Epidemiological validation of a Malay version of the Child Perceptions Questionnaire (CPQ\textsubscript{11-14}) in Brunei

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ABSTRACT

Background

Oral health-related quality of life (OHRQoL) instruments are being used with increasing frequency in oral health surveys. One such instrument is the Child Perceptions Questionnaire (CPQ\textsubscript{11-14}), developed in Toronto as a measure of OHRQoL specifically for 11-to-14-year-old children (Jokovic \textit{et al}, 2002). It aims to improve the description of children's oral health, while taking into consideration the importance of psychological aspects in the concept of health. As the original version of this questionnaire was considered long (37 items), shorter forms were developed with 8 and 16 items to facilitate its use in the clinical settings and population-based oral health surveys (Jokovic \textit{et al}, 2006).

The developers of the CPQ\textsubscript{11-14} have determined the psychometric properties of the long-form and the short-forms CPQ\textsubscript{11-14} to be satisfactory, but state that these measures must be validated and employed in other cultures, involving clinical and population-based samples of children and adolescents in different countries. The short-form measure has been tested and validated in a representative population sample of schoolchildren in New Zealand (Foster Page \textit{et al}, 2008). On the other hand, the long-form CPQ\textsubscript{11-14} has been shown to be valid and reliable in a number of different countries including Canada, the United Kingdom, New Zealand, Uganda, Saudi Arabia, Australia, Brazil, Hong Kong and Denmark. However, neither the long-form nor the short-form CPQ\textsubscript{11-14} has been translated into a Malay (Bahasa Melayu) version and tested in the South-East Asian region.

Schoolchildren are the main target group for public oral health services in Brunei. Until now, data on the Brunei population’s oral health included only the clinical status of oral diseases. Although the focus of the Brunei Ministry of Health has shifted from being disease-oriented to emphasising wellness and the maintenance of the quality of life of the population, a measure of OHRQoL appropriate for use in Brunei has not been available.

Therefore, the aims of the current study were:

1. to produce a Malay version of the short-form CPQ\textsubscript{11-14};
2. to determine the construct validity of the CPQ\textsubscript{11-14} in Brunei; and
3. to determine the discriminative validity of the CPQ11-14 by assessing its ability to distinguish between schoolchildren with and without dental caries and malocclusion.

Method

Ethical approval was granted by the Medical and Health Research and Ethics Committee, Brunei Ministry of Health. Five hundred and sixty-nine 11-14-year-old (Year 6) children in nine government primary schools were asked to participate. Parents and caregivers of the children in the study sample were then mailed (through their class teachers) an information sheet about the study, together with an enclosed consent form. A Malay version of the short-form CPQ11-14 was derived through a forward-backward translation process. The questionnaire was then piloted on 20 schoolchildren and refined for ease of use. Prior to clinical examination, all participants completed a copy of the Malay short-form CPQ11-14. The children were examined for dental caries experience (using the DMFS) and for malocclusion (using the Dental Aesthetic Index) by a single examiner (ARM). Both clinical data and data from CPQ11-14 were entered into a Microsoft Excel spreadsheet, and subsequently imported into SPSS. The psychometric properties of the Malay short-form CPQ11-14 were evaluated in terms of internal consistency, construct validity and discriminant validity. Test-retest reliability was assessed in a subgroup of these children (n = 48).

Results

A total of 457 children (mean age of 11.1 years, range = 10 to 14 years) were examined, giving an effective participation rate of 80.3%. The prevalence of dental caries in the permanent dentition was 44.4%. The mean dmfs and DMFS of deciduous and permanent dentitions were 1.51 (sd, 3.31) and 1.96 (sd, 3.74) respectively. About one-fifth had 4 decayed surfaces in either dentition. The DAI scores ranged from 17 to 91, with a mean of 31.4 (sd, 8.7). The distribution of participants across the four treatment need categories was: minor/none, 24.1%; definite, 37.0%; and severe/handicapping, 38.9%.

The overall CPQ11-14-ISF16 score ranged from 0 to 43, with a mean of 16.8 (sd, 8.7). The number with the minimum score was minimal, with only 1.1% having a score of zero and there were no children with the maximum score. Construct validity was satisfactory, demonstrating significant associations between the mean CPQ11-14-ISF16 scores and the
global ratings of oral health and overall well-being. The CPQ_{11-14}-ISF16 was able to discriminate between different caries status, and there was a significant association between impact prevalence and the number of untreated decayed tooth surfaces in either dentition. Interestingly, the gradient of the scale scores across categories of orthodontic treatment need was in the opposite direction, whereby those in the ‘minor/none’ category had the highest and those in the ‘severe/handicapping’ category had the lowest mean CPQ_{11-14}-ISF16 score and impact prevalence. The Malay short-form CPQ_{11-14}-ISF16 had excellent internal consistency with a Cronbach’s alpha of 0.97 and test-retest reliability ICC of 0.94.

**Conclusion**

The outcome of this study suggests that the Malay short-form CPQ_{11-14} is a valid, reliable and practical instrument for measuring OHRQoL in 11-14-year-old Bruneian children, although its ability to discriminate among children across the malocclusion treatment need categories seems to be limited. This provides further evidence of the instrument’s psychometric properties and its cross-cultural use. However, these are preliminary findings based on a convenience sample, and further testing in replicated studies involving clinical and population samples of children in various settings is necessary to establish the measurement sensitivity and discriminative properties of the Malay short-form CPQ_{11-14}.
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ABBREVIATIONS

ART    Atraumatic Restorative Technique
ASEAN  Association of Southeast Asian Nations
Child-OIDP  Child-Oral Impacts on Daily Performances
CI     Confidence interval
COHIP  Child Oral Health Impact Profile
COHRQoL Children’s Oral-Health-Related Quality of Life
COHQOL® Child Oral Health Quality of Life Questionnaire
CPQ11-14 Child Perceptions Questionnaire
CPQ11-14-ISF16 Item impact short-form version of the 16-item CPQ11-14
CPQ11-14-RSF16 Regression short-form version of the 16-item CPQ11-14
DAI    Dental Aesthetic Index
DMFS   Decayed, Missing, Filled Surfaces
DMFT   Decayed, Missing, Filled Teeth
FIS    Family Impact Scale
GOHAI  General Oral Health Assessment Index
HRQoL  Health-related quality of life
ICC    Intra-class correlation coefficient
MASCO-08 Malaysia Standard Classification of Occupations 2008
MHREC  Medical and Health Research and Ethics Committee
MOH    Ministry of Health
OHIP   Oral Health Impact Profile
OHRQoL Oral-health-related quality of life
OIDP   Oral Impacts on Daily Performances
OR     Odds ratio
P-CPQ  Parental-Caregiver Perceptions Questionnaire
QoL    Quality of Life
SD     Standard deviation
SDS    School dental service
SES    Socioeconomic status
SPSS   Statistical Package for the Social Sciences
WHO    World Health Organization
1. LITERATURE REVIEW

1.1 Background

Oral health is fundamental to overall health, well-being and quality of life. A healthy mouth enables people to eat, speak and socialise without pain, discomfort or embarrassment. It is also an essential and integral component of general health (Locker, 1988). In spite of this, most people still do not consider oral diseases to be serious health problems since they are usually neither life-threatening nor severely debilitating.

Traditionally, oral diseases and disorders are measured in population studies using clinical measures (recorded by dental clinicians during oral examinations) such as the decayed, missing, and filled teeth (DMF) index for dental caries, or the Dental Aesthetic Index (DAI) for malocclusion. These indices indicate the presence and severity of an oral condition. However, these important objective measures only reflect the end point of the disease processes, giving no indication about the impact of the disease process on function or psychosocial well-being (Allen, 2003). In short, the traditional oral disease measures give no hint of the effect of the various conditions (whether a carious tooth, a dry mouth, an ill-fitting denture or generalised periodontitis) on sufferers’ day-to-day function or well-being.

In 1948, the constitution of the World Health Organization (WHO) defined health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948). This definition broadened the concept of health and signalled a departure from the long-held belief that health is merely the absence of pathology. Based on this concept, measuring health should not be confined to the use of exclusively clinical normative indicators. Thus, in assessing oral health status, there is a need to consider subjective assessments of oral health. This has led to the development of a number of measures to assess the impact of oral health problems on individual’s physical, social, and psychological well-being. These measures, which were initially designed as socio-dental indicators or subjective oral health indicators, are now more usually referred to as measures of oral health-related quality of life (OHRQoL). Subjective indices to measure OHRQoL might be useful for practical, political, and theoretical purposes (Locker, 1996). Such measures have
been increasingly used in various countries, since they add important complementary information to traditional oral health indices.

To date, a number of measures have been constructed, most of which have been shown to have good technical properties (Slade, 1997). These measures, however, have been developed for and primarily used among adult populations. It is highly unlikely that any of the measures developed for adult and elderly populations would be suitable for children given their conceptual basis, item content and response formats. Measures for children need to be appropriate to the age-related activities and roles of the child (Osman and Silverman, 1996). Assessing the impact of oral health on the life quality of children is complex, and, despite development in this research area for over three decades, measures of child OHRQoL have emerged only relatively recently. This is probably due to the complex, conceptual and methodological issues involved in developing self-report health status indicators for child populations (Pal, 1996; Pantell and Lewis, 1987). This has been a significant omission, since children are subjected to numerous oral and oro-facial conditions, including dental caries, malocclusions, cleft lip and palate, and craniofacial anomalies, all of which have the potential to significantly impact on their quality of life.

In recent years, however, different outcome measures have been discussed and demonstrated to overcome this omission. The only such measures currently available for children are the Child Oral Health Quality of Life (COHQOL©; Jokovic et al., 2002; Jokovic et al., 2003a; Locker et al., 2002), the Child-Oral Impacts on Daily Performances (Child-OIDP; Gherunpong et al, 2004a) and the Child Oral Health Impact Profile (COHIP; Broder et al, 2007). However, the adaptation of such instruments for international research poses a number of difficulties. First, there is the issue of language and cultural differences and thus the need to develop culturally equivalent measures. Second, it is imperative that the psychometric properties of the instruments be assessed when employed in different settings, as they should exhibit consistent findings by different researchers in different settings.
1.2 Oral Health and Oral Diseases – An Overview

1.2.1 The importance of oral health

It is recognised that oral health is important to the physical, mental and social well-being of the people. Good oral health constitutes not only a good state of functionality of the teeth and mouth but also contributes to self-esteem and psychosocial wellness of the individual in addition to elimination of pain and discomfort.

It is on the basis of these considerations that optimum oral health has been defined as ‘a standard of health of the oral and related tissues that enables an individual to eat, speak and socialise without active disease, discomfort and embarrassment, and which contributes to the general well-being’ (Locker, 1988). Cohen and Jago (1976) also stated that oral health goes beyond purely clinical indicators, and that this should not be equated with the absence of disease and deformity.

1.2.2 Impact of oral diseases

Common oral conditions present certain salient features. Their high prevalence leads to great impact on individuals and society in quality of life terms, particularly with respect to pain, discomfort or functional limitations. Oral diseases can have social, general health and financial impacts. Each of these will be discussed in turn.

1.2.2.1 Social impact

The impact of oral diseases on people’s daily lives is subtle and persistent, influencing eating, sleeping, resting and social roles. Good oral health makes an important contribution to an attractive appearance, self-esteem and quality of life. Missing or decayed teeth and ill-fitting dentures can make people feel self-conscious and lead to loss of confidence and social isolation.

Until recently, the psycho-social consequences of oral conditions have received little attention, as they are rarely life-threatening. Furthermore, the oral cavity has historically been dissociated from the rest of the body when considering general health status. However, recent
research has highlighted that oral disorders have emotional and psycho-social consequences as serious as other disorders. In Canada, Locker (1992) reported that one-third of adults aged 50 years or older reported problems with eating, communication, and social interaction and 18.7% worried a great deal about their oral health. Almost one-third were dissatisfied with some aspect of their oral health status. In the early 1980s, Reisine (1985) used data from the 1981 US National Health Interview Survey to report that 4.87 million dental conditions had caused 17.7 million days of restricted activity, 6.73 million days of bed disability, and 7.05 million days of work loss in the USA. In Australia, Spencer and Lewis (1988) reported that 1.1 million work days were lost and 3.2 million days had reduced work activity levels as a result of dental disorders. It was also shown that the impact of oral disorders on Australian children was significant, with 646,000 days being lost from school in that year. Gift et al (1989) has reported comparable findings for school-aged children in the USA.

Collectively, the prevalence and recurrences of these impacts constitute a silent epidemic; further propagation of oral diseases can be quite devastating, leading to an unimaginable amount of pain, suffering and misery. These intangible factors have resulted in millions of hours of productivity loss in the work place, schools and homes.

1.2.2.2 General health impact

Tooth decay, gum disease and oral cancer can be prevented. Many of the principal factors that can lead to poor oral health are also risk factors for other major preventable diseases, including cardiovascular disease, cancer and diabetes (Sheiham and Watt, 2000). The common risk factors include inappropriate diet (diets high in sugary foods and drinks), smoking/use of tobacco and other carcinogenic substances, poor hygiene, injuries and excessive alcohol consumption (Sheiham and Watt, 2000).

Evidence of the interrelationship between general and oral health has increased in recent years, with several studies confirming the links between oral health and diabetes (Pihlstrom et al, 2005, Lamster et al, 2008), and some evidence for an association of poor oral health and cardiovascular disease (Mattila et al, 2005). Obesity, in addition, has been shown to be associated with poorer oral health (Lundin et al, 2004; Alabdulkarim et al, 2005). In a cohort study of adults from New Zealand, those who grew up in families with low socioeconomic status had worse cardiovascular health and a higher burden of periodontal disease and dental
caries, than did adults who were living in families with middle or high socioeconomic status during childhood (Poulton et al, 2002). As good oral health is integral to good general health and well-being, improvements in oral health should also result in improvements to the individual’s general health.

1.2.2.3 Financial impact

Oral disease also has a multifaceted impact on an individual’s health and well-being, with wide-ranging effects that result in high health services and personal costs. Oral disease, much of which is preventable, is one of the most costly diet-related diseases. Dental treatment is expensive for the individual and for the society as a whole. For example, dental caries and its sequelae can cause significant pain and are expensive to treat. The burden of dental caries lasts a lifetime because, once the tooth structure is destroyed, it will usually need restoration and additional maintenance throughout life. In developing countries, where the prevalence of dental caries is low and the disease tends to occur on the occlusal surfaces of a few teeth, the costs of treatment are higher than can be met by the funds available for essential public health programmes. Consequently, 90% of such lesions remain untreated (Robert and Sheiham, 2002). In Brunei, with a population of less than 400,000 people, the Department of Dental Services spent more than $10 million Brunei Dollars on oral health services for the 2007-2008 financial year. This accounts for 3.9% of the Ministry of Health’s budget (Department of Dental Services, 2008). In Australia, tooth decay is the second most costly diet-related disease with an economic impact comparable with that of heart disease and diabetes (Australian Institute of Health and Welfare¹). A comparison of Brunei’s dental expenditure with that of other selected countries is presented in Table 1.1.

Table 1.1 Comparison of dental expenditure to other selected countries

<table>
<thead>
<tr>
<th>Countries</th>
<th>Dental Expenditure (Million)</th>
<th>Population</th>
<th>Per capita expenditure</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>B$ 10</td>
<td>386,357</td>
<td>B$ 26</td>
<td>3.9% of health budget</td>
</tr>
<tr>
<td>(2007-08)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>England</td>
<td>£ 2081 (~ B$ 6,243)</td>
<td>50,763,000</td>
<td>£ 41 (~ B$ 123)</td>
<td>Budget increased by 11%</td>
</tr>
<tr>
<td>(2008-09)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>A$ 512 (~B$ 666)</td>
<td>20,549,100</td>
<td>A$ 24.91</td>
<td>5.7% of health budget</td>
</tr>
<tr>
<td>(2005-06)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>Total Health budget = RM$ 7,556</td>
<td>24,800,000</td>
<td>RM$ 17 (~B$ 8)</td>
<td>Health budget is 6.88% of National budget and 3.56% of GNP</td>
</tr>
<tr>
<td>(2003)</td>
<td>Dental services budget = 5.5% = RM$ 416 (~B$ 189)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Department of Dental Services, Brunei, 2008

Other indirect economic costs associated with oral diseases include negative effects on work productivity, days lost at work, schools and homes, and a greater financial burden on the community. Adulyanon et al (1996) in their study in Thailand showed that 74% of 35-44-year-olds had daily performances affected by their oral state, while 46% reported that their emotional stability was affected. In the USA, an estimated 51 million school hours are missed annually because of health problems affecting the mouth (Elliott, 2008). In Aboriginal children in Western Australia, dental caries is the fifth and sixth most common disease causing hospitalisation in pre-schoolchildren (aged 1-4 years) and primary schoolchildren (aged 5-12 years), respectively (Tennant et al, 2000). A summary of the impact of oral disease is presented below in Figure 1.1.
Pain and discomfort

Difficulty eating
Poor diet

Impact of general health, for example, nutritional status links to peptic ulcers and cardiovascular disease

ORAL DISEASE

Poor appearance
Low self-esteem
Poor quality of life

Health system costs
High cost of treatment for dental disease

General practitioner visits
Hospital admissions

Economic costs
Low productivity
Days lost at work and school
Increase burden to community

Figure 1.1 Impact of oral disease (Department of Human Services, Australia, 1999)
1.3 Oral Health-Related Quality of Life (OHRQoL)

Quality of Life (QoL) is defined as an individual’s perception of his or her position in life, in the context of the culture and value systems in which he/she lives, and in relation to his/her goals, expectations and concerns (WHOQOL, 1995). Health contributes to QoL, and the real impact of health and disease on QoL is known as health-related quality of life (HRQoL). HRQoL is one dimension of a wider concept of QoL (Bowling, 2005), and is defined in relation to optimum levels of mental, physical, role, and social functioning. It includes relationships, as well as perceptions of health, fitness, life satisfaction, and well-being (Bowling, 2001). In dentistry, the terms ‘HRQoL’ and ‘QoL’ are now in common use to describe the outcomes of oral health conditions and therapy for those conditions. In addition, there has been a proliferation of measures designed to quantify those outcomes. These measures, which were initially designated as socio-dental indicators or subjective oral health indicators are now more usually referred to as measures of oral health-related quality of life (OHRQoL).

