed that it may have an impact if the parent brushed their children's teeth or whether they let the child do it themselves. This was seen when a parent said "*I'm not that confident and what I tend to do is, I just show her how I am brushing and we kind of do it together in the mirror.*" (P2). However in international literature, both qualitative and quantitative studies have demonstrated that the frequency that parents brush their children's teeth was directly associated with the degree of confidence that the parent had in tooth brushing; parents who were more confident in successfully carrying out brushing their preschooler's teeth, did so more often and maintained the brushing over time (Amin & Harrison, 2009; Gussy et al., 2008).

Diet

Eating sugary foods was often referenced in interviews as something that the parent did when they were growing up, and is a habit they have continued as an adult. Parents identified sugar consumption as a factor which impacts their own current oral health status. Thus, parents recognised that sugar was a potential factor that could cause harm to their child's teeth, and therefore tried to limit the amount of sugar the child was eating. Most parents recognised that limiting sugar consumption was difficult given the current food environment, which is discussed in the section below.

Many parents found managing sugar difficult and were confused with the information they had, with some of the parents believing fruit needed to be avoided due to its sugar content. Participants recognised that the prevalence of sugar was a much larger factor now compared to when they were growing up, and people are much more aware of the harm that sugar can cause to a person's oral health.

Income

Associations between health and socioeconomic status are widely recognised (Hernandez & Blazer, 2006). International literature demonstrates that children from lower income households are more likely to begin brushing their teeth at a later age, brush their teeth less frequently, and are more likely to only visit a dental professional when there is a problem with their teeth, when compared with children from higher income households (Bach & Manton, 2014; Pieper et al., 2012; Pine et al., 2000; Skeie et al., 2006; Van den Branden et al., 2013). However, for a number of potential reasons, this relationship was not seen in this research. One of these reasons the relationship was not observed may be due to the broad range of factors that were being adjusted for within the research. As discussed in Chapter 2, it is not an individual's low income itself that causes poorer oral health behaviours, it is flow-on effects of having a low income (Pieper et al., 2012). These secondary factors include having less access to healthy food options, and often not having access to dental services (Pieper et al., 2012; Pine et al., 2000; Skeie et al., 2006; Van den Branden et al., 2013). These factors were not specifically controlled for in the research.

Free dental care in New Zealand, as well as the access to the Plunket and Well Child/Tamariki Ora Services, seems to have had a positive impact on low income families. As discussed, this removes the main financial barrier to visiting dental professionals that is seen in overseas literature. However, it does not make it easier for parents to buy healthy food products or to have fluoridated water supplies. Participants who were interviewed for this study referred to the fact it would be hard to buy tooth brushes and to eat healthy on a low income. To overcome the remaining financial barriers, participants who were interviewed for this study suggested the Government provide tooth brushes and toothpaste to high need families, and reduce the G.S.T. on healthy foods such as fresh fruit and vegetables.

Parents' education level

When other factors were adjusted for no differences were found in the quantitative study between oral health behaviours by parent's level of education. However, there were trends indicating that the more educated a parent was, the less likely they were to perform the preventative oral health behaviours on their preschooler. This contradicts the international literature that shows a parent's education level has a substantial positive impact on oral health behaviours. It has been observed internationally that preschoolers whose mothers have a lower education level tend to brush their preschooler's teeth less frequently and delay their child's visit to a dental professional when compared with preschoolers' whose mothers have a higher education level (Edelstein, 2002; Van den Branden et al., 2013).

There are several potential reasons why the New Zealand results contradict international literature; including that New Zealand parents may have more equal access to oral health information. In the interviews Plunket was the most quoted source of knowledge for parents receiving oral health information. Plunket is a Government-funded service and therefore available to all parents, regardless of income (which has a link to a parent's education level).

Living between two households

The interviews revealed a difference in oral health care and behaviours provided for children living between two households compared to living in just one household. While these results need to be read with caution, as there was only one participant interviewed where the child was living between two households, there are some interesting differences seen that align with the international literature. International literature in the area shows a significantly higher prevalence of early childhood caries in preschoolers who live across two households (Hallett & O'Rourke, 2003; Plutzer & Keirse, 2011).

5.2.7 Community and environmental-level factors

Food environment

A common theme discussed by all interviewees was the impact sugar has on their children's oral health, as discussed previously. While sugar was identified as an issue by all participants, they acknowledged that other parents may not view sugar as a problem, or may not know how to avoid the sugar even if could identify it as an issue. This may be especially common in low-socioeconomic areas due to the accessibility and affordability of foods with a high sugar

content (Jamieson et al., 2006; Lingström et al., 2003; Shahar et al., 2005; Tinanoff & Palmer, 2000).

Parents found it difficult to reduce their child's sugar consumption. Two reasons were identified for this: the first being that sugary food and drinks were appealing to children, both in taste and through marketing (such as through being associated with popular television characters). The second is that sugar is found in a large amount of readily available foods.

Some interviewees went on to discuss possible solutions to deal with the large amount of sugar in society with a tax on sugar being a desirable option for over half of the interviewees. The detrimental effect of sugar on oral health, as well as obesity, has received a lot of media attention recently and this might be one of the reasons why it featured heavily (un-prompted) in the interviews. In the interviews parents referenced television programmes where they had seen the impact that sugar had on teeth, and these motivated them to avoid sugar in their preschooler's diet.

Marketing of sugary foods was discussed by some of the parents in the interviews. Parents talked about the marketing of food products to children in supermarkets. Parents were aware that bright-coloured products, cartoon characters and placement of foods were all strategies that were targeting children. One parent went as far as saying that she did not take her children to the supermarket anymore as it was easier than having to say no when her children asked for unhealthy foods. However, this course of action has its own repercussions, as learning how to shop at a supermarket is an important life skill, especially as it can directly relate to the ability to cook healthy food. Teaching children to shop at the supermarket is recommended by the MoH in the food and nutrition guidelines for children (Ministry of Health, 2012). Allowing companies and supermarkets to market food in any manner they choose is having a detrimental impact on uptake of the MoH recommendation. To facilitate the MoH recommendations the Government could consider regulating the marketing of food products.

Accessing dental services

Within the interviews, a majority of the parents talked of the difficulties they have had in accessing the local dental service. These difficulties varied between participants and included, not being able to get in touch with the dental service, and the opening hours of the dental

practice meaning it was difficult to get an appointment. Another parent talked about being lucky to have social support around the family which meant they could take the child to the dentist while they worked.

International literature has shown that having social support around parents is beneficial. One option that could be investigated to remove this barrier is a policy which allows working parents to get time off work to take their child to health appointments. Using oral health as an example, this would ensure that the child actually gets to visit a dental professional as well as ensuring that the parent receives the recommended advice on how to care for their preschooler's teeth.

Oral health promotion

Many of the parents also discussed the current (mid-2017) oral health promotion advertisement that is encouraging tooth brushing in preschoolers. Many parents said it acted as a good reminder, and prompted parents to say they would like to see more similar promotional material. This emphasises that parents feel they lack knowledge about preschool oral health and are keen to acquire that knowledge.

A further community level factor was the interviewees' exposure to health promotion messages through advertising. It appears that parents are generally trying to adopt the recommended practices, and this can be seen by the reliance on health professionals as well as the benefit interviewees mentioned they received from public health promotion. A benefit of this finding is that an increase in health promotion messages is likely to increase the overall knowledge that parents have. A focus on public health promotion would also eliminate the risk of information being passed on through informal channels that do not align with recommendations, such as through friends. Due to the difficulties encountered when trying to access dental professionals, health promotion messages from trusted sources have the potential to make a large improvement in the oral health of New Zealand children.

5.2.8 Summary

There are a number of factors that influence the oral healthcare that parent's provide for their preschooler. One of the key factors that influence a parent's behaviours is their level of preschool oral health knowledge. When knowledge was broken down into population groups

it was clear that differences existed between characteristics of people. For example, parents with older children, parents who brushed their teeth twice a day, parents with a higher household income, and parents who had previous experience caring for a child, on average had greater knowledge and were more likely to perform the recommended oral health actions. Conversely, parents who were not in these groups had a lower level of knowledge and were less likely to perform the recommended oral health behaviours on their preschoolers. These findings show that substantial benefits could be achieved through targeted efforts to increase knowledge among certain population groups.

Knowledge was not the only factor associated with oral health behaviours that parents performed on their preschoolers and many other factors, both positive and negative, were also found to be associated. These broader factors have been categorised in line with the Fisher-Owens' Model into child-level, family-level, community-level and environmental factors. These findings indicate that preschool oral health needs to be examined from a broad perspective as there are many influences. Applying the Fisher-Owens Model highlighted the interrelationship between factors and the importance of ensuring that New Zealand has a solid framework in place to support and improve preschool oral health that involves as many of these related factors as possible. The application of the Fisher-Owens Model and how the findings of the thesis further expand the model is now discussed, followed by the discussion of potential policy initiatives and future research ideas.