1.3.1 Definition of OHRQoL

Dental professionals have used the term OHRQoL to describe the impact of oral health on a patient’s personal experiences. OHRQoL is an aspect of dental health addressing the patient’s self-perceived perception of whether his or her current oral health status has an impact upon his or her actual QoL (Cunningham and Hunt, 2001; Inglehart et al., 2002; Locker, 1988). Locker and Allen (2007) defined OHRQoL as the impact of oral disorders on aspects of every day life that are important to patients and persons, with those impacts being of sufficient magnitude, whether in terms of severity, frequency or duration, to affect an individual’s perception of their life overall. Although different studies have used different definitions for OHRQoL, the consensus emerging from the literature is that it has three main dimensions: physical symptoms, perception of well-being, and functional capacity (Chen and Hunter, 1996).
1.3.2 Conceptual framework for measuring oral health

Traditional clinical measures of oral health ignore the perceptions and feelings of the person and the effect of their mouth on them. Therefore, measures of oral health are needed which consider the impact of oral health and disease on everyday life (Sheiham et al, 1982; Locker, 1996; Sheiham and Spencer, 1997).

The first major contribution towards a model for OHRQoL was made by Locker (1988) (Figure 1.2), who abandoned the clinical focus and instead based his conceptual framework on the WHO's International Classification of Impairments, Disabilities, and Handicaps (1980). In this model, disease can lead to impairment, defined as any anatomical loss or abnormality; the loss of a tooth is an example. Impairment may then lead to functional limitation, described as a loss of body parts or systems (for example, difficulty in uttering particular sounds). Another consequence of impairment could be pain and discomfort, whether physical or psychological. Either of these may lead to physical, psychological or social disability, described as any limitation in or lack of ability to perform the activities of daily living. An example could be mispronunciation which caused a person to be misunderstood during conversation. A final consequence is handicap; this is the experience of disadvantage, such as in the situation where a person experiences difficulties in securing employment due to an inability to communicate effectively, or where social contact is minimised due to the embarrassment of complete denture wearing.

![Figure 1.2 Locker's model of oral health](image-url)

Figure 1.2 Locker's model of oral health
This model has a number of strengths. First, it identifies distinct areas of human experience relative to disease and illness; second, it is a multidimensional model and provides the basis for the development of a broad range of measures of oral health status; and third, its key concepts and the measures derived from them are linked in a linear sequence that moves from a biological to a behavioural to a social level of analysis (Locker and Miller, 1994).

Locker (2004) later pointed out that this model has no explicit link to QoL, and he recommended the adoption of a modification of the Wilson and Cleary (1995) model. The latter model incorporates the notion of QoL, and emphasises that it is a much broader concept than that of health. In this model, oral diseases and disorders result in oral symptoms, compromised physical and social functioning, and negative health perceptions which, in turn, are influenced by environmental and functional characteristics, and they impact on QoL (Figure 1.3).

![Figure 1.3 The Wilson and Cleary model](image-url)
1.3.3 Development of OHRQoL

About 35 years ago, Cohen and Jago (1976) identified a need for the development of a tool with appropriate socio-psychological (as well as clinical) content, and recommended the development of what they termed "sociodental indicators." In dentistry, the need for a comprehensive approach to study the social and psychological impact of oral disease was first realised in the mid-1980s, when Reisine (1985) used a battery of previously validated scales (the Sickness Impact Profile) to determine the impact of several common but serious dental conditions (for example, temporomandibular joint pain) on QoL. Those findings indicated that a number of patients were affected in their home, work, social, and leisure activities as a result of their dental conditions. However, that measure is a generic measure of health status, and may not be sensitive to all oral health problems. Since this early work, at least 14 dental questionnaires have been developed for use among adults, each with a specific number and range of questions that address mainly the negative impact of disease and ill-health (section 1.5 presents a brief overview of the adult oral-specific health status measures which are currently available).

1.3.4 Types of OHRQoL instrument

This section first discusses the differences between generic and specific measures, and then examines the differences between global and multi-item measures.

1.3.4.1 Generic vs. specific measures

HRQoL measures may be generic or specific. Generic HRQoL measures summarise a spectrum of domains and dimensions of health that apply equally and broadly to diverse conditions or populations, and they usually incorporate the domains of physical, mental, and social health. Generic HRQoL measures, however, are not designed to identify important disease-specific dimensions, which are often essential for the measurement of the outcome of a particular disease, or for detecting important clinical changes. Therefore, generic HRQoL measures may not be sufficiently responsive to show changes as a result of oral disease or dental intervention. In addition, generic HRQoL measures include a wide range of questions, some of which will be irrelevant, particularly in orthodontics where the patients are fit and well, with no physical deficit (Cunningham and Hunt, 2001).
In contrast, specific OHRQoL measures are designed for use in clinical situations. Their narrow focus means that they are potentially more responsive to small, but clinically important, changes in health (Cunningham and Hunt, 2001; Guyatt et al, 1993; Allen, 2003). As a result, their content validity is likely to be higher than that of generic measures (Slade and Spencer, 1994). Specific instruments may be divided into four types: (1) condition-specific, focusing on individuals with a particular disease or clinical condition; (2) domain-specific, focusing in detail on one dimension only, such as the psychological domain; (3) population-specific, focusing on subgroups of people such as older people or children; and (4) symptom-specific, focusing on one type of symptom, such as pain (Guyatt et al, 1993; Camilleri-Brennan and Steele, 1999). Of these, condition-specific instruments are the most commonly used specific measures to assess QoL (Cunningham and Hunt, 2001). The advantage of these instruments is that the emphasis is on a specific area of QoL, rather than on assessing QoL globally (Allen, 2003; Camilleri-Brennan and Steele, 1999).

In many situations, both generic and specific measures are of value and can be used in combination to facilitate the investigator’s ability to compare between populations (generic) and identify specific areas of problems for different patient groups (condition-specific). A comparison between generic and condition-specific measures is presented in Table 1.2.

### 1.3.4.2 Global vs. Multi-item measures

There are also two main types of OHRQoL instruments: (1) global (single-item) measures; and (2) multi-item measures (or scales). Each can be very useful. Single-question measures are known as global ratings. They ask either about current health (global ratings) or about current health relative to a previous occasion (global transition ratings). They have an advantage over multi-item measures in that they place a minimal demand on respondents’ time. The brevity of global questions is also their main disadvantage, however, as the summary answers do not provide information about specific aspects of health compromised by the disease/disorder (Jokovic et al, 2005). Consequently, it has been argued that they cannot be used for clinical decision-making purposes, such as in treatment and rehabilitation planning (Jokovic et al, 2005).

By contrast, multi-item measures comprise a number of specific, conceptually-related items which reflect the different dimensions of OHRQoL. Whether one or the other is used depends
on whether the researcher feels that the global item is a valid and reliable measure of the concept of interest, or whether it is felt that it is better to ask multiple questions about the various aspects of OHRQoL (Fayers and Machin, 2000). In fact, global and multi-item measures are often used together, as the former can serve as an important validity check for the latter, particularly where a newer measure is being used and there may be uncertainty about its properties. Whichever is used, it can be either self-administered, or administered by interview.

**Table 1.2** Comparison of generic and condition-specific measures (Cunningham and Hunt, 2001)

<table>
<thead>
<tr>
<th></th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generic</strong></td>
<td>Single instrument</td>
<td>May not focus adequately on area of interest</td>
</tr>
<tr>
<td></td>
<td>Comparison across different interventions or conditions is possible</td>
<td>May not be sufficiently responsive</td>
</tr>
<tr>
<td></td>
<td>May be useful when condition-specific measures are not available</td>
<td>Some questions will be irrelevant</td>
</tr>
<tr>
<td></td>
<td>Detects differential effects in different aspects of health status</td>
<td>Some generic instruments are excessively long</td>
</tr>
<tr>
<td><strong>Condition-specific</strong></td>
<td>Clinically sensible</td>
<td>Does not allow cross-condition comparisons</td>
</tr>
<tr>
<td></td>
<td>More responsive</td>
<td>May be limited in terms of populations and interventions</td>
</tr>
<tr>
<td></td>
<td>More acceptable to patients as they cover only relevant areas</td>
<td>Developmental process (reliability, validity testing) is time-consuming</td>
</tr>
<tr>
<td></td>
<td>Usually shorter than generic measures</td>
<td>More expensive to develop, administer and score</td>
</tr>
</tbody>
</table>
1.3.5 Uses of OHRQoL

OHRQoL measures can have political, theoretical and practical uses. Each of these will be discussed in turn.

1.3.5.1 Political application

The political application of OHRQoL measures is in advocating for the application of scarce resources towards oro-facial care and research (Slade and Spencer, 1994). In the public health context, resources for oral health care are diminishing at the same time as the availability of sophisticated treatment options is increasing (Slade and Spencer, 1994). The information provided by OHRQoL measures facilitates a greater understanding of how individuals perceive their oral health needs and what oral health conditions drive them to seek health care. Therefore, the description of health outcomes helps to draw attention to the importance of oral disease as part of general health.

1.3.5.2 Theoretical application

The theoretical application of OHRQoL measures involves enhancing understanding of the sociology and psychology of health and oral health-related behaviours. When assessing the outcomes of oral diseases and disorders of various kinds, OHRQoL measures have the advantage that they are multidimensional and consider symptoms, physical functioning, and emotional and social well-being (Locker, 1988). Consequently, they can be used to assess both the need for and outcomes of clinical and psychosocial interventions from the perspective of the individuals concerned. Individuals’ perceived impact of conditions has been identified as a motive for preventive and care-seeking behaviour, and identification of those perceptions should offer an opportunity to promote appropriate behaviours more effectively. As such, they have the potential to improve the quality of clinical and psychosocial care (Marcusson et al, 2001).

1.3.5.3 Practical application

The practical application of OHRQoL measures are perhaps the broadest and most exciting. They are used in describing and monitoring the health status of populations in oral health
surveys, and can be used in the evaluation of services' effectiveness, as well as in their economic evaluation. They can help to identify groups with poor oral health, and can pinpoint those conditions which have the greatest impact on OHRQoL, thus ensuring that scarce oral health resources can be used to maximum effect. They can be used in health promotion and needs assessment, and as outcome measures in clinical trials (Locker, 2004). They can also be used in clinical practice to monitor an individual patient's condition, to facilitate the decision-making process for a patient who is faced with choosing between various treatment options, and to simplify procedures for informed consent.

1.4 Cross-cultural adaptation of HRQoL instruments

There has been a world-wide increase in the demand for subjective measures of HRQoL in recent years, due to factors such as the rising burden of chronic diseases (for example, cancer), and the desire to measure the impact of different types of health interventions. However, most HRQoL measures were developed in English-speaking countries (Guillemin et al, 1993), but even within these countries, researchers must consider immigrant populations in studies of health, especially when their exclusion could lead to a systematic bias in studies of health care utilisation or QoL (Gonzalez-Calvo et al, 1997; Guillemin et al, 1993).

Therefore, in order to achieve accurate, cross-culturally comparable versions, formal methods of translation and adaptation need to be applied. The term "cross-cultural adaptation" is used to encompass a process that looks at both language (translation) and cultural adaptation issues in the process of preparing a questionnaire for use in another setting (Beaton et al, 2000). In other worlds, this process involves both linguistic translation where the measure is literally translated into the new language and cultural translation where it is adjusted appropriately for the cultural context, as well as an evaluation process to ensure comparability with the original tool. Several publications have outlined processes for achieving this cross-cultural adaptation. Guillemin et al published a report in 1993, in which recommendations were proposed based on their review of the literature. This was followed by two publications outlining guidelines for a comprehensive cross-cultural adaptation process (Beaton et al, 2000; Bullinger et al, 1998).
Although there is no universal agreement on how to adapt an instrument for use in another cultural setting, there is agreement that it is inappropriate to simply translate and use a questionnaire in another linguistic context (Guillemin et al., 1993; Herdman et al., 1998; Bullinger et al., 1998; Wang et al., 2006; Beaton et al., 2000). The cross-cultural adaptation of HRQoL instruments involves a series of steps that are undertaken by the researcher in order to ensure that an instrument that has been originally developed for one population (source) retains the same meaning and measures as the intended construct when it is used in a different population (target). This process consists of two phases, firstly, language translation, and secondly, cultural adaptation of the translated instrument to the target population. Each of these will be discussed in turn.

1.4.1 Translation guidelines and process

Generally, the cross-cultural adaptation process outlined in most of the published guidelines consists of a forward-backward translation of the instrument from the source language into the target language (Guillemin et al., 1993; Bullinger et al., 1998; Herdman et al., 1998; Beaton et al., 2000). The process of translating instruments into a new language includes: forward translation, synthesis, back-translation, and expert committee review.

Stage I: Forward translation
The first stage in translation process is the forward translation. Most of the guidelines recommend a minimum of two independent bilingual translators whose mother tongue is the target language, with a good understanding of the original language (Herdman et al., 1998; Beaton et al., 2000; Guillemin et al., 1993). The first translator should be aware of the concepts being examined in the questionnaire being translated, while the other translator should neither be aware nor informed of the concepts being quantified and preferably should have no medical or clinical background (Beaton et al., 2000). In this way, the translations can be compared and discrepancies that may reflect more ambiguous wording in the original or discrepancies in the translation process noted (Beaton et al., 2000).

Stage II: Synthesis of the translations (reconciliation stage)
The second stage is to synthesise the results of the translations by the two translators and a recording observer. This is sometimes referred to as the reconciliation stage. Working from the original questionnaire as well as the first translator and the second translator versions,
a synthesis of these translations is first conducted to produce one common translation (Beaton et al., 2000).

Stage III: Back-translation
This is a process of validity checking to make sure that the translated version is reflecting the same item content as the original versions (Beaton et al., 2000). Again, most of the guidelines recommend a minimum of two independent back-translators, with the source language (English) as their mother tongue (Herdman et al., 1998; Beaton et al., 2000; Guillemin et al., 1993). Both back-translators should have no prior knowledge of the measure, and should not see the source or any other language version before or during back-translation. The main reasons are to avoid information bias and to elicit unexpected meanings of the items in the translated questionnaire (Guillemin et al., 1993; Leplege and Verdier, 1995).

Stage IV: Expert Committee
The expert committee should comprise of methodologists, health professionals, language professionals, and the translators (forward and back-translators) (Herdman et al., 1998). The expert committee assesses if a word or several words reflect the same ideas or subjects in both the original and adapted versions of the questionnaire (Herdman et al., 1998; Beaton et al., 2000; Guillemin et al., 1993). This assessment ensures that items are translated correctly and are relevant in the new setting (Beaton et al., 2000; Guillemin et al., 1993; Wang et al., 2006). If there are uncertainties around the meaning of specific words or items, the developer of the original instrument can be contacted for clarifications (Herdman et al., 1998; Guillemin et al., 1993). It is also suggested to return to the target population and have experts in the field to discuss subtleties brought out by the various translation proposals (Beaton et al., 2000). The instrument should be adjusted accordingly after a consensus is reached (Beaton et al., 2000; Guillemin et al., 1993).

1.4.2 Cultural adaptation of HRQoL instruments

Once a consensus is reached in regards to the translated instruments, it should be adapted culturally to maintain the content validity of the translated instrument at a conceptual level across different cultures (Guillemin et al., 1993; Guyatt, 1993; Beaton et al., 2000; Herdman et al., 1997; Ferraz, 1997). This is to ensure that the impact of a disease (or its treatment) that is being measured by the instrument is described in a similar manner when international
comparisons are made. This cultural adaptation process of HRQoL instruments consists of two stages, firstly, pre-testing of the translated instrument, and secondly, psychometric evaluation of the translated instrument.

1.4.2.1 Pre-testing the translated instrument

The first stage in the cultural adaptation is pre-testing the translated instrument in the target population. This will indicate how well the instrument will perform in the field. Between 30 and 40 respondents are viewed as appropriate in the pre-test (Beaton et al., 2000). During the pre-test, respondents are probed for their understanding, and the acceptability and emotional impact of the items in order to detect confusing or misleading items (Beaton et al., 2000). Any difficulties in understanding of items or questions are noted and changes are made which are subsequently reviewed again before being finalised.

1.4.2.2 Psychometric evaluation of the translated instrument

Once a translated instrument has been developed, its measurement equivalence is determined by testing its psychometric properties. This is done through an epidemiological study of a selected sample from the target population. The performance of the translated instrument is usually assessed in terms of its reliability and validity. Streiner and Norman (2003) have suggested that it is necessary to test these as items are developed, and each time they are used to test new hypotheses. Assessing the reliability of HRQoL measures is relatively straightforward. Test-retest and internal consistency reliability are easily evaluated and involve few theoretical issues (Locker and Miller, 1994). However, assessing validity is always more difficult, since concurrent and construct validity involve theoretical as well as methodological problems (Locker and Miller, 1994). Validity is the extent to which self-report items measure what they purport to measure (Donovan et al., 1993). The validity of HRQoL measures is best determined through examining their construct validity, discriminant validity, content validity and criterion validity. Each will be briefly discussed.

*Construct validity*

Construct validity reflects how well the instrument projects the theory on which its questions are based (Streiner and Norman, 2003). Construct validity can be assessed by comparing the overall score from an instrument with the response to a single question addressing a global
assessment of oral health. For example, construct validity is claimed when there are significant and consistent associations between the overall score from an instrument and the global ratings of oral health and oral health well-being (McGrath and Bedi, 2001).

**Discriminant validity**

Discriminant validity (which is another expression of construct validity) addresses the ability of an instrument to discriminate among groups of individuals known to differ in terms of function and well-being. Quite simply, people respond to the same phenomena in different ways if the context in which they experienced it changes or if they modify their understandings of the phenomena (Pescosolido, 1992).

**Content validity**

Content validity concerns inferences that may be drawn from item findings; that is, whether items measure what they set out to (Donovan et al., 1993). It reflects the clarity, comprehensiveness and relevance of the questions in the instrument (Rubio et al., 2003; McGrath and Bedi, 2001). Content validity can also be referred to as logical validity when experts deem the questions to be logically sound, or as face validity when questions reflect appropriately the supporting theory (Tsakos et al., 2001). More broadly, content validity can denote the scope or range of the instrument’s questions: do they include all important and relevant domains?

**Criterion validity**

Criterion validity refers to the agreement between a measure and a gold standard. However, since there is no gold standard of adult OHRQoL measure exists, well-established measures such as the Oral Health Impact Profile-14 (OHIP-14) and the Oral Impacts on Daily Performances (OIDP) can be used for comparison purposes (Anastasi and Urbina, 1997; Streiner and Norman, 2003; Bland and Altman, 1999). On the other hand, Locker (2001) suggested that a global self-rating of oral health can be used as a proxy gold standard because it is simple and yet a powerful measure of oral health (How would you describe the health of your teeth or mouth?). As for children, global ratings of the child’s oral health and the extent to which the oral/oro-facial condition affected his/her overall well-being can be used as a proxy gold standard (Jokovic et al., 2002). These questions are worded, respectively, as follows: "Would you say that the health of your teeth, lips, jaws and mouth is..." and "How
much does the condition of your teeth, lips, jaws or mouth affect your life overall? (This will be discussed more fully in Section 1.8.2).

In summary, cross-cultural adaptation is necessary when the instrument is intended for use on a target population that is culturally different from that of the original version. However, HRQoL instruments developed for use in one country cannot just be translated into another language; rather, for a questionnaire to be relevant and appropriate in a different setting, cultural adaptation is needed. It involves a series of steps in order to ensure consistency in the content and face validity between source and target versions of a questionnaire. The cross-cultural adaptation process also allows data collection efforts to be the same in cross-national studies or to avoid the selection bias that may be associated with studies that must exclude all patients who were unable to complete a form in English, for example, because there are no translated versions of the questionnaire.

1.5 Adult measures – Brief Overview

Several OHRQoL measures have been developed and validated for use among adults (Table 1.3). Most of these grew out of studies that focused on the impact of caries, periodontal disease, and tooth loss and replacement among older adults. They are being used with increasing frequency in oral health surveys and clinical trials to complement clinical indicators in order to obtain a comprehensive account of treatment needs and outcomes. Although these measures are similar with respect to their conceptual basis, they differ in length, the health domains they address, and in the complexity of their scoring mechanisms (Locker et al, 2004). Each instrument has a specific focus and level of sensitivity and the appropriate choice needs careful thought.
**Table 1.3** Examples of currently available oral specific health status measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Authors</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Impacts of Dental Disease (SIDD)</td>
<td>Cushing et al, 1986</td>
<td>14</td>
</tr>
<tr>
<td>Rand Dental Health Index</td>
<td>Gooch &amp; Dolan, 1989</td>
<td>3</td>
</tr>
<tr>
<td>Sickness Impact Profile (SIP)</td>
<td>Reisine et al, 1989</td>
<td>73</td>
</tr>
<tr>
<td>General Oral Health Assessment Index (GOHAI)</td>
<td>Atchison &amp; Dolan, 1990</td>
<td>12</td>
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The following subheadings briefly discuss the three most commonly used adult OHRQoL measures; namely, the Oral Health Impact Profile (OHIP), the Oral Impacts on Daily Performances (OIDP), and the General Oral Health Assessment Index (GOHAI).

### 1.5.1 The Oral Health Impact Profile (OHIP)

The Oral Health Impact Profile (OHIP) is one of the most comprehensive instruments available. The OHIP was developed and evaluated in Australia by Slade and Spencer (1994).
It consists of 49 items that are subdivided into the seven domains of functional limitation, physical discomfort, psychological discomfort, physical disability, psychological disability, social disability and handicap. These conceptual domains were derived and based on the oral health model described by Locker (1988), and items were derived from qualitative interviews with patients suffering from a wide variety of oral disorders. In the original derivation of the instruments, items were weighted using data collected among older people in Australia (Slade and Spencer, 1994; Slade, 1997). Subsequent investigation has shown that the item weights provided only limited benefits over an unweighted scoring system in a sample of older people in Canada (Allen and Locker, 1997), and most researchers now do not use the item weights.

1.5.2 The Oral Impacts on Daily Performances (OIDP)

The Oral Impacts on Daily Performances (OIDP) was developed and evaluated in Thailand by Adulyanon and Sheiham (1997). It measures impacts on eight daily performances at the functional level of Locker’s interpretation of the WHO model of health. The eight performances are: eating and enjoying food; speaking and pronouncing; cleaning teeth; sleeping and relaxing; smiling; laughing and showing teeth without embarrassment; maintaining usual emotional state; carrying out major work or social role, and enjoying contact with people.

Although both the OHIP and OIDP were derived from the same theoretical framework (WHO, 1980; Locker, 1988), the OHIP assesses oral impacts at all levels of this model (Slade, 1997), whereas the OIDP only assesses oral impacts on the disability and handicap levels (Adulyanon and Sheiham, 1997). In this regard, it has been claimed that the OIDP was designed to assess only ultimate oral impacts because evaluating impacts on the whole spectrum of the theoretical framework may be redundant and cause double-scoring of the same impacts at different levels, thereby overestimating the real magnitude of impacts of oral conditions on QoL (Adulyanon and Sheiham, 1997; Sheiham et al, 2001). The scoring systems used in the OHIP and OIDP also differ: whereas the OHIP assesses only the frequency of oral impacts on QoL, the OIDP assesses both the frequency and the severity of such oral impacts.
1.5.3 The General Oral Health Assessment Index (GOHAI)

The General Oral Health Assessment Index (GOHAI) was developed by Atchison and Dolan (1990) and used in North America for elderly patients. It consists of 12 statements covering a range of adverse effects ranging from functional disorders through to the social consequences of those disorders. It was developed to evaluate the following three dimensions of OHRQoL: (1) physical function, including eating, speech and swallowing; (2) psychosocial function, including worry or concern about oral health, dissatisfaction with appearance, self-consciousness about oral health and avoidance of social contacts because of oral problems; and (3) pain or discomfort, including the use of medication to relieve pain or discomfort from the mouth (Atchison, 1997).

1.5.4 Short-form measures

With most OHRQoL measures being originally developed as long questionnaires, the length and therefore the time involved in completing such questionnaires was not entirely practical for use in clinical or epidemiological studies. Locker and Allen (2002) identified four reasons as to why a long measure may need to be shortened: (1) a measure that takes long time to complete and score may not be feasible in clinical settings; (2) a long questionnaire increases the cost of administration and data management; (3) respondent burden may mean that it cannot be used in studies of some segments of the population, such as frail older people; and (4) item nonresponse is higher with long questionnaires and may lead to a loss of a substantial proportion of cases or problems arising from the necessity to impute missing data or to exclude cases with missing data (leading to a loss of both information and statistical power).

For these reasons, efforts have been made to shorten some existing measures while retaining such important psychometric properties as reliability and precision. The most notable example of this was Slade’s development of the short-form OHIP (Slade, 1997). This has 14 items which correspond to the 7 domains which are represented in the original 49-item OHIP, and there are two items per domain. The short-form measure has been shown to have acceptable validity and reliability (Slade, 1997; Allen and Locker, 2002), and has now been validated in a number of different cultures and age groups, including adolescents (Broder et al, 2000) and young adults (Thomson et al, 2006).
1.6 Children’s Oral Health-Related Quality of Life (COHRQoL)

Although there has been a marked increase in the development and use of OHRQoL measures in the past two decades, most have been developed for use in adults. The importance of assessing OHRQoL in children has been highlighted (McGrath et al., 2004), but very few studies have been conducted on child populations. Children are affected by numerous oral and oro-facial disorders, all of which have the potential to compromise functioning, well-being, and QoL. It is unlikely that any of the adult measures are suitable for children, given their conceptual basis and content (Johnson, 1991). Since children are the prime target group of oral healthcare services in many countries, and they represent the major focus of dental public health research and practice, measures of OHRQoL applicable to this population group are essential.

1.6.1 Implications of assessing COHRQoL

A child’s oral health can impact on eating, smiling, speaking and socialising. Oral conditions such as dental caries may result in pain which, in turn, may lead to consequences for a child’s daily life such as taking time off from school or having difficulty in eating. Facial appearance and its relation to body image, self-esteem and emotional well-being also play important roles in social interaction. Therefore, assessing the impact of oral health on the life quality of children has implications on many fronts. It has been pointed out that COHRQoL assessments reflect patients’ perceptions (children’s own feelings) about their oral health and thereby can improve communication between patients, parents and the dental team (Weintraub, 1998). Moreover, it can provide a measure of outcomes for clinicians in assessing the quality and outcome of care. Measuring oral impacts in children is particularly relevant, as it will aid researchers and policymakers in assessing need, prioritising care and evaluating treatment outcomes (Sheiham et al., 1982). Furthermore, children do not live in isolation; children’s oral condition may affect their parents. For example, dental caries can lead to toothache, which can be distressful and worrying for the affected children, which in turn may lead to consequences on their parents such as taking time off from work to bring their children to the dental clinics. Conversely, good oral health can have positive benefits for children and their parents. Studies using the life-course approach have highlighted that dental conditions have wider repercussions not only for the present but also in adulthood (Reisine, 1985). These issues have stimulated current interest in COHRQoL.
1.6.2 Challenges in developing COHRQoL measures

There are numerous methodological and conceptual problems to face in developing COHRQoL measures. For example, children’s understanding of illness and health is age-dependent, due to social, language, emotional, and cognitive development (Pal, 1996). At the same time, important physiological changes are taking place: the dentition is changing; teeth are erupting; and the jaws are growing (Gherunpong et al., 2004a; Pal, 1996). These occur at certain stages of life and, hence, measuring and comparing these changes at different ages may be difficult.

Measuring OHRQoL in children by means of questionnaires is associated with several challenges because of variation in the children’s ability to read, or to think in abstract terms, and so their age-related ability to understand the concepts used in the questionnaire should be taken into account (McGrath et al., 2004; Locker et al., 2007). Furthermore, children’s cognitive development varies such that the wording of items, specific dimensions and their relevance and meaning to children of similar ages can differ, and the changes in a child over time can make repeated measurements difficult to compare (Eiser et al., 2000). Therefore, OHRQoL measures for children should be different from those for adults or older people. They need to suit children’s capability and interests. This may be why there have been very few OHRQoL studies in children, while many more have been carried out in adults and older people.

1.6.3 Modes of administration

When considering the mode of administration of a child QoL measure, a number of issues need to be addressed, as a balance between maximising compliance and reducing costs often needs to be made. Modes of administration of OHRQoL instruments include self-completion questionnaires, face-to-face interview, telephone interview, and parent/guardian responders, if the child is unable to answer the questions him- or herself for any reason (Guyatt et al., 1993). The most popular method is, almost without exception, the patient-completed questionnaire. A self-complete questionnaire is the most cost-effective method of administration, but it may be more suitable for older children. Response rates tend to be lower than with other approaches, but administration costs are minimised and questionnaires can be mailed by the investigators. Face-to-face interviews can be used for younger children where their ability to
concentrate on the questionnaire is limited or understanding of some of the questions may require assistance. This is more costly but compliance is higher. It is, of course, essential to minimise any further interpretation of the questions by the interviewers at the time, and inter-examiner reliability should be assessed. Telephone interviewing is less costly than face-to-face interview administration and achieves a higher compliance rate than self-completed questionnaires; however, validity issues may arise, particularly when they are used with younger children (Jenny and Campbell, 1997). Hence, there should be a balance between being as comprehensive as possible, and yet ensuring that a measure is sufficiently succinct so that the instrument can be practically administered.

1.6.4 Parent vs. Child reports

One issue with respect to measuring the OHRQoL of children which continues to receive a great deal of attention is that of parent reports versus those from the child. In general, the preferable source of health status information is the child, provided that reliable and valid data can be obtained (Hays et al., 1995). However, children are often considered unreliable respondents and, until recently, proxy ratings were preferred. This was based on concerns that children’s reports of their health and QoL would not meet accepted psychometric standards of validity and reliability, because of limitations in their cognitive capacities and communication skills (Theunissen et al., 1998). However, this approach is not free from limitations, especially in relation to its accuracy. There is evidence to suggest that proxy responses by parents correlate poorly with the perceptions of the child they are representing (Achenbach et al., 1987; Fink, 1989; Pantell and Lewis, 1987). In general, parents underestimate the impact of oral conditions on their children’s emotional and social QoL. However, there is greater agreement between parents and children in observable aspects of QoL, such as physical functioning (Marshman and Robinson, 2007). Moreover, concerns have been raised about the accuracy of parental assessments, particularly with respect to older children. Corresponding with this suggestion, one study (Jokovic et al., 2004a) found that parents had more knowledge about younger children than older children. This reflects the fact that, as children get older, they spend more time away from parental supervision and share their experiences with parents to a lesser extent.

It is now well recognised that, with appropriate questionnaire techniques, valid and reliable information can be obtained from children. Children and parents do not necessarily share
similar views about OHRQoL. Jokovic et al (2002) showed that the impact of child oral and oro-facial conditions on functional and psychosocial well-being is substantial and that children aged 11-14 years were able to give psychometrically acceptable accounts of that impact. Thus, children should be the primary source of information regarding their OHRQoL (Gherunpong et al, 2004a; Ronen et al, 2003; Jokovic et al, 2003b), at least at that age. Nevertheless, there is still value in obtaining parent/caregiver reports. Although parents' reports may be incomplete due to lack of knowledge about certain experiences, they still provide useful information. Parsons et al (1999) have suggested that parents/caregivers are often the principal decision makers with respect to a child's health and so their perceptions can have a major influence on treatment choices. Furthermore, healthcare often provides for parents' needs rather than those of children. Whether measurement in children is possible will depend on the child's age and level of development. In very young children, QoL measurements can be based only on proxy reports (usually from parents). With regard to primary schoolchildren, however, parents' reports might become less accurate as the child gets older and becomes more independent. The child's own report will tend to be more accurate. Thus, proxy reports do not represent the reality experienced by the child, but they can supplement or complement the children's evaluation, and useful information may be lost if parental reports are not obtained in addition to those provided by their children.

1.6.5 Effects of clinical oral health status on COHRQoL

It is useful to gain insight into the effects of oral conditions on children's daily lives, as they may not only limit children's current functioning, but also compromise their future development and achievements. Oral diseases and disorders during childhood can have a negative impact on the life of children and their parents. The resulting pain, infection, functional restrictions and embarrassment about appearance may not only have an adverse effect on these children's school performance, but also on their social relationships, emotional well-being and, very importantly, on their disease management.

1.6.5.1 Dental caries and COHRQoL

Dental caries is the most common chronic disease of childhood. The World Health Organization has estimated that 60-90% of all school-age children are affected (WHO, 2002). Most outcome measures in dental healthcare have been associated with the clinical approach
to oral health by equating health with absence of disease. For the disease of dental caries, the composite decayed, missing and filled teeth (DMF) index (Klein and Palmer, 1938) was introduced in 1938 and has been used widely as the major outcome measure of dental health. However, the DMF index has been criticised because it ignores changes in quality (that is, changes associated with the individual’s perceived functional and psychosocial impacts of the disease).