5.3 Fisher-Owens Model

The Fisher-Owens Model, outlined in Chapter 1, was used in this thesis to guide the research and help underpin the complexity of oral health in preschoolers. The multilevel approach of the Fisher-Owens Model helped demonstrate the wide range of factors that influence a child's oral health. The model consolidates the evidence from oral health research, demonstrating that there are not only a number of factors that influence an individual's oral health, but that these factors are related and occur at a number of different levels. These levels include a child-level, a family-level and a community-level. The model also recognises the concept of time and that environmental factors are involved. This thesis mainly considers how the factors surrounding the parent influence how they care for their preschooler's teeth. The parent, and their lifestyle, is represented in the family-level factors, which surrounds the individual (or child-level)

factors. The multiple levels were used throughout the research to structure the literature review, to present the qualitative findings and to help answer the research questions of this thesis.

Overall the model was helpful in guiding the research and the thinking of how best to consider the various factors that impact oral health. However, there were gaps in the model that seemed critical, and were found to be associated with how a parent cared for their preschooler's teeth. These gaps mainly occurred at the environmental level, such as the current food and beverage environment and access to health services. Based on this critique of the model, from the findings of this thesis the model was reconstructed and can be seen in *Figure 3*.

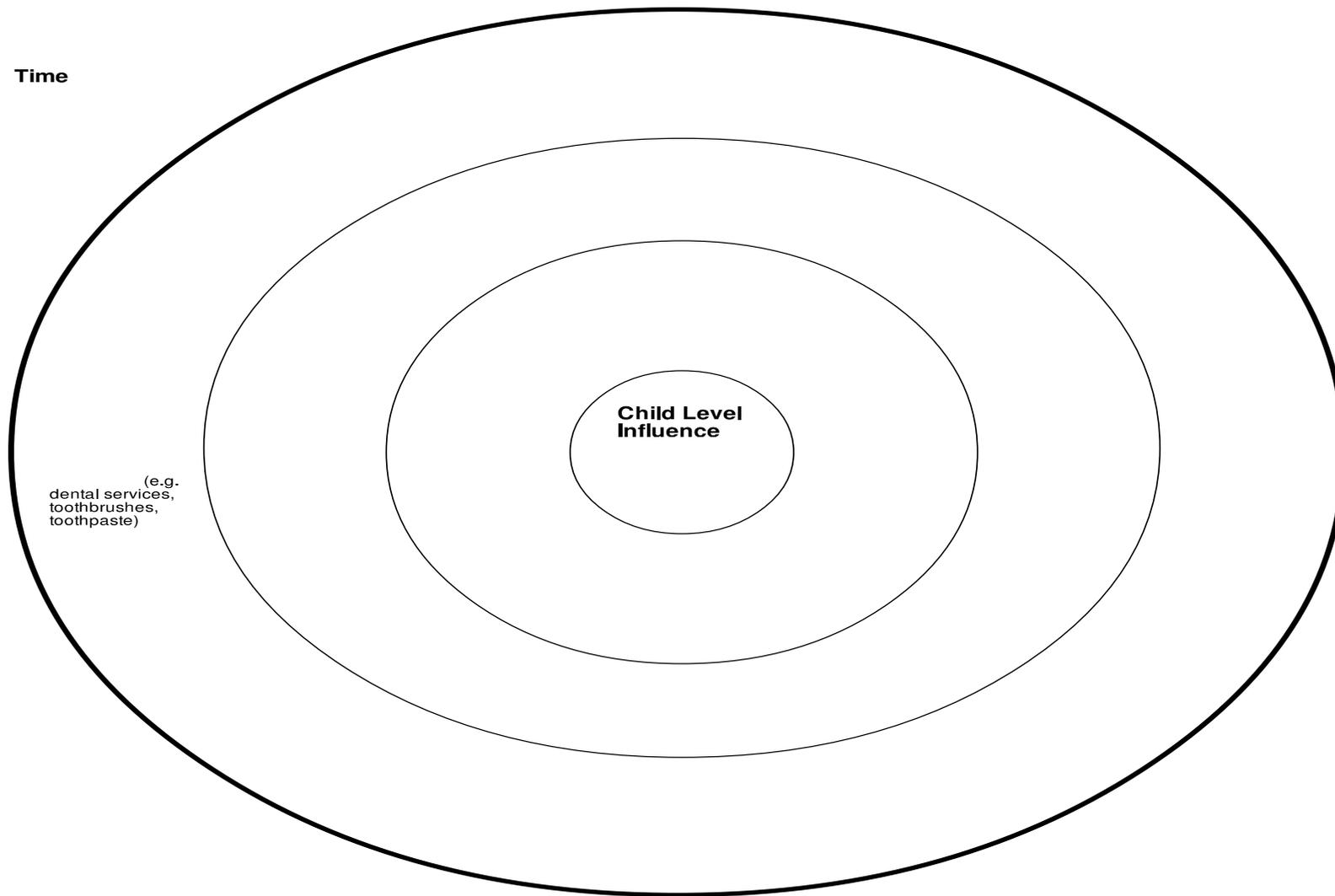


Figure 3. The updated Fisher-Owens Model

This updated Fisher-Owens Model places the child, and their associated influencing factors, at the centre. This is because children are encompassed by their surrounding factors (that is, family-level influences, which are in turn affected by community-level influences, and the environment they live in). Each wider ring of this model represents a different level of influence and each level relates to its neighbouring level(s). These rings demonstrate the rings of support around the child. The closer rings are to the child indicates a more direct influence on the child's oral health status, and as you move to the outer rings, the impact on the child's oral health is less direct (but does not necessarily mean it does not have a substantial influence). Overall, if factors comprising the rings, both proximally and distally to the child are strong, then the greater the support for the child, or in a preschooler's case, the greater the support that the parent has when caring for their child's oral health.

The outer ring of the model represents the environment the child lives in. If this ring is weak, such as through insufficient government policies in place to protect the child, the level of support this ring provides to the child is compromised. This puts more pressure on the support provided by the inner rings to protect the child and therefore the rings interact with each other. Likewise, if the community-level factors are not sufficient to support parents when they care for their child, it places more pressure on the family-level factors, where the parent is represented, to protect the child's oral health.