The effect of dental caries on the overall quality of health and well-being has not been well studied. The disease can lead to toothache, which can be distressful and worrying for the affected children and their parents. Foster Page et al (2005) found that children with greater dental caries experience had higher impacts on their QoL, suggesting they are likely to have experienced more oral pain, had difficulties with chewing, have been worried or upset about their mouths or to have missed school due to their cumulative disease experience; this shows an indirect effect of clinical signs on daily functioning via reported symptom status, as predicted by Wilson and Cleary (1995). In the USA, Canada, and the UK, for example, there is evidence that early childhood caries greatly affects COHRQoL (Fejerskov and Manji, 1990; Filstrup et al, 2003; Low et al, 1999). On the other hand, Malden et al (2008) found that the provision of dental treatment under general anaesthetic for young children with severe dental caries experience is associated with substantial and highly significant improvements in both their OHRQoL and in the impact on their families.

1.6.5.2 Malocclusion and COHRQoL

The oro-facial region is usually an area of significant concern for the individual because it draws the most attention from other people in interpersonal interactions and is the primary source of vocal, physical, and emotional communication. As a result, patients who seek orthodontic treatment are concerned with improving their appearance and social acceptance, and this is often more than they are with improving their oral function or health. Orthodontic treatment is different to most other medical interventions in that it aims to correct variation from an arbitrary norm (O’Brien et al, 1998). Research into the outcomes of orthodontic treatment has tended to concentrate on traditional indices and measurements (for example, cephalometric measures before and after treatment) or measures of morbidity (for example, root resorption following treatment). Unfortunately, these outcome measures reflect only the professional viewpoint, and not that of the patient. Such measurements have also been
criticised because they are not always relevant to patients’ functional or social requirements. These clinical indicators are still of importance, however, but they require supplementation with OHRQoL measures. There are two main reasons for this: first, the OHRQoL outcome does not necessarily correlate with objective findings; second, patients’ ratings of the outcome may not correlate with those of clinicians (Bennett and Phillips, 1999). It is for these reasons that self-report OHRQoL instruments should be used, as it is then the patient’s own views and feelings which are being measured.

In 1976, when sociodental outcomes were being adopted to evaluate the impact of oral problems on people’s lives, Cohen and Jago (1976) pointed out that, among all oral disorders, malocclusions are the most difficult to measure. Essentially, this is because the diagnosis implies considerations that involve both professional view regarding deviations from “normal” occlusion and cultural values that influence body image and aesthetic knowledge. O’Brien et al (1998) considered the rationale for HRQoL assessment in orthodontics and noted that the majority of measures which have been developed in the field of dentistry are not applicable to orthodontic patients, primarily because most orthodontic conditions are asymptomatic and relate to aesthetics, rather than features such as pain or discomfort. Furthermore, given that many orthodontic patients are children or young adolescents, there may be some potential barriers to the use of OHRQoL measures. This is particularly so with generic measures that may be lengthy, unduly complex and contain items which appear irrelevant to the respondent. For these reasons, the greater use of condition-specific measures with a small number of relevant items should be pursued. The issue is further complicated by the fact that most treatment is undertaken during adolescence when the individual is undergoing major life changes anyway, and it is difficult to identify which changes are solely due to the orthodontic treatment (O’Brien et al, 1998).

There has been limited research into the use of OHRQoL measures in individuals with malocclusion. One cross-sectional study was conducted in Brazil using the Oral Impacts on Daily Performance (OIDP) scale and the shortened version of the Oral Health Impact Profile (OHIP-14) (de Oliveira and Sheiham, 2003). This showed that adolescents (15-16-year-olds) who had completed orthodontic treatment reported fewer oral health impacts on their daily life activities than those currently under treatment or those who had never had treatment. Considering the categories of malocclusion severity, Foster Page et al (2005) observed a distinct gradient in the mean of emotional and social well-being domain scores, whereby
those in the most severe category had the highest scores and those in the least severe category had the lowest ones, on average. Similarly, Kok et al (2004) and O'Brien et al (2007) found statistically significant differences between malocclusion and non-malocclusion groups, but only for the emotional and social well-being health domains. Furthermore, difficulty with smiling due to the position of the teeth has been found to be one of the most important COHRQoL impacts (Gherunpong et al, 2004b). These findings suggest that the most significant impact of malocclusion on QoL is psychosocial, rather than influencing oral health through oral or functional problems.

1.6.5.3 Periodontal problems and COHRQoL

Periodontal problems were the other important oral conditions affecting COHRQoL, as shown by Gherunpong et al (2004b), where more than one-fifth of children perceived that bleeding and swollen gums caused impacts on their life, particularly in relation to difficulty cleaning, a problem experienced by nearly half of all children. Moreover, children who had difficulty with cleaning their teeth because of gum inflammation are unlikely to achieve good levels of oral hygiene, because brushing may lead to bleeding, and their gum problems would undoubtedly persist or even get worse.

In summary, oral disease and conditions produce many symptoms among children that give rise to physical, social and psychological effects that influence their day-to-day living or life quality. Therefore, assessing the impact of the mouth and teeth on QoL is especially important in children as oral health status can affect their growth, weight, socialising, self-esteem, and learning abilities. However, measuring COHRQoL is associated with several challenges, not only because of the different development stages children go through, but also because children's oro- and craniofacial features grow and change constantly. Another important issue is whether reliable and valid data can best be obtained from children themselves or from their parents. However, several COHRQoL measures have now been developed which indicate that, with appropriate questionnaire techniques, valid and reliable information can be obtained from children.
1.7 Children’s measures – Overview

The only measures currently available for children are the Child-Oral Impacts on Daily Performances (Child-OIDP), the Child Oral Health Impact Profile (COHIP) and the Child Oral Health Quality of Life (COHQOL). Each will be described.

1.7.1 The Child-Oral Impacts on Daily Performances (Child-OIDP)

The Child-OIDP was developed and evaluated in Thailand by Gherunpong et al (2004a), who adapted the original OIDP developed for adults (Adulyanon and Sheiham, 1997) for use in children. The Child-OIDP was developed on a large population-based sample with the aim of being used for dental health service planning. Its theoretical framework is the same as for the original OIDP, and it attempts to quantify the relative frequency of the impact of oral problems on eight daily tasks (namely, eating and enjoying food, speaking and pronouncing clearly, cleaning teeth, smiling, sleeping, laughing and showing teeth without embarrassment, maintaining usual emotional state without being irritable, and carrying out major work or social roles and enjoying contact with other people). It assesses the ability to perform daily activities, thus reflecting the ultimate outcomes of the WHO model. However, the Child-OIDP is different from the original OIDP in terms of the sequence of the questions and the Likert type scales of severity and frequency, and the reference period has been shortened to the previous 3 months, as opposed to the 6 months used in the adult measure. The calculation of the index involves the multiplication of the severity and frequency scores for each performance. A sum is made of the values obtained for the eight performances, resulting in a range from 0 to 72; this is then divided by 72 and multiplied by 100, so that the final Child-OIDP score can range from 0 to 100.

1.7.2 The Child Oral Health Impact Profile (COHIP)

The generic Child Oral Health Impact Profile (COHIP) was developed and evaluated in the United States by Broder et al (2007). It was developed to measure OHRQoL in children: parallel forms of the COHIP exist for the child and caregiver, respectively. It was designed to be used with a broad age range (8-15 years) across oral conditions, and to include positive (for example, confidence and attractiveness) as well as negative aspects of OHRQoL. The COHIP consists of 34 items forming five conceptually distinct subscales: (1) Oral health is
composed of specific oral symptoms that are not necessarily related to one another (for example, pain and spots on teeth); (2) Functional well-being includes items related to the child's ability to carry out specific everyday tasks or activities (for example, speaking clearly and chewing); (3) Social-emotional well-being pertains to peer interactions and mood states; (4) School environment incorporates items pertaining to tasks associated with the school environment; and (5) Self-image addresses positive feelings about self (Broder et al., 2007). All questions ask about the description of the child’s teeth, mouth or face in the previous 3 months. Scores can range from 0-136 for the overall scale. Subscales scores are calculated by summing the responses of the items specific to the subscale. The overall OHRQoL score is computed by summing the subscale scores.

1.7.3 The Child Oral Health Quality of Life (COHQOL®)

The generic Child Oral Health Quality of Life (COHQOL®) was developed and evaluated in Toronto by Jokovic et al. (2002). It was designed for use with children and young people with a range of oral and oro-facial conditions including caries, malocclusions and clefts. Currently, it is the most widely used measure of OHRQoL in children. The COHQOL® is a set of multidimensional scales measuring the negative effects that oral and oro-facial diseases and disorders may have on the well-being of 6-14-year-old children and their families.

The COHQOL® consists of Parental-Caregiver Perceptions Questionnaire (P-CPQ), Family Impact Scale (FIS) and Child Perceptions Questionnaires (CPQ). Each will be briefly discussed.

1.7.3.1 The Parental-Caregiver Perceptions Questionnaire (P-CPQ)

The Parental-Caregiver Perceptions Questionnaire (P-CPQ) is an instrument that assesses a parent's or a caregiver's perceptions regarding the impact of children's oral health status on QoL (Jokovic et al., 2003b). The measure is not intended to be a classic proxy measure (that is, a substitute for children's own reports of their oral health and well-being). Rather, it is intended to supplement the information obtained from children with the conditions of interest. The main rationale for developing such a questionnaire is that parents/caregivers are intimately involved in the health and healthcare of their children and that the treatment of children's health problems is as likely to be influenced by parental perceptions of a child's...
needs as it is by the needs of the child (Jokovic et al, 2003b). It has 31 items distributed across 4 subscales: oral symptoms (6 items), functional limitations (8 items), emotional well-being (7 items), and social well-being (10 items). The questions refer only to the frequency of events in the previous 3 months. Global ratings of the child’s oral health and impact of the oral condition on his or her overall well-being were also obtained from the parents/caregivers.

### 1.7.3.2 The Family Impact Scale (FIS)

The Family Impact Scale (FIS) is a scale that assesses a parent’s or a caregiver’s perception of the effect of oral disorders on family functioning (Locker et al, 2002). It consists of 14 items that attempt to capture the effect of a child’s oral or oro-facial condition on parental and family activities, parental emotions, family conflict and family finances. There are a number of reasons why the FIS is an essential component of a COHQOL© measure (Rothman et al, 1991). These are: (1) the central role played by the family in child health; (2) the likelihood that chronic illness in a child will impact on the family to some degree; (3) the fact that healthcare interventions often address parental needs and concerns as well as the child; and (4) the fact that parental reports of a child’s health may be influenced by the degree to which the parent is physically or emotionally affected by the child’s condition.

### 1.7.3.3 The Child Perceptions Questionnaires (CPQ)

The Child Perceptions Questionnaires (CPQ) measure children’s perceptions of their OHRQoL. It has slightly different questions in the forms designed for children 8 to 10 years of age (CPQ8-10), and 11 to 14 years of age (CPQ11-14), and these assess impact from the child’s perspective (Jokovic et al, 2002; Jokovic et al, 2004b). These measures will be described further in Section 1.8.

Overall, efforts have been made to develop a measure of OHRQoL that would be appropriate for use in children. Such measures required attention to developmental issues such as abstract thinking and readability, as well as to goals set by the WHO definition of health. Therefore, different questionnaires have been developed for specific age categories. To date, the only published OHRQoL measures for school-age children are the Child-OIDP, the COHIP and the COHQOL©. They are usually based on self-administered questionnaires or self-reported interviews, and are sometimes accompanied by questionnaires for parents/caregivers.
1.8 The Child Perceptions Questionnaire (CPQ)

The Child Perceptions Questionnaire (CPQ) is a component of the COHQOL© and was developed in Toronto to collect OHRQoL data directly from children themselves (Jokovic et al, 2002; Jokovic et al, 2004b). Two questionnaires were designed for use among children aged 8-10 years (CPQ$_{8-10}$) and 11-14 years (CPQ$_{11-14}$). Age-specific questionnaires are required, as these age groups differ from each other but are relatively homogenous in terms of cognitive development (Jokovic et al, 2002).

1.8.1 The long-form CPQ$_{8-10}$

The CPQ$_{8-10}$ was designed to suit the cognitive ability of 8-10-year-old children. Rebok et al (2001) stated that children as young as 8 to 10 years old were found to almost universally understand the nature of tasks and basic terms presented to them. The CPQ$_{8-10}$ consists of 25 items organised into 4 health domains: oral symptoms, functional limitations, emotional and social well-being. It uses a four-week recall period, which is said to further enhance the performance of the instrument (Jokovic et al, 2004b). Humphris et al (2005) examined the reliability and construct validity of the CPQ$_{8-10}$ among a convenience sample of schoolchildren and found acceptable internal consistency reliability (Cronbach’s alpha = 0.88) and significant associations between scale scores, a measure of self-esteem and a single question on the extent to which the mouth was a problem. However, Do and Spencer (2005) found that there was evidence that some young children had a tendency to use extreme responses, that is, floor or ceiling effect. The term floor effect refers to when data cannot take on a value lower than some particular number, whereas the term ceiling effect is precisely the opposite (Everitt, 2002). In other words, floor and ceiling effects refer to the lowest and the highest possible scores, respectively.

1.8.2 The long-form CPQ$_{11-14}$

The CPQ$_{11-14}$ is a specific questionnaire for assessing the impact of oral health conditions on the quality of life of 11-14-year-old children. It is a self-administered questionnaire composed of 37 items enquiring about impacts on four health domains: oral symptoms ($n = 6$), functional limitations ($n = 9$), emotional well-being ($n = 9$) and social well-being ($n = 13$) (Jokovic et al, 2002). All questions ask about the frequency of events in the previous 3
months in relation to the child’s oral/oro-facial conditions; for example: In the past 3 months, how often have you had: trouble sleeping; felt unsure of yourself; missed school; been teased or called names by other children; avoided taking part in activities like sports, clubs, trips because of your teeth, lips, jaws or mouth? The response options and associated response codes are: (0) never, (1) once/twice, (2) sometimes, (3) often, and (4) every day/almost every day (Jokovic et al., 2002). Summing the response codes for all items generates an overall CPQ11-14 score and scores for each domain can also be determined. Lower domain scores indicate better OHRQoL. The full questionnaire is presented in Appendix 6.

The CPQ11-14 also contains global ratings of the child’s oral health and the extent to which the oral/oro-facial condition affects his/her overall well-being. They precede the multi-item scales in the questionnaire. Global ratings are widely used in health service research, and there is evidence that, not only do they provide a summary of how people perceive their health, they can be as useful as multi-item scales (Jokovic et al., 2005). A global rating saves time for both respondents and investigators. There is also research indicating the potential of such measures as predictors of the use of health services, survival and functional decline (Wilson and Cleary, 1995). However, the disadvantage with single-item measures is that the summary answers do not provide information about aspects of health compromised by the disease and consequently cannot be used for treatment and rehabilitation planning (Jokovic et al., 2005). These questions are worded as follows: Would you say that the health of your teeth, lips, jaws, and mouth is? and How much does the condition of your teeth, lips, jaws or mouth affect your life overall? These global ratings have a five-point response format. The responses are scored as follows: for global rating of oral health, (0) excellent, (1) very good, (2) good, (3) fair, and (4) poor; and for overall well-being, (0) not at all, (1) very little, (2) somewhat, (3) a lot, and (4) very much (Jokovic et al., 2002).

1.8.2.1 Development of the long-form CPQ11-14

The CPQ11-14 was designed using a process recommended by Juniper et al. (1996) and Guyatt et al. (1986) in order to ensure that the final questionnaire contained items which were of the greatest relevance to children with oral and oro-facial conditions. Participants in both the development and evaluation of the CPQ11-14 were children with dental caries (a paediatric
dentistry group), malocclusions (an orthodontic group) or clefts of the lip and/or palate (an oro-facial group).

First, a preliminary pool of items was developed by a review of existing patient-based oral health and child health outcome measures. The relevance, clarity and comprehensiveness of these items were assessed in a face and content validity study by an expert panel composed of health professionals who treat children with oral and oro-facial disorders and parents of child patients with these conditions. Based on their comments, a modified item pool was developed and then revised further, following in-depth interviews with 11 child patients. Items for the final questionnaire were selected using an item impact study. This identified the items of greatest importance to the patient population in question. Eighty-three children attending oro-facial, paediatric and orthodontic clinics were asked whether, in the past 3 months, they had experienced the problem described in each item; they were then asked to rate how important this problem was on a 5-point scale (does not bother me at all = 0 to bothers me very much = 4). For each item, an impact score was calculated by multiplying the percentage of children who had experienced the problem by that item’s mean importance rating. Items were assembled into four health domains and were then selected based on their ranking within these domains (Jokovic et al, 2002). Those which were rated the most frequent and bothersome were selected for the final questionnaire. The development process for the long-form CPQ11-14 is presented in Figure 1.4.
Figure 1.4 Development of the long-form CPQ11-14 questions (Jokovic et al, 2006)

1.8.3 The short-form CPQ11-14

As this 37-item questionnaire was considered long, shorter forms were developed to facilitate its use in clinical settings and population-based oral health surveys (Jokovic et al, 2006). A short-form version would broaden its application, by reducing the burden on participants and the time and financial costs of data collection, and decreasing the likelihood of unit or item non-response. The CPQ11-14 was shortened to 16 and 8 items by using the item-impact method (that resulted in the short-forms CPQ11-14-ISF16 and CPQ11-14-ISF8, respectively) and stepwise regression method (that resulted in the short-forms CPQ11-14-RSF16 and CPQ11-14-RSF8, respectively) using data collected during the development of the long-form CPQ11-14. The CPQ11-14-ISF16 and CPQ11-14-RSF16 are very similar, as they share 14 of their 16 items. The questions specific to the CPQ11-14-ISF16 concern temperature sensitivity and being asked about the condition of the teeth/mouth, while those specific for the CPQ11-14-RSF16 concern trouble sleeping and not wanting to speak in class. In contrast, the 8-item short-forms had only 2 questions in common (Table 1.4). The procedures used in developing the ISF and RSF versions are outlined below.
1.8.3.1 Development of the short-form CPQ$_{11-14}$

The item impact and the regression analysis methods were used to develop two 16-item questionnaires (with each domain containing four items) and two 8-item questionnaires (with two items per domain).

Using the item impact method, data from the CPQ$_{11-14}$ item reduction study were used to select the questions with the highest impact scores in each domain. The children were asked whether they experienced the problem described by each question and, if yes, indicated its importance on a 5-point scale (does not bother me at all = 0 to bothers me very much = 4). The questions were then ranked within health domains according to their impact scores, which represent products of the question frequency and the mean bother rating. The top 4 and 2 questions (based on their impact scores) were then selected for each domain for the CPQ$_{11-14}$-ISF16 and CPQ$_{11-14}$-ISF8, respectively (Jokovic et al., 2006). The advantage of the item impact approach is that it selects those items of most importance to the people who will be completing the questionnaire; they may be considered to be the ultimate experts concerning the impact of a given condition on their quality of life (Juniper et al., 1997).

Using the regression method, the dependent variable was the overall score for the long-form CPQ$_{11-14}$, calculated by summing the response codes to its 37 questions. The independent variables were the scores for individual questions in the CPQ$_{11-14}$. A single model was generated with all items included, and a forward stepwise procedure was used to identify the best predictors of the overall score. The questions with the largest contribution to the coefficient of variation ($R^2$) in each domain were then selected; this involved four and two items per domain for the 16- and 8-item questionnaires, respectively (Jokovic et al., 2006). The full 37-item and the 16- and 8-item short-form versions of the CPQ$_{11-14}$ according to the four health domains are presented in Table 1.4.
Table 1.4 The full 37-item and the 16- and 8-item short-form versions of the CPQ11-14 according to the four health domains (where OS is oral symptoms; FL, functional limitations; EWB, emotional well-being; and SWB, social well-being)

In the past 3 months, how often have you had/been because of your teeth/mouth?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OS</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Pain in teeth, lips, jaws or mouth&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td>2</td>
<td>Bleeding gums</td>
</tr>
<tr>
<td>3</td>
<td>Mouth sores&lt;sup&gt;a,b,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td>Bad breath&lt;sup&gt;a,b,c,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>Food caught between/in teeth&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>6</td>
<td>Food stuck to roof of mouth</td>
</tr>
<tr>
<td><strong>FL</strong></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Breathing through the mouth</td>
</tr>
<tr>
<td>8</td>
<td>Taken longer than others to eat a meal&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td>9</td>
<td>Trouble sleeping&lt;sup&gt;b,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>10</td>
<td>Difficult to bite or chew food like apples, corn on the cob or steak&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>11</td>
<td>Difficult to open your mouth wide</td>
</tr>
<tr>
<td>12</td>
<td>Difficult to say any words&lt;sup&gt;a,b,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>13</td>
<td>Difficult to eat foods you would like to eat</td>
</tr>
<tr>
<td>14</td>
<td>Difficult to drink with a straw</td>
</tr>
<tr>
<td>15</td>
<td>Difficult to drink or eat hot or cold foods&lt;sup&gt;a,c&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>EWB</strong></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Irritable/frustrated&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>17</td>
<td>Felt unsure of yourself</td>
</tr>
<tr>
<td>18</td>
<td>Shy/embarrassed&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td>19</td>
<td>Concerned with what other people think&lt;sup&gt;a,b,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>20</td>
<td>Worried that is less healthy than other people</td>
</tr>
<tr>
<td>21</td>
<td>Upset&lt;sup&gt;a,b,c,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>22</td>
<td>Nervous or afraid</td>
</tr>
<tr>
<td>23</td>
<td>Worried that is less healthy than other people</td>
</tr>
<tr>
<td>24</td>
<td>Worried that is different than other people</td>
</tr>
<tr>
<td><strong>SWB</strong></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Missed school because of pain, appointment or surgery</td>
</tr>
<tr>
<td>26</td>
<td>Had hard time paying attention in school</td>
</tr>
<tr>
<td>27</td>
<td>Had difficulty doing your homework</td>
</tr>
<tr>
<td>28</td>
<td>Not wanted to speak/read out loud in class&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>29</td>
<td>Not wanted/been unable to participate in sports/clubs&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>30</td>
<td>Not wanted to talk to other children</td>
</tr>
<tr>
<td>31</td>
<td>Avoided smiling/laughing when around other children&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>32</td>
<td>Had difficulty playing a musical instrument such as a recorder, flute, clarinet, trumpet</td>
</tr>
<tr>
<td>33</td>
<td>Not wanted to spend time with other children</td>
</tr>
<tr>
<td>34</td>
<td>Argued with other children or your family&lt;sup&gt;a,b,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>35</td>
<td>Teased/called names by other children&lt;sup&gt;a,b,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>36</td>
<td>Left out by other children</td>
</tr>
<tr>
<td>37</td>
<td>Asked questions about your teeth, lips, jaws or mouth by other children&lt;sup&gt;a,c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>CPQ11-14-ISF16  
<sup>b</sup>CPQ11-14-RSF16  
<sup>c</sup>CPQ11-14-ISF8  
<sup>d</sup>CPQ11-14-RSF8
1.8.4 Initial validation of the CPQ11-14

The instrument was initially evaluated in a study of three groups of children recruited from clinical settings in Toronto (Jokovic et al., 2002). These were: a paediatric dental group who were attending clinics for the treatment of dental caries; a group just about to begin orthodontic treatment; and an oro-facial group consisting of children with cleft lip and palate or craniofacial anomalies being treated at a specialist hospital-based clinic. These groups were chosen because they had distinct clinical characteristics that were expected to have differential effects on the COHRQoL, thus maximising variation for validity testing. Internal consistency reliability and test-retest reliability were excellent, with all Cronbach’s alphas and Intra-class Correlation Coefficients (ICCs) exceeding 0.80. Discriminant validity was established by comparing scale and sub-scale scores across the three groups. As hypothesised, scores were highest in the oro-facial group, lowest in the paediatric dental group and intermediate for the orthodontic group. Construct validity was established by significant positive correlations between scale scores and children’s global ratings of their oral health and the extent to which the condition of the teeth and mouth affected their life overall. Jokovic et al. (2006) also found the psychometric properties of all four short-forms to be satisfactory, but stated that these measures must be validated and employed in other cultures, involving clinical and population-based samples of children and adolescents in different countries.

1.8.5 Cross-cultural validation of the CPQ11-14

There is nonetheless a need for measures specifically designed to be used in non-English-speaking countries and also among immigrant populations, since cultural groups vary in disease expression and in their use of various healthcare systems. The original English version of the CPQ11-14 has been shown to be valid and reliable for use in countries such as the UK (Marshman et al., 2005; ÓBrien et al., 2006), New Zealand (Foster Page et al., 2005) and Australia (Do and Spencer, 2008). The questionnaire has also been shown to be valid and reliable in a number of different non-English-speaking countries including Uganda (Robinson et al., 2005), Saudi Arabia (Brown and Al-Khayal, 2006), Brazil (Goursand et al., 2008; Barbosa et al., 2009), Hong Kong (McGrath et al., 2008) and Denmark (Wogelius et al., 2009). Of all these validation studies, only three studies used a random sample of a school-based population (Foster Page et al., 2005; ÓBrien et al., 2006; Do and Spencer, 2008), while others
used convenience samples of children attending dental clinics or of the school-based population, as shown in Table 1.5.

Table 1.5 Previous studies on epidemiological validation of the CPQ\textsubscript{11-14}

<table>
<thead>
<tr>
<th>Authors</th>
<th>Country (Language)</th>
<th>Settings (Sampling)</th>
<th>Number of participants</th>
<th>Number of CPQ items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jokovic \textit{et al} (2002)</td>
<td>Toronto (English)</td>
<td>Clinical (Convenience)</td>
<td>123</td>
<td>37, 16 and 8</td>
</tr>
<tr>
<td>Foster Page \textit{et al} (2005)</td>
<td>New Zealand (English)</td>
<td>Population (Random)</td>
<td>430</td>
<td>35, 16 and 8</td>
</tr>
<tr>
<td>Robinson \textit{et al} (2005)</td>
<td>Uganda (Lugandan)</td>
<td>Population (Convenience)</td>
<td>174</td>
<td>37</td>
</tr>
<tr>
<td>Marshman \textit{et al} (2005)</td>
<td>U.K (English)</td>
<td>Clinical (Convenience)</td>
<td>89</td>
<td>37</td>
</tr>
<tr>
<td>Do and Spencer (2008)</td>
<td>Australia (English)</td>
<td>Population (Random)</td>
<td>468</td>
<td>31</td>
</tr>
<tr>
<td>Goursand \textit{et al} (2008)</td>
<td>Brazil (Portuguese)</td>
<td>Clinical (Convenience)</td>
<td>160</td>
<td>37</td>
</tr>
<tr>
<td>McGrath \textit{et al} (2008)</td>
<td>Hong Kong (Chinese)</td>
<td>Clinical (Convenience)</td>
<td>225</td>
<td>37</td>
</tr>
<tr>
<td>Barbosa \textit{et al} (2009)</td>
<td>Brazil (Portuguese)</td>
<td>Population (Convenience)</td>
<td>120</td>
<td>37</td>
</tr>
<tr>
<td>Wogelius \textit{et al} (2009)</td>
<td>Denmark (Danish)</td>
<td>Clinical (Convenience)</td>
<td>168</td>
<td>37</td>
</tr>
</tbody>
</table>
In summary, the CPQ_{11-14} was developed in Toronto as a measure of OHRQoL specifically for 11-to-14-year-old children (Jokovic et al, 2002). The long-form CPQ_{11-14} was designed using the item impact method that focuses on items of most relevance to participants. As the original version of this questionnaire was considered long (37 items), shorter forms were developed with 8 and 16 items to facilitate its use in the clinical settings and population-based oral health surveys (Jokovic et al, 2006). Two methods were used to produce the short-forms: item impact and stepwise regression using data collected during the development of the long-form CPQ_{11-14}. The authors have determined the psychometric properties of these short-forms to be satisfactory, but state that these measures must be validated and employed in other cultures, involving clinical and population-based samples of children and adolescents in different countries. The short-form measure has also been tested and validated in a representative population sample of schoolchildren in New Zealand (Foster Page et al, 2008). On the other hand, the long-form CPQ_{11-14} has been shown to be valid and reliable in a number of different countries including Canada, the United Kingdom, New Zealand, Uganda, Saudi Arabia, Australia, Brazil, Hong Kong and Denmark.
1.9 Public oral healthcare in Brunei

This section presents a brief overview of public oral healthcare in Brunei. An important aspect contributing to the well-being of Brunei citizens is the provision of free medical/dental healthcare by the Government of His Majesty the Sultan of Brunei Darussalam at all government hospitals, healthcare centres and clinics throughout the nation. Brunei citizens benefit greatly from this, as they are charged only B$1.00 (equivalent to about NZ$1.10) to seek medical/dental consultation and a complete health/dental check-up at all Government hospitals and clinics. The Government not only provides primary and tertiary oral healthcare but also ensures dissemination of oral health education to the whole Brunei population. Privately-funded dental health care encompasses only a minority of dental service provision in Brunei. As the services rendered in the public sector are heavily subsidised by the government, a large number of the population use the public oral healthcare system.

1.9.1 History of oral healthcare in Brunei

Dentistry in Brunei started in the post-war era. The Dental Services started as hospital-based services in 1950, at the old hospital in the Brunei-Muara district. The service was slowly expanded and, currently, there are four main Government hospital-based dental clinics in the four districts, 12 dental clinics in health centres, 1 specialist dental clinic, 62 school dental clinics, and also 4 flying medical/dental services teams for remote areas. The Ministry of Defence also operates four dental centres which mainly provide services for its personnel and their families. In addition to the Government hospitals in each district, there is one private hospital in the Brunei capital.

1.9.2 Dental manpower

The Dental Services started out with 1 dentist, 3 assistants and 2 nurses in 1950. By 2008, there were 88 dentists (65 in the Ministry of Health, 8 in the Ministry of Defence, and 15 private dentists), 97 dental nurses/therapists, 83 dental surgery assistants and 27 dental technicians (Department of Dental Services, 2008). The ratio of dentists to the general population is high; currently, there are 23 dentists per 100,000 people in Brunei. Comparatively, in the Southeast Asian Nations (ASEAN) region, in countries such as Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and
Vietnam, the ratio of dentists to the general population is 3, 3, 8, 12, 3, 11, 26, 13 and 2 dentists, respectively, per 100,000 people (CAPP database\(^2\)).

1.9.3 Current oral healthcare facilities

The Brunei Ministry of Health has established a comprehensive network of oral healthcare facilities. The various types of dental facilities available are described below.

*Hospital-based dental clinics*
These are clinics manned by dental specialists, dental officers, dental nurses/therapists and other personnel. All hospital-based dental clinics provide outpatient care and two of the four hospital-based dental clinics also provide specialist care in oral surgery, orthodontics and periodontics.

*Dental clinics in health centres*
This dental clinic forms part of a health clinic complex. Oral healthcare services are provided as part of the integrated outpatient health services, which also include medical and family health services.

*School dental clinics*
These facilities are located in selected primary and secondary government schools. Oral healthcare services are provided to the schoolchildren by dental nurses/therapists, under the supervision of dental officers.

*Mobile dental teams*
The mobile dental team delivers oral healthcare services to schoolchildren, even to those in remote areas of the country. The team provides services using portable equipment.

*Dental specialist clinic*
The dental specialist clinic is located in the Brunei capital. The oral surgeon provides specialist care in the oral and facial area, and the paediatric dental specialist provides specialist care for children.

\(^2\) [http://www.whocollab.od.mah.se/](http://www.whocollab.od.mah.se/)
Other facilities

Government dental clinics are also located in other establishments, such as the Police Training Centre and in prisons.

1.9.4 Primary oral healthcare

A large network of health centres and clinics located throughout the country provides primary oral healthcare services. In remote areas that are not accessible or which are difficult to access by land or water, primary oral healthcare is provided by the flying medical/dental services. The primary oral healthcare services provide basic curative, corrective and rehabilitative services to render the patient orally-fit, control all active diseases and restore acceptable oral function. These are delivered to the population by targeting particular groups, namely toddlers, pre-school children, primary and secondary schoolchildren, antenatal mothers, children with special needs, adults and older people. The programme has been designed and implemented to ensure optimal oral health outcomes. Each will be briefly discussed.

Toddler programme

The ‘early childhood oral healthcare programme’ is an extension of the antenatal programme and targets postnatal mothers and parents/carers of children aged 5 years and below who are seen under the Child Health Services of the Ministry of Health (MOH). The main objective of the early childhood oral healthcare programme is to promote and maintain good oral health of toddlers, contributing to optimum growth and development.

Pre-school service

The oral healthcare programme for pre-schoolchildren is provided for kindergartens. This programme utilises a friendly, non-invasive approach whereby dental nurses/therapists introduce dentistry to children via promotional and preventive initiatives. These include toothbrushing sessions, puppet shows, role-play and other fun activities. In keeping with the non-invasive approach, the Atraumatic Restorative Technique (ART) is used to provide necessary restorative care for the children.

School dental service

The school dental service (SDS) is the main thrust of the public oral health services. The Brunei SDSs started in 1958 to help dentists to cope with the unmet needs of the
schoolchildren. Initially, the SDS had 2 dental nurses from New Zealand providing dental services in school dental clinics. At present, there are 62 school clinics throughout the country serving schoolchildren below the age of 16, providing routine dental treatment and dental health activities to schoolchildren, parents, guardians and teachers.

Oral healthcare to primary and secondary schoolchildren is delivered through the SDS; this utilises the Incremental Dental Care Approach, a systematic and comprehensive approach for delivery of care with the final objective that the children achieve an orally-fit status. Care is delivered mainly at school dental clinics, dental clinics, and mobile dental teams. This programme ensures accessibility besides blending with the educational environment. Expansion to reach almost 90% of primary schoolchildren in 2007 has been largely through the outreach strategy implemented since the early 1970s. These mobile teams utilising portable equipment have brought oral healthcare to even the most remote areas (Department of Dental Services, 2008).