The factors that were highlighted blue in the model were additional factors that were not in the original model. These additional factors were identified in this research as having a large impact on a child's oral health. As there are so many factors involved in the developmental process of early childhood caries, it is beneficial to highlight these everyday factors that have a significant impact on the health of a child.

Overall, this model demonstrates the plethora of factors that influence a child's oral health status in New Zealand, while also representing the factors that influence how parents care for their preschooler's oral health. Moreover, this model demonstrates that there are multiple levels of intervention points, each of which could be prioritised, and all of which could significantly contribute to an improved oral health status of children in New Zealand. The model also demonstrates that to improve a child's oral health, environmental-factors cannot be ignored. The responsibility for preschool oral health care cannot remain focused at the family-level (or individual-level), we need to look to the outer rings of the model (the environmental

level) and make it a public health priority to develop initiatives to support preschool oral health. Therefore, both a targeted approach and general policies (for example a sugar tax) should be utilised in order to have a positive impact on children's oral health status and so that overall all children can have a better quality of life.

5.4 Strengths and limitations of the research

There are only a handful of studies that look at oral health in New Zealand children, and only a small number studies both internationally and in New Zealand that have investigated how a parent's knowledge of preschool oral health might be associated with oral health behaviour parents provide for their preschoolers. Therefore, this study helps address this knowledge gap and provides a valuable resource to future researchers and policy makers.

As discussed in Chapter 3, adopting a mixed methods approach is a strength of the study as the combination of the methods compensates for the weaknesses of each individual method (quantitative and qualitative) and strengthens the overall study. However, each phase of the study had its individual strengths and weaknesses.

The strengths of the HPA data set, which made up the quantitative phase of this thesis, were that it had a large sample size with over 1000 respondents. The survey also used a number of questions from trusted surveys, which as Bryman suggested, is a strength as the questions have already been trialled, which adds validity to the question (Bryman, 2008). There were also limitations of the study which included, the sample was cross-sectional, which means the temporal relationship could not be detected and causality could not be implied. The recruitment method for participants in the quantitative survey was also a limitation. While a large range of participants were recruited, there was a large proportion of the population that did not have the opportunity to be included in the survey, as it was sent to an existing consumer panel that participants sign themselves up to. Therefore, if parents were not enrolled in this service, they did not have the opportunity to participate in the survey. The survey was also conducted through the internet, which low-income parents may not have access to; this inherently reduces their opportunity to participate which is a concern as they have been identified as a high priority group. This may have been one of the reasons that low-income participants were under represented in the survey.