**Antenatal service**

The aim of the antenatal programme is to impart oral health knowledge to mothers as agents-of-change for oral health in the home environment by stimulating behavioural change among family members. They are also given free oral health treatment. Antenatal mothers who frequent the Maternal and Child Health Clinics are referred to the nearest Government dental clinics for oral health promotion sessions and routine examinations. Further appointments are scheduled, if necessary.

**Outpatient service**

Oral healthcare for adults is provided on a demand basis. More complex cases are referred to dental specialists for further management. The outpatient dental service provides a safety net for the whole population in realising the service objective of improving the dental health status of the population.

**Service for children with special needs**

The paediatric care division has recognised children with special needs as one of the priority groups. A programme for children with special needs is at outpatient clinics besides some form of treatment given to children at the institutions. The objective of this programme is to improve oral health of children with special needs that will contribute to enhance QoL.
Inculcating good oral health practices, increasing awareness of carers of children with special needs and improving skills of dental personnel are some of the activities carried out. This is to ensure that good oral health is achieved through oral health promotion, clinical preventive measures and other necessary treatments in line with the Department of Dental Services vision towards ‘Healthy Mouth Healthy Nation’

_Flying Dental Service_

The flying dental service began in the 1980s, was officially combined with the medical flying service in 1988 and is still in operation today. Currently, the Department of Dental Services provide flying services to 4 rural communities twice a month.

1.9.5 Specialist oral healthcare

Specialist care is available in seven disciplines: oral and maxillofacial surgery, orthodontics, periodontics, paediatric, restorative, prosthodontic, and public health dentistry. These services are available by referral from primary care clinics.

1.9.6 Community oral healthcare

The focus of community oral healthcare is on prevention of caries. These include oral health promotion, fluoridation, and school-based fissure sealants.

Oral health promotion

Oral health promotion is a priority intervention and is integrated into oral health programmes for all identified target groups. Oral health promotion activities include oral health talks, exhibitions and oral health campaigns. Occasional oral health seminars are also conducted for Maternity and Child Health personnel. The goal is to provide them with the relevant oral health knowledge and skills. It is hoped that this would increase their confidence towards oral health and motivate them to include it as part of general health promotion. In addition, tooth brushing drills for pre-school and schoolchildren and other activities like role-play and puppet shows are carried out at pre-schools. All these activities aim to promote awareness of the importance of oral health and oral health practices that are necessary to maintain good oral health for improved QoL.
**Water fluoridation**

In 1987, the first water fluoridation plant was launched. About 95% of the Brunei population now receives fluoridated water (Department of Dental Services, 2008). The Ministry of Health has clearly appreciated the value of this measure and certain areas of the country benefit from this cost-effective caries-reduction intervention. The programme is currently being consolidated and expanded. The existing, extensive piped water supply, together with the co-operation between the Ministry of Health and various water authorities has contributed significantly towards the success of the programme.

**School-based fissure sealant**

This school-based fissure sealant programme is a clinical preventive programme aimed at preventing dental caries. Under this programme, fissure sealants are applied to permanent molars in children at risk for occlusal caries. In addition, fluoride varnish programme to primary schoolchildren who are at high caries risk are also carried out in selected schools without dental clinics. Children with high dmft (dmft > 4) in Primary 1 to Primary 3 classes are selected for this programme.
1.10 Overview of oral health in Brunei

In Brunei, as in most other Southeast Asian Nations (ASEAN), there has been a dramatic decline in caries in children and adults. This decline in caries activity has been attributed to an increase in preventive measures such as the widespread use of fluoridated toothpaste, fluoridation of public water supplies, the use of fissure sealants, and changing public awareness. However, the planning of future dental services in Brunei is compromised by a lack of up-to-date information. There is evidence from small scale surveys undertaken in 1999 that the oral health in Brunei of both adults and children is poor.

1.10.1 Dental caries status

Dental caries is still a major public health problem in Brunei. According to the 1999 oral health survey, only one-tenth of 5-6-year-olds were caries-free; on average, each 12-year-old had nearly 5 permanent teeth that had experienced dental decay (Table 1.6). The prevalence of caries was highest among the 35-44 age group, being present in almost all adults. The dental health of the pre-school children in Brunei has not been documented to the same extent as the dental health of the schoolchildren. This is probably because deciduous teeth still are not considered to be as important or as valuable as permanent teeth, and also because the older children may be going to school and are easier to identify and include in oral health surveys.

Table 1.6 Dental caries status of the population of Brunei Darussalam (1999)

<table>
<thead>
<tr>
<th>Districts</th>
<th>5-6-year-olds</th>
<th>10-12-year-olds</th>
<th>13-15-year-olds</th>
<th>35-44-year-olds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% CF&lt;sup&gt;a&lt;/sup&gt;</td>
<td>dmft</td>
<td>% CF&lt;sup&gt;a&lt;/sup&gt;</td>
<td>DMFT</td>
</tr>
<tr>
<td>Brunei-Muara</td>
<td>13.7</td>
<td>7.2</td>
<td>12.7</td>
<td>4.8</td>
</tr>
<tr>
<td>Belait</td>
<td>10.3</td>
<td>7.7</td>
<td>14.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Tutong</td>
<td>9.2</td>
<td>6.8</td>
<td>9.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Temburong</td>
<td>0.0</td>
<td>15.0</td>
<td>3.2</td>
<td>8.1</td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td>11.3</td>
<td>7.1</td>
<td>12.9</td>
<td>4.8</td>
</tr>
</tbody>
</table>

<sup>a</sup>CF - Caries-free
<sup>b</sup>DNA - Data not available
1.10.1.1 Comparisons with WHO and FDI global oral health goals

The oral health status of Brunei children and adults has not reached the standard set by the World Health Organization and the International Dental Federation. The findings from the 1987 and 1999 oral health surveys have also shown that there has been hardly any improvement in the oral health status of the children of Brunei (Table 1.7).

Table 1.7 WHO and FDI global oral health goals for the year 2000

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>WHO / FDI global oral health goals</th>
<th>Oral health status in Brunei</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000a</td>
<td>1987b</td>
</tr>
<tr>
<td>5-6</td>
<td>50% should be caries-free</td>
<td>3% caries free</td>
</tr>
<tr>
<td>12</td>
<td>3 or fewer DMFT</td>
<td>4.91 DMFT</td>
</tr>
<tr>
<td>18</td>
<td>85% should retain all their teeth</td>
<td>No data available</td>
</tr>
<tr>
<td>35-44</td>
<td>50% reduction in 1981 levels of edentulousness</td>
<td>No data available</td>
</tr>
<tr>
<td>&gt;65</td>
<td>25% reduction in 1981 level of edentulousness</td>
<td>No data available</td>
</tr>
</tbody>
</table>

Source: aCAPP database, Website available at: http://www.whocollab.od.mah.se/expl/globgoals20.html; bDepartment of Dental Services, 1987; cDepartment of Dental Services, 1999

1.10.1.2 Comparisons with other ASEAN and Asian countries

Comparisons of the global frequency and distribution of dental caries are complicated by diagnostic criteria that differ from study to study. However, based on data from the WHO Oral Health Country/Area Profile Programme (CAPP database3), the dental caries status of 12-year-old children in Brunei is amongst the worst in the ASEAN region and other Asian countries (Table 1.8). For a country with the financial means, this does not reflect positively on the healthcare system in Brunei. Despite the Department of Dental Services utilising most

3 http://www.whocollab.od.mah.se/
of its resources to combat oral diseases through a curative approach, a large amount of active
tooth decay are still not being treated.

Table 1.8 Dental caries status of ASEAN and other selected countries (ranked according to
DMFT level)

<table>
<thead>
<tr>
<th>Countries</th>
<th>Population (Million)(^a)</th>
<th>Gross national income per capita (PPP international $)(^a)</th>
<th>Year(^b)</th>
<th>Mean DMFT (at age 12)(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASEAN countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brunei</td>
<td>0.4</td>
<td>49,900</td>
<td>1999</td>
<td>4.8</td>
</tr>
<tr>
<td>Philippines</td>
<td>86.3</td>
<td>3,430</td>
<td>2005-06</td>
<td>2.9</td>
</tr>
<tr>
<td>Indonesia</td>
<td>228.9</td>
<td>3,310</td>
<td>1995</td>
<td>2.2</td>
</tr>
<tr>
<td>Vietnam</td>
<td>86.2</td>
<td>2,310</td>
<td>2001</td>
<td>1.9</td>
</tr>
<tr>
<td>Thailand</td>
<td>63.4</td>
<td>7,440</td>
<td>2006</td>
<td>1.9</td>
</tr>
<tr>
<td>Laos</td>
<td>5.8</td>
<td>1,740</td>
<td>2006</td>
<td>1.8</td>
</tr>
<tr>
<td>Malaysia</td>
<td>26.1</td>
<td>12,160</td>
<td>1997</td>
<td>1.6</td>
</tr>
<tr>
<td>Cambodia</td>
<td>14.2</td>
<td>1,550</td>
<td>2003-07</td>
<td>1.1</td>
</tr>
<tr>
<td>Myanmar (Burma)</td>
<td>48.4</td>
<td>510</td>
<td>1999</td>
<td>1.0</td>
</tr>
<tr>
<td>Singapore</td>
<td>4.4</td>
<td>43,300</td>
<td>2002</td>
<td>1.0</td>
</tr>
</tbody>
</table>

| Other selected countries  |                             |                                                             |            |                           |
| China                     | 1,328.5                     | 4,660                                                       | 1995       | 1.0                       |
| Australia                 | 20.5                        | 33,940                                                      | 2003-04    | 1.0                       |
| New Zealand               | 4.1                         | 25,750                                                      | 2007       | 1.5                       |
| Japan                     | 128.0                       | 32,840                                                      | 2005       | 1.7                       |
| Republic of Korea         | 48.1                        | 22,990                                                      | 1995       | 3.1                       |

Source: \(^a\)WHO, Website available at: http://www.who.int/countries/en/; \(^b\)CAPP database, Website available at: http://www.whocollab.od.mah.se/

Brunei is faced with a more pressing problem, because dental caries among children is a substantial problem despite the tenacious efforts of the SDS to try to bring it under control. When New Zealand pioneered the use of dental nurses to treat schoolchildren in 1925, their ratio of number of teeth extracted per 100 teeth filled was similar to what Brunei dental nurses are doing currently (Table 1.9). However, it should be noted that these data are only for those children who utilised dental services, and it shows only those cases which Paediatric Dental Services can handle. The caries prevalence in the community as a whole is much higher.
Table 1.9 Treatment of caries (number of teeth extracted per 100 teeth filled) by Dental Nurses

<table>
<thead>
<tr>
<th></th>
<th>No. of teeth extracted per 100 teeth filled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>63.6</td>
</tr>
<tr>
<td>2006</td>
<td>69.1</td>
</tr>
<tr>
<td>2007</td>
<td>34.1</td>
</tr>
<tr>
<td>New Zealand</td>
<td></td>
</tr>
<tr>
<td>1925</td>
<td>78.6</td>
</tr>
<tr>
<td>1974</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Source: School Dental Service Unit, Department of Dental Services, Brunei

1.10.2 Malocclusion status

An epidemiological assessment of malocclusion is very useful for the public dental service to determine priority for orthodontic treatment. Unfortunately, there has been no study on malocclusion and orthodontic treatment need in Brunei. Currently, there is increasing social pressure for the provision of orthodontic treatment in the government dental service which is evident in the 2-3 years waiting list. The present number of only 4 orthodontists for the whole country is insufficient to meet the rising demand.

The closest country that can be made for comparison with the Brunei population is Malaysia. Malaysia consists of an almost similar ethnic composition to that of Brunei, and the two countries share common cultural and lifestyle factors. A study by Woon et al (1989) found that the Chinese and Malays had almost similar distributions of the different types of occlusion. They also found a significantly higher prevalence of Class III occlusion among the Chinese and Malays than among Indians. In addition, a crowded dentition was also a norm for the three races. In another study, Esa et al (2000) utilised the Dental Aesthetic Index (DAI) with a random sample of 1,519 12-13-year-old schoolchildren in Malaysia; they found that most participants (62.9%) required no orthodontic treatment. Only about 7% had a handicapping malocclusion that needed mandatory treatment. Malocclusion, as defined in their study, was found to be significantly associated with gender, but there were no significant
differences in mean DAI scores among Malays, Chinese and Indian children. The prevalence of increased maxillary overjet was high across all groups (over 40%).

1.10.3 Challenges faced by the Department of Dental Services

The people of Brunei enjoy one of the highest standards of healthcare in the ASEAN region and in Asia. Brunei’s infant mortality rate is 6.6 per 1,000 livebirths and life expectancy is 74.1 and 77.7 years for males and females respectively (Department of Policy and Planning, 2008). Hence, it is indeed disheartening to note that the oral health status of Brunei children and adults has not reached the standard set by the WHO.

As shown earlier, the prevalence of oral diseases in Brunei, particularly dental caries, is still high despite the tenacious efforts of the Dental Services to try to bring these diseases under control. Consequently, because of the huge disease burden that is being placed on the services, the management of dental caries and its undesirable consequences is through a highly curative treatment-orientated strategy. The economic cost of utilising such a curative and rehabilitative strategy is prohibitively high and the costs incurred will only escalate year after year. This would not only put a strain on Brunei’s valuable resources but, sadly, the Dental Services would be fighting a losing battle.

The lack of awareness of the importance of oral health among the community may contribute to the lack of emphasis on dental prevention and oral health promotion. This is very likely due to the fact that oral diseases are often not considered to be serious health problems because they are usually neither life-threatening nor severely debilitating. However, failure to bring this seemingly insignificant problem under control will inevitably result in further propagation of oral diseases whose consequences can be quite devastating leading to an unimaginable amount of pain, suffering and misery. Therefore, Brunei has to come up with innovative ways of tackling this destructive and costly problem due to the consequences of oral diseases. Obviously, clinical dentistry alone cannot resolve this epidemic of oral diseases. Only by utilising evidence-based strategies through oral health promotion and prevention of oral diseases at the individual and population level, can the Dental Services be more effective in reducing the prevalence of dental caries. Once this is brought down to a more manageable level, the remaining dental decay can then be better managed at the clinical level. Clearly, knowing how much of an impact the various oral conditions make on Brunei children would
allow the Ministry to prioritise its oral service delivery and also indicate to both policymakers and the public just what the scale of the problem is. This is the advantage of validating and using an OHRQoL measure.

1.11 Aims of the study

Schoolchildren are the main target group for public oral health services in Brunei. Until now, data on the Brunei population’s oral health included only the clinical status of oral diseases. Although the focus of the Brunei Ministry of Health has shifted from being disease-oriented to emphasising wellness and the maintenance of the QoL of the population, a measure of OHRQoL appropriate for use in Brunei has not been available.

The need to test the psychometric properties of instruments, such as those for measuring OHRQoL in a new environment, has been stressed (Robinson et al, 2003). The English-language short-form versions of the CPQ_{11-14} were developed and validated in Toronto, Canada (Jokovic et al, 2006). The short-form measure has been tested and validated in a representative population sample of schoolchildren in New Zealand (Foster Page et al, 2008). On the other hand, the long-form CPQ_{11-14} has been shown to be valid and reliable in a number of different countries including Canada, the United Kingdom, New Zealand, Uganda, Saudi Arabia, Australia, Brazil, Hong Kong and Denmark. However, neither the long-form nor the short-form CPQ_{11-14} has been translated into a Malay (Bahasa Melayu) version and tested in the South-East Asian region. It is imperative that different language versions of the same measure be evaluated as they should exhibit similar psychometric properties (validity and reliability) to the original versions, if they are to be supported for cross-cultural and cross-national comparisons and other activities in health services research (Lawrence, 2001).

Therefore, the aims of the current study were:

1. to produce a Malay version of the short-form CPQ_{11-14};
2. to determine the construct validity of the CPQ_{11-14} in Brunei; and
3. to determine the discriminative validity of the CPQ_{11-14} by assessing its ability to distinguish between schoolchildren with and without dental caries and malocclusion.
2. METHOD

2.1 General approach to the investigation

Section 2.1 presents an overview of the methods used. Subsequent sections present more detailed descriptions of the study procedures. Previous studies using the CPQ
11-14 have used different sample sizes and settings. The highest sample size was 468 schoolchildren in a study conducted in Australia by Do and Spencer (2008), while the lowest was 89 in a study conducted in the UK by Marshman et al (2005). Only three previous studies have used population-based random samples of schoolchildren (Foster Page et al, 2005; ÓBrien et al, 2006; Do and Spencer, 2008), while others have used convenience samples of either schoolchildren attending public schools (Robinson et al, 2005; Barbosa et al, 2009; Wogelius et al, 2009), or children attending paediatric clinics (Jokovic et al, 2002; Marshman et al, 2005; Brown and Al-Khayal, 2006; Goursand et al, 2008; McGrath et al, 2008). The current study aimed to produce a Malay version of the CPQ
11-14, and to evaluate its validity and reliability in a sample of schoolchildren in Brunei.

Brunei is located on the island of Borneo, the third largest island in the world. It borders the Malaysian state of Sarawak to the east and south, and the South China Sea to its north and west (Figure 2.1). The official name for Brunei is Negara Brunei Darussalam (Negara Brunei – the state of Brunei, and Darussalam – Abode of Peace). There are four districts in the country: Brunei-Muara, Tutong, Belait and Temburong. The capital, Bandar Seri Begawan, is located in Brunei-Muara district. Brunei Darussalam mid-year population estimate in 2008 was 398,000 persons, comprising 211,000 males and 187,000 females. Brunei-Muara district has the largest population of 276,600 persons, followed by Belait district with 66,000 persons, Tutong district with 45,300 persons and Temburong district, which has the smallest population of about 10,100 persons. Brunei has a mixture of Southeast Asian ethnic groups: about two-thirds are Malay, one-tenth are Chinese, and the remainder are indigenous peoples or Indians. Of the total population, 106,200 persons were below the age of 15 years and 13,200 persons were aged 65 years or above (Department of Statistics, 2008).
The current schooling system in Brunei is administratively divided into zones, which includes both government and non-government schools, and in which they are divided into different areas: Brunei I, Brunei II, Brunei III, Brunei IV, Tutong I, Tutong II, Belait and Temburong. Brunei-Muara is the most densely populated district among the 4 districts in Brunei, where about 70% of Year 6 schoolchildren attended primary schools in the Brunei-Muara district in 2010 (Table 2.1). It was proposed that a convenience sample of schoolchildren aged 11-14 years attending the final year (Year 6) in 9 government primary schools in Brunei-Muara district would be invited to participate in the study.
### Table 2.1 Numbers of Year-6 children in Government primary schools (2010), by district

<table>
<thead>
<tr>
<th>District</th>
<th>No. of Schools</th>
<th>No. of Classes</th>
<th>No. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei District</td>
<td>61</td>
<td>152</td>
<td>3276</td>
</tr>
<tr>
<td>Brunei I</td>
<td>13</td>
<td>26</td>
<td>572</td>
</tr>
<tr>
<td>Brunei II (A)</td>
<td>10</td>
<td>30</td>
<td>702</td>
</tr>
<tr>
<td>Brunei II (B)</td>
<td>12</td>
<td>28</td>
<td>551</td>
</tr>
<tr>
<td>Brunei III</td>
<td>11</td>
<td>38</td>
<td>862</td>
</tr>
<tr>
<td>Brunei IV</td>
<td>15</td>
<td>30</td>
<td>589</td>
</tr>
<tr>
<td>Tutong District</td>
<td>29</td>
<td>43</td>
<td>586</td>
</tr>
<tr>
<td>Tutong I</td>
<td>16</td>
<td>27</td>
<td>355</td>
</tr>
<tr>
<td>Tutong II</td>
<td>13</td>
<td>16</td>
<td>231</td>
</tr>
<tr>
<td>Belait District</td>
<td>16</td>
<td>33</td>
<td>633</td>
</tr>
<tr>
<td>Temburong District</td>
<td>11</td>
<td>13</td>
<td>165</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>117</strong></td>
<td><strong>241</strong></td>
<td><strong>4660</strong></td>
</tr>
</tbody>
</table>

Preparation for the study took place at the University of Otago in February 2010. During this stage, the study protocol was produced, the principal investigator was trained, and the examination form and the questionnaire were designed. In Brunei, the official permissions were sought and the materials needed for the study implementation were prepared in March 2010.

After gaining approval from the Director of Schools (Ministry of Education) on the 6th of March 2010 (approval number: KP/DS/19:3; Appendix 1), ethical approval for the study was sought from the Medical and Health Research and Ethics Committee, Ministry of Health, Brunei. It was granted on the 15th of March 2010 (approval number: MHREC/EDU/2010/7(7); Appendix 2). As far as possible, the survey was conducted with minimal disruption to the schools’ daily routine. For this reason, the principals of the schools involved were requested to indicate when would be the most appropriate time for the survey to be carried out in their schools. After all of this information had been received, the most suitable schedule for the survey was drawn up. The fieldwork for the study was carried out from 7th April to 10th May 2010 (Appendix 3). Given that schools are open only in the
mornings, there was an estimated 3.5 to 4 hours window in the morning, and we spent 5-10 minutes per child, with about 30-35 children examined per dental examination session.

Parents and caregivers of the children in the study sample were then mailed (through their class teachers) an information sheet for the parent and the child about the study, together with an enclosed consent form (Appendix 4). Both the information sheet and consent form were bilingual. The consent form also sought information on the parent/caregiver’s occupation and the child’s basic demographic characteristics (age at last birthday, gender and ethnicity). Information in relation to income or level of education was not collected because it was considered that this might discourage parents’ participation. The children’s verbal assent was also obtained before the clinical examination. Each child was given a disposable mirror, a toothbrush and oral hygiene advice for their time and effort associated with participation (Appendix 10, Figure 1). Confidentiality of the participants was strictly maintained. A unique identification number was assigned to each child and all data analyses used that number only.

The study had two aspects: the administration of a questionnaire, followed by a clinical examination. A questionnaire was designed, using a short-form version of the CPQ11-14. It was then translated to a Malay version and then processed, printed and copied.

Prior to clinical examination, all participants completed a copy of the Malay version of the CPQ11-14. The children were asked whether in the past three months they had experienced the problem described by each item. Response options for the items comprising the measure were coded from 0 to 4 (further described in Section 2.3.3).

The clinical examinations were conducted by a single examiner, Dr Amirul Rizan Mohamed (ARM), at each school and examining children on site using the school dental clinic, utilising school dental equipment (chair and light), gloves, disposable dental mirror and a disposable millimetre ruler (Appendix 10, Figure 2). A portable chair and lighting were used in one school which did not have dental chair. Clinical data were manually recorded on an examination sheet (Appendix 5) and later entered into a Microsoft Excel spreadsheet by ARM. The questionnaire data were also entered after the questionnaires had been checked for completeness by a research assistant.
The collected dataset was analysed using the statistical package SPSS for Windows, Version 17.0 (SPSS Inc, Chicago, USA).

### 2.2 Sampling procedure

#### 2.2.1 Sample size

The sample included 11-14-year-old schoolchildren in the last year of primary school (Year 6). In 2010, there were approximately 3,300 Year 6 schoolchildren in all government primary schools in Brunei-Muara district, of whom 569 attended 9 primary schools in Brunei Zone II. Since there were no specific guidelines with respect to appropriate sample power for testing the performance of the CPQ<sub>11-14</sub>, a sample size of 569 Year 6 schoolchildren who are either citizens or permanent residents of Brunei was proposed, as this was higher than that used in any previous study. Nine government primary schools in Brunei Zone II were chosen for the study, and it was felt that this would be the most sound option. If the response rate was assumed to be 80%, this would decrease the total sample size to 455 children, which was still higher than in any previous studies. It was decided to use government primary schools only, as most government schools have their own school dental clinic, but none in the non-government schools do. This allowed minimisation of the transportation, equipment and logistical issues, because school dental clinics could be used as the examination area.

#### 2.2.2 Sampling strategy

The study was carried out on a sample of primary schoolchildren attending government schools in Brunei Zone II, Brunei-Muara district. This is an inner-city Brunei district area with a culturally diverse population (Figure 2.2). This area has been exposed to more than 20 years of water fluoridation, together with a well established school dental service which provides both curative and preventive care, as well as health education programmes. Nine government schools that were covered by the school dental clinic were selected, and all 569 students in Year 6 were asked to participate.
2.3 Questionnaire details

This study used a short-form of the CPQ_{11-14} which allowed use of any and all of the 4 short-form versions which have so far been developed (Foster Page et al, 2008). This had 20 items: 2 global ratings about oral health and oral health-related well-being, 4 questions on oral symptoms, 5 questions on functional limitations, 4 questions on emotional well-being, and 5 questions on social well-being (Appendix 7).

2.3.1 Cross-cultural adaptation of the CPQ_{11-14} into the Malay version

A Malay version of the short-form CPQ_{11-14} was derived through a forward-backward translation process. Forward translation of the CPQ_{11-14} into the Malay version was done by the examiner (ARM) and Hajah Sofinah Binti Haji Yusof, a secondary school mathematics teacher who speaks English fluently. One of the translators was unaware of the purpose and concepts of the study. These preliminary versions were then evaluated by Haji Mufarridon Bin Haji Hidup, a secondary school Malay teacher who is also fluent in English. This
translator proposed alternative translations after he deemed the original translated items or response choices unacceptable. The forward translated version was then finalised by discussion among the examiner and translators.

The reviewed new Malay version was then back-translated into English by another two independent back translators: Hajah Siti Kachee Binti Haji Mandor (Acting Principal Dental Nursing Officer) and Hajah Noraini Binti DP Haji Abdul Wahab (Senior Dental Nursing Officer). Both back-translators are Malay, bilingual and unaware of the purpose and concepts of the questionnaire or the nature of the study. The two versions (the original and the back-translated one) are presented in Appendix 8.

The examiner and all 4 translators reviewed the forward and the back-translated English translations. For the items or response choices where the back-translated and the original versions did not agree, the choice of words was discussed among the translators until a final version was reconciled. The steps of this process are presented in a flow chart (Figure 2.3).

![Flow chart of the cross-cultural adaptation of the CPQ11-14 into a Malay version](image)

**Figure 2.3** Flow chart of the cross-cultural adaptation of the CPQ\textsubscript{11-14} into a Malay version
2.3.2 Pilot study

A pilot study was carried out on the 24th of March 2010 (2 weeks before the actual field survey commenced) on a sample of 20 children between 11 and 14 years of age recruited from one of the government primary schools that did not make up part of the main sample. This exercise was carried out to: test the intra-examiner reliability and the protocol for the study; determine the time required for the administration of the questionnaire and examination; and verify the wording of the CPQ11-14. For evaluating the language used in the final Malay version, the alternative I did not understand was added to each question for identifying the questions that were not understood by the children (Appendix 9). Questions with this alternative item that were chosen by 15% or more of the participants were discussed by the examiner and the translators, who then replaced problematic items by culturally acceptable ones. All necessary changes were introduced before the main study.

2.3.3 Final questionnaire

The Malay version of the CPQ11-14 contains a total of 20 items: 2 global ratings about oral health and oral health-related well-being, 4 questions on oral symptoms, 5 questions on functional limitations, 4 questions on emotional well-being, and 5 questions on social well-being. Two separate 16-item short-form versions had been previously developed by Jokovic et al (2006) using (a) item impact and (b) regression methods. As indicated in Table 2.2, the CPQ11-14-ISF16 and CPQ11-14-RSF16 (ISF, impact short-form; RSF, regression short-form) are very similar, as they share 14 of their 16 items. The items unique to the CPQ11-14-ISF16 concern temperature sensitivity and being asked about the condition of the teeth/mouth, while those unique to the CPQ11-14-RSF16 concern trouble sleeping and not wanting to speak in class. The responses are scored as follows: for global rating of oral health, (0) excellent, (1) very good, (2) good, (3) acceptable, and (4) bad; for overall well-being, (0) not at all, (1) very little, (2) some, (3) a lot, and (4) very much; and for the remaining 18 questions, (0) never, (1) once or twice, (2) sometimes, (3) often, and (4) every day or almost every day.

2.3.4 Administration of the questionnaire

Each child completed the CPQ11-14 in the dental clinic waiting room just prior to the dental examination (Appendix 10, Figure 3). This was done in small groups, in order to reduce time.
The translated CPQ\textsubscript{11-14} was self-administered to avoid interviewer bias. However, the research assistant was available whenever the children needed help in answering the questions, and he would make sure that each child answered the questionnaire without communicating with each other and that all questions were answered prior to the dental examination.

**Table 2.2 Content of the CPQ\textsubscript{11-14}**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Items in the CPQ\textsubscript{11-14}</th>
<th>ISF16\textsuperscript{a}</th>
<th>RSF16\textsuperscript{a}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral symptoms</td>
<td>Pain in teeth/mouth</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mouth sores</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad breath</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Food stuck in between teeth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional limitations</td>
<td>Difficulty biting/chewing hard foods</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>Difficulty eating/drinking hot/cold drinks</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>Difficulty saying any words</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trouble sleeping</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>Taken longer to eat a meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional well-being</td>
<td>Felt irritated/frustrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Felt shy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upset</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concerned what people think about your teeth/mouth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social well-being</td>
<td>Avoided smiling/laughing</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>Not wanted to speak/read out loud in class</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teased/called names</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asked questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Argued with children/family</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Unless otherwise indicated, items are in both versions.
2.4 Clinical Examinations

Written consent was received from the parents/caregivers who had been invited to participate in the study. In all, consent forms were received for the examination of 474 (83.4%) of the 569 invited.

2.4.1 Examination Technique

The clinical examinations were carried out by a single examiner (ARM), examining children on site using the school dental clinic with the help of a dental surgery assistant and a dental nurse, who acted as a recorder for the examination and in the administration of the questionnaire respectively (Appendix 10, Figure 4).

The following standardised examination procedure was used:
1. Standardised positions for child and examiner: child reclined partially, examiner sitting behind with dental light shining into child’s mouth;
2. Standardised sequence of examination: dental caries and then DAI;
3. Data recorded by research assistant with examiner calling each tooth surface for caries data, and a code for each DAI item.

2.4.2 Dental Caries

A dental caries examination following WHO guidelines (WHO, 1997) was carried out prior to the assessment for malocclusion. The teeth were examined wet and were not cleaned prior to examination. A disposable dental mirror was used to visually inspect the teeth. All children in imminent need of a dental extraction were referred to school dental therapists for dental treatment.

For each tooth, its presence or absence was noted, after which the dental caries status of each surface was determined (in the order: occlusal, mesial, buccal, distal and lingual). The codes for the surfaces were:
- 0 for sound,
- 1 for decayed,
- 2 for filled,
- 3 for filled and decayed,
- 4 for crown or bridge abutment,
- 5 for missing due to caries,
- 6 for missing due to other reason,
- 7 for unerupted,
- 8 for excluded, and
- 9 for fissure sealant. Caries data were
manually recorded on an examination sheet (Appendix 5) and later entered into a Microsoft Excel spreadsheet.

2.4.3 The Dental Aesthetic Index (DAI)

The orthodontic assessment was carried out using the Dental Aesthetic Index (DAI; Cons et al, 1986), which assesses the relative social acceptability of dental appearance by collecting and weighting data on 10 intraoral measurements. A disposable plastic millimetre ruler was used to measure the deviations (in millimetres) before they were recorded.

Each participant was examined and scored for the ten components of the DAI. Each component was multiplied by its corresponding regression coefficient using the rounded weights (Table 2.3). The products were added, and summed with the regression constant (13) to give the total DAI score. This enables each individual to be placed on a dental appearance continuum ranging from 13 (the most socially acceptable) to 100 (the least acceptable), and orthodontic treatment need can be prioritised based on the pre-defined categories of 'minor/none' (scores 13 to 25), 'definite' (26 to 31), 'severe' (32 to 35), or 'handicapping' (36 or more) (Estioko et al, 1994; Table 2.4). Where a child presented with a mixed dentition, he/she was asked directly about the reason for any missing teeth, since these are allocated the highest weight. If the response from the child was not conclusive, the examiner had to rely on his judgement in order to determine whether teeth had been extracted to improve aesthetics, as recommended in the DAI guidelines (Cons et al, 1986).