The survey was also not representative of the New Zealand population; it had a large proportion of respondents with high qualification levels and high household incomes, and was under-represented in the number of respondents with a low household income. A selection bias was present in the study due to the larger portion of higher educated, well-off participants in the survey and the low level of Māori participants. This could have made the issue of preschool oral health not look as serious in New Zealand as it is. The small number of non-New Zealand European and non-Māori participants meant there was only enough power to analyse differences by New Zealand European and Māori participants. Therefore, while the findings tell us a story and identify areas to focus efforts and future research, the sample was not representative of New Zealand and the findings of the research will need to be applied with caution when identifying target groups for intervention. These are limitations of the HPA data set, and are therefore, limitations of this research and impacts how the findings can be interrupted and applied.

A limitation of the data chosen from the quantitative phase of this thesis included the limited select set of variables, which meant there was a limited ability to adjust for confounding, or to investigate whether other variables were associated with oral health knowledge and behaviour. There would have also been benefit in using a wider range of questions to represent a parent's knowledge to provide a more robust measure.

There were also limitations in the qualitative phase of the research. These limitations include the small sample size, only piloting the interview with one person, and that only parents from the Wellington region were interviewed. The findings relating to the health service providers are relevant only to the local oral health service in Wellington, and therefore differences may be seen in other parts of New Zealand. However, generalisability is a limitation of all qualitative research, and qualitative research is rarely intended to be representative of the population. The aim in the qualitative sample was to interview low socioeconomic participants. To achieve this, low socioeconomic areas, which were identified by the local school decile, were targeted. A limitation of this is that a participant may live in an area with a low school decile, but not themselves be low socioeconomic. The participant's deprivation status, calculated by using the NZiDep survey was not identified until the participant was at the interview. The impact of this method meant some of the participants had a higher level of socio-deprivation than was initially targeted.

Another factor that is considered both a strength and limitation of the study is the different population characteristics that made up the quantitative and qualitative research. In some ways, this was a strength as it meant the qualitative research filled gaps of the quantitative research; however, this factor also made the populations hard to compare and connecting findings became more difficult.

Despite the limitations of the methods, valuable and significant data was gained from both the quantitative and qualitative research, allowing the research questions of the thesis to be comprehensively answered from several different angles. Despite the limitations, the survey produced useful material for answering the research questions and advancing the understanding of how parents care for their preschooler's oral health.

5.5 Implications for policy and practice

This section discusses the implications that the study's findings have for policy development. The policy recommendations below have been developed from the findings of this work, and have the potential to have a tangible benefit for preschool oral health care.

Utilise the Plunket and Well Child/Tamariki Ora Services to inform parents about preschool oral health

If parents increase their knowledge of oral health, this is likely to lead to better care of preschool oral health through improved oral health promoting behaviours. In addition, parents indicated that they would be receptive to more information on how to care for their preschooler's oral health. Plunket was quoted the main source of the interviewee's oral health knowledge. Given this, it is recommended that Plunket services have an increased focus on preschool oral health and that preschool oral health actions are clearly and comprehensively set out in the Plunket book that is available to new parents. From the interviews, it seemed that the Plunket services occasionally provided this information, however it appeared it was not consistent across the sector. Therefore, it is recommended that Plunket services consistently provide a high level of preschool oral health information to parents, in a timely manner.

Some suggestions made by parents to improve oral health knowledge was to include providing an oral health timeline in the Plunket book, providing parents with tooth brushes and toothpaste at Plunket sessions, and helping guide parents on how to care for their preschooler's oral health

in the recommended way. This could include practical advice on how to effectively brush their preschooler's teeth, which was one area that parents identified as they would benefit from increased knowledge in (this would also lead to greater confidence).

As the Plunket service is already well established, this recommendation could be a simple and cost effective way to implement preschool oral health education. This recommendation should not be limited to Plunket services and should also occur in organisations that provide a comparable service to Plunket such as the Well Child/Tamariki Ora Service.

Increased public awareness

Many of the interview participants commented on the beneficial impact that the recent HPA 'tooth fairy' advertisement had and how they appreciated receiving this information. There needs to be a stronger understanding of the importance of preschool oral health across the community and one way to achieve this is through broad public health awareness.

Parents want to do the best thing for their children, and an increase in preschool oral health promotion generally will help to improve the awareness of oral health in all communities. A concerning finding was that parents are sometimes provided with mixed messages about the recommended preschool oral health behaviours. Broad public awareness campaigns will help to ensure consistent and correct messages are getting to the population.

Improve accessibility of dental services

Parents, especially working parents, had difficulty accessing the dental services provided. As lifestyles change and there are more single parents, or both parents working full time jobs it would be appropriate to adapt health services to meet parent's changing needs. Based on the difficulty some parents had accessing the local dental service, further funding of regional dental services is recommended to allow these services to operate outside of working hours. Increased funding could allow the clinic to stay open later some nights which would enable working families to have access outside working hours. Other options could include encouraging businesses to have more flexible working conditions, or raising the minimum wage to ensure people can take time off work to look after their own, and their child's health.

Providing tooth brushes and toothpaste to high need families

To ensure that the cost of oral health promoting products is not a barrier for low income families, the Government could look at funding tooth brushes and toothpaste to high need families.

Review food and beverage pricing to influence behaviour

There may be benefit in reducing the price of health foods such as fruit and vegetables and increasing the price of food and beverages with high sugar content, such as sugar-sweetened beverages. This was referred to by interviewees and an area that should also be focused on in further research. Reducing the cost of fruit and vegetables would allow healthy food to become more affordable for all families, and the increase in price of sugar-sweetened beverages would send a message about the negative consequences these beverages have. To achieve this, the current amount of tax applied to these foods and beverages would need to be increased and the increased revenue collected could be used to cover any discount offered on healthy food, as well as contributing towards the social cost that occurs from consuming unhealthy foods (including among others, poor oral health).

Approach to oral health promotion

The reality is, there are a plethora of social determinants of health that could be targeted together and doing so would have overlapping benefits which would improve the health of the country, including oral health. The home environment is impacted by many factors, including household income, the level of social deprivation in the area, as well as whether the child is living in one household or across two. The home environment is an important social determinant of health and therefore there it would be beneficial to look at grouping social policies together to improve environmental conditions that impact preschooler health, including preschool oral health.

5.6 Implications for future research

This section discusses the implications of the study findings for future research. Ideas that would benefit from future research are set out below and are based on the findings of this work.

Adopting a focused approach towards young parents

A reduced level of knowledge and worse oral health care behaviours were seen in younger parents. Therefore, targeting this population group for further studies is likely to have a beneficial effect. There would be benefit in conducting further research with young parents to identify what specific information they would find useful to receive and how they would prefer to receive that information. This will ensure that the messages can reach the target population in the most effective manner.

Access to dental services in other regions

The qualitative research identified that parents found it difficult to access the local dental service. This research was collected from participants that resided in the greater Wellington region. There would be benefit in conducting research with parents outside of the Wellington region to determine if the same problems accessing dental services exist in other regions. It would be important to include both urban and rural areas to understand the challenges faced in accessing services in different parts of New Zealand.

Broader research would confirm the extent to which the results from the qualitative study are limited to Wellington, or whether they apply more broadly and the issues identified need to be addressed at a national level.

Focusing on children living across two households

This research demonstrated that having a child living in two households may have an impact on the care of a preschooler's oral health. However, there was only one parent interviewed in this research. Therefore, this area would benefit from further research to identify and understand the factors that apply specifically to children living between two households.

5.7 Conclusion

Early childhood caries is a public health concern both in New Zealand and internationally, not only due to the large number of New Zealand children who are affected, but due to the ethnic and socioeconomic disparities that are evident. Early childhood caries can present physical, functional and psychological consequences for a preschooler, and can also have direct and indirect consequences on an individual's health later in life. There are also significant

economic consequences for both the individual and society that arise. Thus, preventing early childhood caries from occurring in all population groups is critical.

The development of early childhood caries had previously been identified as multilevel, with a number of factors contributing to their development. As early childhood caries is largely preventable, it is important to understand the factors that drive the development of early childhood caries so that we are able to develop and implement appropriate preventive measures.

Because preschoolers rely on their parents to care for their oral health this study focused on determining what factors impacted a parent's ability to care for their preschooler's teeth. There is limited oral health research in New Zealand and this study provides a valuable addition to the knowledge base. The lack of New Zealand specific research has meant that previous decisions and policies relating to preschool oral health have been derived from international evidence. In light of these factors, the aim of this thesis was to answer the research question:

What factors influence the oral health care parents provide for their preschooler?

This study established that parent's knowledge of preschool oral health is strongly associated with the oral health care parents provide for their preschooler. Therefore, significant benefits would be seen from ensuring that parents have a high level of knowledge when it comes to preschool oral health behaviours. The results also demonstrated that knowledge was greater if the parent was older, if a parent brushed their teeth at least twice, and if the parent's child was older than two years of age. It is important that policies are put into place to target high-risk groups that were identified in this thesis such as young mothers.

However, as shown in the Fisher-Owens Model (Fisher-Owens et al., 2007), there are broader factors that need to be considered when examining the development of early childhood caries. These factors involve a wide range of family-, community- and environmental factors, such as access to dental services and regulating the food environment. Thus, this thesis demonstrates that to reduce early childhood caries, and the inequalities that exist, change needs to occur across a number of areas.

It is time that improving the oral health of New Zealanders, especially young New Zealanders, becomes a focus. To begin with, we need to focus on the enabling factors that will allow parents to perform the recommended oral health behaviours for their preschooler, and this should start at the community level. Ensuring that policy interests are aligned with the research is critical to achieving real change in this area. This study has highlighted a number of factors that influence parents' preschool oral health knowledge and behaviours, and has examined these by population groups. The results provide a background from which targeted policies can be developed.

The evidence of poor oral health in New Zealand, and the disparities that exist, demonstrate that while free dental care for under-18's is beneficial through reducing some of the financial barriers to accessing to dental care, this alone does not necessarily address the inequalities in preschool oral health. The findings of this study demonstrate that oral health care is a complex issue, with multiple levels of factors impacting the care that parents can provide for their preschooler.

Increasing the awareness and knowledge that parents have of recommended preschool oral health behaviours, through health promotion messaging and health professional services, is paramount, and it appears that parents are very receptive to receiving more information on this topic. Increasing knowledge, coupled with improving access to dental services and targeted policies, has the potential to make a substantial difference to preschool oral health and to provide overall and long-term benefits to both individuals and to the community.

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Appendix 1. – Interview schedule

 <p>UNIVERSITY of OTAGO Te Whare Wānanga o Ōtago NEW ZEALAND</p>	<p>Key Informant Semi-structured Interview Guide</p> <p>Exploring parental factors influencing preschoolers' oral health status and care</p>
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Participant number:

Date and place of interview:

Consent

Have you read the information and consent sheets? Have you filled in participant info sheet?
Are you happy for me to record this interview for later transcription? Do you have any questions? (Obtain verbal consent)

Thank you for agreeing to take part in this research. As we have discussed, I would like to ask you some questions about the oral health of your preschool-aged child and some of your family's oral health care routines.

Oral health care routines

I'm going to start by asking you a few questions to help me better understand your child/children and some of your typical everyday routines (if they have more than one child, the interview will include both children).

Q1) First what's your child's name?

Probe: (if not obvious) are they a boy or a girl, how old, older or young siblings

Q2) Could you tell me about your child's everyday routines (i) after they get up in the morning and (ii) before they go to bed?

Prompt: Meals, hygiene, dental hygiene, supervised brushing

Probe: How important is dental hygiene for you? Why is it important?

Factors that influence parents' capacity to care for children's teeth

Now I'm going to ask you some questions about things that make it easier or harder to look after your child's teeth

- Q3) Where did you get information on how to care for your child's teeth from?
Prompts: own dentist, Plunket, friends, family
Probe: How useful was that information for you?
Probe: What sort of things did it tell you about caring for your child's teeth?
Prompt: tooth brushing, visiting the therapist, diet and nutrition
- Q4) How confident do you feel about being able to brush your child's teeth?
Probe: Think of a time when it was difficult to brush your child's teeth.
Probe: What was difficult about that? What things would have made it easier for you to brush their teeth?
Prompts: more information, cost of brushes and toothpaste
- Q5) Has your child ever visited a dentist or dental therapist?
If no: Do you know where to take your child if they needed to visit a dentist or dental therapist?
If yes: Can you tell me why they visited the dentist or therapist? How did you know when and where to take them?
- Q6) Thinking about your visit:
What things make visiting the dentist or dental therapist easy?
What things made the visit difficult?
Prompts: location, transportation, work, knowledge of service
What would make it easier for you to visit the dentist or dental therapist?
Prompts: better transportation, hours of opening, location of clinic
- Q7) Thinking about your own everyday routines and past experiences with your teeth, how do you think they may have influenced how you brush and care for your children's teeth?
Prompts: previous bad experiences, cost, accessing services
- Q8) Other than brushing and visiting the dentist or dental therapist, what other things do you think are important for children to have healthy teeth?
Prompts: food and drink, money, time, more knowledge

Probe: How easy or difficult is it for you make sure that your children has healthy food and drinks, enough time, etc? What would make it easier for you to be able to provide healthy food and drinks, enough time, etc?

Prompts: cost of food, poor availability of healthy food, income, time

Concluding questions

Do you have any other comments?

Would you mind if I contact you if I have any further questions?

Thank you for helping me with this study.

Appendix 2 – participant information sheet

 <p>UNIVERSITY of OTAGO Te Whare Wānanga o Otago NEW ZEALAND</p>	<p>Exploring parental factors influencing pre-schoolers' oral health care and status</p> <p>Participant Information Sheet</p>
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Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

Who is doing this study?

This project is being led by researchers at the University of Otago, Wellington as part of requirements for Sarah Dallas's Masters in Public Health in the Department of Public Health, University of Otago, Wellington. Sarah is supervised by Dr. Moira Smith, Senior Research Fellow and Andrew Waa, Lecturer, in the Department of Public Health, University of Otago, Wellington.

What is the aim of the project?

The study aims to explore parental influences on the oral health care and status of pre-schoolers. The findings will help to provide an understanding of pre-schoolers' oral health in New Zealand, and will help to identify things that could be done to improve it.

Who would we like to interview?

We would like to interview six parents or the main caregiver of children aged six months to four years and 11 months of age. We are seeking participants recruited through early child education centres and the researchers' existing community contacts.

What will participants be asked to do?

Should you agree to participate you will be asked to take part in one interview which will last around 30 to 45 minutes. Interviews will be face-to-face, conducted at a time convenient to you. Interviews will be conducted by Sarah Dallas and some will also be attended by one of her supervisors. The interviews will be recorded with your permission. Along with the consent form, we have included a brief questionnaire for you to complete. This questionnaire will provide demographic information so that we can describe the group of participants. It will not be used to describe you individually.

You can choose not to participate in this project without any disadvantage to yourself.

What will be the nature of the questions?

This project involves an open-questioning technique. The general line of questioning will be about caring for your preschool-aged child's teeth. The interview will explore the challenges and beneficial factors that influence the care and health of your child's teeth.

The exact nature of the questions has not been determined, but will depend on the way in which the interview develops. We have developed some questions in advance to use as a guide during the interview. Consequently, although the Department of Public Health is aware of the general areas to be explored in the interview, the Committee has not been able to review the precise questions to be used. In the event that the line of questioning develops

in such a way that you feel hesitant or uncomfortable you have the right to decline to answer any particular question(s).

What data or information will be collected and what use will be made of it?

The interviews will be typed up and the written transcripts analysed. The results will be reported in a Masters of Public Health thesis that will be available at the University of Otago (Dunedin, New Zealand) library. They may also be published in reports, as articles in peer-reviewed journals, and presented at academic meetings and conferences. Some verbatim quotes will be used to illustrate key findings. We will make every attempt to preserve your anonymity. If your quotations are to be included in publications you will not be named but a general descriptive title will be included.

The data collected will be stored securely in password-protected computer files or in locked filing cabinets in the Department of Public Health and only Sarah Dallas and her supervisors will be able to access it. Those with access to the written versions of the interview include Sarah Dallas and her supervisors and the person who typed up the interviews; only the interviewer(s) will know of the informant. All audio-files will be erased from the recorder(s) once they have been copied to a password-protected computer file. Any personal information held on the participants such as contact details will be destroyed at the completion of the research. Data obtained as a result of the research will be retained for at least 5 years in secure storage.

What will be the benefits and risks of participation?

Although participants will receive no direct benefit from participating, we hope the study will provide much-needed information on the oral health of young New Zealanders and how best to improve it.

It is not expected that participation in the study will have any adverse impacts on participants. Participants will not incur any financial costs.

Can participants change their mind and withdraw from the project?

Your participation is entirely voluntary. You do not have to take part in this study. If you do agree to take part in the study, you are free to withdraw from the study at any time, without having to give a reason and without any disadvantage to yourself.

What if participants have any questions?

If you have any questions about this project, either now or in the future, please feel free to contact the researchers:

Sarah Dallas
Department of Public Health
sarahdallas1@gmail.com

and

Dr. Moira Smith
Department of Public Health
Phone: 04 385 5541
moira.smith@otago.ac.nz

This study has been approved by the Department stated above. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