2.4.4 Calibration of investigator

Prior to the data collection, the examiner underwent two calibration sessions with Dr. Lyndie Foster Page (LFP) at the School of Dentistry, University of Otago and George Street Normal School on the 17th and 19th of February 2010, respectively (Appendix 10, Figure 5). The purpose of these sessions was to calibrate ARM to the more experienced examiner and to minimise the inter-examiner reliability. This involved examining 5 orthodontic models and 6 schoolchildren, and then computing intraclass correlation coefficients (ICC) to check on inter-examiner reliability. These were 0.99 for DMFS, and 0.96 for mean DAI scores, indicating very good agreement.
Table 2.3 Dental Aesthetic Index items in order of recording

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Missing incisor, canine, and premolar teeth (maxillary and mandibular enter total #)</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Crowding in the incisal segments 0 = no segment crowded 1 = 1 segment crowded 2 = 2 segments crowded</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Spacing in the incisal segments 0 = no spacing 1 = 1 segment spaced 2 = 2 segments spaced</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Diastema in mm</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Largest anterior irregularity in maxilla (upper) in mm</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Largest anterior irregularity in mandible (lower) in mm</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Anterior maxillary overjet (upper) in mm</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Anterior mandibular overjet (lower) in mm</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Vertical anterior openbite in mm</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Antero-posterior molar relation Normal = 0 ½ cusp = 1 Full cusp = 2</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Constant</td>
<td>13</td>
</tr>
</tbody>
</table>

Total DAI score

Table 2.4 Categories for prioritising orthodontic treatment using the DAI

<table>
<thead>
<tr>
<th>DAI scores</th>
<th>Severity levelsa</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-25</td>
<td>Minor or no anomaly; no treatment indicated</td>
</tr>
<tr>
<td>26-31</td>
<td>Definite malocclusion; treatment elective</td>
</tr>
<tr>
<td>31-35</td>
<td>Severe malocclusion; treatment highly desirable</td>
</tr>
<tr>
<td>36+</td>
<td>Handicapping malocclusion; treatment mandatory</td>
</tr>
</tbody>
</table>

aAfter Estioko et al (1994)
2.4.5 Socioeconomic status

Information on the parent/caregiver’s occupation was recorded from the consent form. Since there is no socioeconomic status (SES) measure available in Brunei, SES was determined using the Malaysia Standard Classification of Occupations 2008 (MASCO-08). MASCO-08 was developed in accordance with International Standard Classification of Occupations by International Labour Organisation widely used worldwide (Ministry of Human Resources, Malaysia). MASCO-08 consists of 4,257 job titles and uses the basic principle of occupational classification, based on type of work and tasks or job performed as well as the concept of skill level and specialisation. The occupational classification structure has ten major groups: (1) Managers, (2) Professionals, (3) Technicians and Associate Professionals, (4) Clerical Support Workers, (5) Service and Sales Workers, (6) Skilled Agricultural, Forestry and Fishery Workers, (7) Craft and Related Trade Workers, (8) Plant and Machine operators and Assemblers, (9) Elementary Occupations, and (0) Armed Forces Occupations. In this study, occupational classifications 1 to 2 were categorised as ‘high-SES’, 3-7 as ‘medium-SES’; and 0, 8-9 as ‘low-SES’.

2.5 Test-retest reliability

Forty-eight randomly selected participants (representing 10% of the total sample) were invited to complete a second copy of the questionnaire to enable assessment of the test-retest reliability. In each dental examination session, the research assistant selected 3-5 students to complete a second copy of the questionnaire and for clinical re-examination, without informing the examiner. The research assistant was instructed to allow a time difference (not very specific but usually near the end of the examination session) between the first and second examination. Intra-examiner reliability for both the DMFS and the DAI scores was high with ICCs of 0.99 and 0.98 respectively.

2.6 Data Recording

All coded readings were dictated to a research assistant during the dental examination for entry onto an examination sheet. All collected data were checked by the examiner to ensure
all the data were entered correctly. All completed forms were duplicated and stored separately. Both clinical data and data from CPQ$_{11-14}$ were entered into a Microsoft Excel spreadsheet, and subsequently imported into SPSS.

2.7 Data Analysis

All data were analysed using the Statistical Package for Social Sciences (SPSS) for Windows, Version 17.0 (SPSS Inc, Chicago, USA). To enable simultaneous analysis of the examination study data and the questionnaire survey data to be undertaken, the dental examination data file was merged with the questionnaire data file using the unique identification numbers. The data analysis is described in detail below. The level of statistical significance was set at $P < 0.05$.

2.7.1 Descriptive analysis

Initially, descriptive analyses (sample description, caries and malocclusion prevalence, and analysis of mean scores of the CPQ$_{11-14}$) were performed. Gender was categorised as ‚male and 2 ‚female; age was recorded as age at last birthday and categorised as ‚10-11 years and ‚12-14 years. Caries experience data were used to calculate the caries prevalence and severity for both deciduous and permanent teeth. These data were also used to categorise children into three groups based on the number of untreated decayed surfaces present in either dentition: having 0, 1-3, or 4+ untreated decayed surfaces. The CPQ$_{11-14}$ data were summarised in two ways. First, the CPQ$_{11-14}$ responses were used to calculate mean scores for CPQ$_{11-14}$-ISF16 and CPQ$_{11-14}$-RSF16. The sum of the response code scores for the 16 questions gave an overall evaluation of the extent to which each child’s oral condition affected his or her QoL. Since there were 16 questions, the highest possible score for the total scale was 64, and the lowest, 0. A second summary measure of the CPQ$_{11-14}$ data was the prevalence of impacts, which was determined by counting the number of items for which the child responded ‘often’ or ‘every day or almost every day’ and then identifying those individuals with one or more impacts.
2.7.2 Bivariate analysis

Descriptive statistics were followed by bivariate analyses, which used Chi-square tests (where appropriate) for comparison of proportions, and independent samples t-tests or ANOVA for comparison of the means of continuous variables. Where data were highly skewed (as with DMFS), non-parametric tests (such as the Mann-Whitney U-test or the Kruskal-Wallis H-test) were used to test the statistical significance of differences between means. Bivariate analyses were undertaken to assess the associations between mean CPQ_{11-14} scores, the clinical characteristics and the sociodemographic variables. The performance of the CPQ_{11-14} was assessed with regard to validity and reliability. Data from the first administration of this part of the study was used to assess the validity of the instrument.

2.7.2.1 Discriminant validity

Discriminant validity was assessed by comparing mean scores by caries experience and malocclusion treatment need categories. As the CPQ_{11-14} scores were approximately normally distributed, ANOVA rather than non-parametric tests were used to assess the associations between mean scale scores and the clinical characteristics. The hypothesis was that scores would be higher among children with caries and least socially acceptable dental appearance, and lower in children with no caries and most acceptable dental appearance.

2.7.2.2 Construct validity

Construct validity was assessed by means of associations between the mean CPQ_{11-14} scores and responses to the two global questions of oral health and overall well-being. It was hypothesised that individuals reporting a negative influence of oral conditions on everyday life and poor oral health would have higher CPQ_{11-14} scores than individuals reporting a positive influence or good oral health.

2.7.2.3 Test-retest reliability

Test-retest reliability was assessed by calculating the intra-class correlation coefficient (ICC) based on the repeated questionnaire of a subsample of 48 participants chosen among those 457 that made up the main sample, using the following criteria: ≤ 0.40 (weak), 0.41-0.60
The internal consistency of the CPQ\textsubscript{11-14} was determined by the Cronbach alpha statistic; this produced an estimate of reliability based on all correlations between all items in the questionnaire (Cronbach, 1951).

### 2.7.3 Multivariate analysis

Multivariate modelling used linear regression (for continuous dependent variables such as mean CPQ\textsubscript{11-14} score and caries severity) or logistic regression (for dichotomous dependent variables such as caries and impact prevalence). The difference was considered to be significant when the \(P\)-value was smaller than 0.05. A 95\% confidence interval (CI) was computed for the correlation coefficients and the odds ratios, indicating statistically significant relationships if both correlation coefficient values were greater or less than 0 and if both odd ratio values were greater or less than 1. The summary of data analysis for this study is provided in Table 2.5.

**Table 2.5 Summary of data analysis**

<table>
<thead>
<tr>
<th>Type</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univariate analysis</td>
<td>Describe the sample.</td>
</tr>
<tr>
<td></td>
<td>Derive summary indices for caries.</td>
</tr>
<tr>
<td></td>
<td>Derive summary indices for malocclusion.</td>
</tr>
<tr>
<td></td>
<td>Compute various CPQ\textsubscript{11-14} scale and subscale scores.</td>
</tr>
<tr>
<td>Bivariate analysis</td>
<td>Association between caries experience, mean CPQ\textsubscript{11-14} score and impact prevalence.</td>
</tr>
<tr>
<td></td>
<td>Association between malocclusion and CPQ\textsubscript{11-14} score and impact prevalence.</td>
</tr>
<tr>
<td></td>
<td>Validation of CPQ\textsubscript{11-14} scores against the global measures.</td>
</tr>
<tr>
<td>Multivariate analysis</td>
<td>Using linear and logistic regression to model CPQ\textsubscript{11-14} score and impact prevalence to assess the independent effects of sociodemographic variables on CPQ\textsubscript{11-14} scores and impact prevalence.</td>
</tr>
<tr>
<td></td>
<td>Using linear and logistic regression to model caries severity and prevalence to assess the independent effects of sociodemographic variables on caries severity and prevalence.</td>
</tr>
</tbody>
</table>
3. RESULTS

3.1 Analysis of participation rate

The study population was all Year 6 schoolchildren attending the nine government primary schools in Brunei Zone II, Brunei-Muara district. Of a total of 569 eligible children, 474 returned the consent form. Seventeen children were unable to be examined, due to two having moved to another school, while the other 15 children were absent from school when the examinations were scheduled. The 457 who remained represented an overall participation rate of 80.3%, and all subsequent analyses refer to those 457 children. A summary of the overall responses is presented in Table 3.1.

Table 3.1 Overall response rate (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Response rate</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consent to examine</td>
<td></td>
</tr>
<tr>
<td>Children examined</td>
<td>457 (80.3)</td>
</tr>
<tr>
<td>Children not examined</td>
<td>17 (3.0)</td>
</tr>
<tr>
<td>Consent refused</td>
<td>17 (3.0)</td>
</tr>
<tr>
<td>No response</td>
<td>78 (13.7)</td>
</tr>
<tr>
<td>Total sample</td>
<td>569 (100.0)</td>
</tr>
</tbody>
</table>
All nine primary schools had good participation rates, with three schools having a participation rate of more than 90%, while the lowest was 69.5% (Table 3.2).

**Table 3.2 Participation rate by primary school (brackets contain percentages unless otherwise indicated)**

<table>
<thead>
<tr>
<th>Primary School</th>
<th>Number sampled</th>
<th>Number who participated</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR Amar Pahlawan</td>
<td>63</td>
<td>57 (90.5)</td>
</tr>
<tr>
<td>SR Pulaie</td>
<td>37</td>
<td>34 (91.9)</td>
</tr>
<tr>
<td>SR Anggerek Desa</td>
<td>85</td>
<td>65 (76.5)</td>
</tr>
<tr>
<td>SR DMW Lambak</td>
<td>59</td>
<td>41 (69.5)</td>
</tr>
<tr>
<td>SR Dato Marsal</td>
<td>115</td>
<td>89 (77.4)</td>
</tr>
<tr>
<td>SR Delima Satu</td>
<td>70</td>
<td>57 (81.4)</td>
</tr>
<tr>
<td>SR Suas Muara</td>
<td>66</td>
<td>52 (78.8)</td>
</tr>
<tr>
<td>SR Serasa</td>
<td>38</td>
<td>29 (76.3)</td>
</tr>
<tr>
<td>SR Mentiri</td>
<td>36</td>
<td>33 (91.6)</td>
</tr>
<tr>
<td>All combined</td>
<td>569</td>
<td>457 (80.3)</td>
</tr>
</tbody>
</table>
3.2 Sociodemographic characteristics of participants

A total of 457 children were examined, of whom 220 (48.1%) were boys (Table 3.3). The majority of the children were aged 10 or 11 years, with a mean age of 11.1 years (sd, 0.5). About half belonged to the medium-SES group. The proportion of boys and girls was almost similar for each SES group. Since the sample’s ethnic composition was fairly homogeneous (comprising 95.0% Malay, 1.3% Chinese, and 3.7% Others), ethnic group is not used as an independent variable in the subsequent Tables.

Table 3.3 Sociodemographic characteristics of the sample (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
<th>All combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 11</td>
<td>178 (46.0)</td>
<td>209 (54.0)^a</td>
<td>387 (84.7)</td>
</tr>
<tr>
<td>12 to 14</td>
<td>42 (60.0)</td>
<td>28 (40.0)</td>
<td>70 (15.3)</td>
</tr>
<tr>
<td>SES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>44 (46.3)</td>
<td>51 (53.7)</td>
<td>95 (20.8)</td>
</tr>
<tr>
<td>Medium</td>
<td>106 (46.5)</td>
<td>122 (53.5)</td>
<td>228 (49.9)</td>
</tr>
<tr>
<td>Low</td>
<td>70 (52.2)</td>
<td>64 (47.8)</td>
<td>134 (29.3)</td>
</tr>
<tr>
<td>Primary school attended</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR Amar Pahlawan</td>
<td>25 (43.9)</td>
<td>32 (56.1)</td>
<td>57 (12.5)</td>
</tr>
<tr>
<td>SR Pulaie</td>
<td>20 (58.8)</td>
<td>14 (41.2)</td>
<td>34 (7.4)</td>
</tr>
<tr>
<td>SR Anggerek Desa</td>
<td>24 (36.9)</td>
<td>41 (63.1)</td>
<td>65 (14.2)</td>
</tr>
<tr>
<td>SR DMW Lambak</td>
<td>16 (39.0)</td>
<td>25 (61.0)</td>
<td>41 (9.0)</td>
</tr>
<tr>
<td>SR Dato Marsal</td>
<td>40 (44.9)</td>
<td>49 (55.1)</td>
<td>89 (19.5)</td>
</tr>
<tr>
<td>SR Delima Satu</td>
<td>27 (47.4)</td>
<td>30 (52.6)</td>
<td>57 (12.5)</td>
</tr>
<tr>
<td>SR Suas Muara</td>
<td>32 (61.5)</td>
<td>20 (38.5)</td>
<td>52 (11.4)</td>
</tr>
<tr>
<td>SR Serasa</td>
<td>14 (48.3)</td>
<td>15 (51.7)</td>
<td>29 (6.3)</td>
</tr>
<tr>
<td>SR Mentiri</td>
<td>22 (66.7)</td>
<td>11 (33.3)</td>
<td>33 (7.2)</td>
</tr>
<tr>
<td>All combined</td>
<td>220 (48.1)</td>
<td>237 (51.9)</td>
<td>457 (100.0)</td>
</tr>
</tbody>
</table>

^aP < 0.05

Data by primary school attended are not presented in the analyses which follow, because of statistical power considerations (the number of children in each school was relatively low).
3.3 Dentition status

Overall, more than half of the children were in the mixed dentition (Table 3.4); the proportion for boys was significantly higher than for girls. The mean number of deciduous teeth present was 2.4 (sd, 3.4), with one child having the highest number of 15 deciduous teeth. The number of children in the mixed dentition was significantly higher in the younger age group ($P < 0.05$). No significant difference was observed by SES group.

Table 3.4 Number of children in the mixed dentition, by sociodemographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of children in the mixed dentition$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>142 (64.5)$^b$</td>
</tr>
<tr>
<td>Female</td>
<td>106 (44.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of children in the mixed dentition$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 11</td>
<td>218 (56.3)$^b$</td>
</tr>
<tr>
<td>12 to 14</td>
<td>30 (42.9)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SES</th>
<th>Number of children in the mixed dentition</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>55 (57.9)</td>
</tr>
<tr>
<td>Medium</td>
<td>114 (50.0)</td>
</tr>
<tr>
<td>Low</td>
<td>79 (59.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>All combined</th>
<th>Number of children in the mixed dentition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>248 (54.3)</td>
</tr>
</tbody>
</table>

$^a$Defined as the presence of one or more deciduous teeth along with the permanent teeth
$^bP < 0.05$
3.4 Dental caries experience

3.4.1 The deciduous dentition

In the deciduous dentition, almost one-third of the children had had caries experience (Table 3.5); caries prevalence and severity were significantly higher among boys. Although caries experience (both prevalence and severity) was higher in the 10-11-year-old age group, no significant difference was observed between the two age groups. Children from the medium-SES group had, on average, lower caries experience than their high-SES counterparts, and low-SES children fell between those two groups ($P < 0.05$). There were too few differences in caries experience among the nine schools to justify presentation of those data.

Table 3.5 Deciduous dentition dental caries experience, by sociodemographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Caries prevalence</th>
<th>Caries severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+ dmfs</td>
<td>Mean dmfs (sd)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>95 (43.2)$^a$</td>
</tr>
<tr>
<td>Female</td>
<td>63 (26.6)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
</tr>
<tr>
<td>10 to 11</td>
<td>138 (35.7)</td>
</tr>
<tr>
<td>12 to 14</td>
<td>20 (28.6)</td>
</tr>
<tr>
<td>SES</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>40 (42.1)$^a$</td>
</tr>
<tr>
<td>Medium</td>
<td>66 (28.9)</td>
</tr>
<tr>
<td>Low</td>
<td>52 (38.8)</td>
</tr>
<tr>
<td>All combined</td>
<td>158 (34.6)</td>
</tr>
</tbody>
</table>

$^aP < 0.05$
3.4.2 The permanent dentition

Data on dental caries experience in the permanent dentition are presented in Table 3.6. More than two-fifths of the children had had permanent caries experience, with a mean of 2.0 (sd, 3.7) surfaces affected. In contrast to the deciduous dentition situation, permanent dentition caries prevalence was greater among girls, those in the 12-14-year-old age group, and among children of medium-SES. There were no significant differences in permanent caries experience by gender or SES group, but there was a difference by age group, whereby it was higher among the older children ($P < 0.05$).

**Table 3.6** Permanent dentition dental caries experience, by sociodemographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Caries prevalence</th>
<th>Caries severity</th>
<th>Caries severity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1+ DMFS</td>
<td>Mean DMFS (sd)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>93 (42.3)</td>
<td>1.88 (3.79)</td>
</tr>
<tr>
<td>Female</td>
<td>110 (46.4)</td>
<td>2.04 (3.70)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 11</td>
<td>166 (42.9)</td>
<td>1.73 (3.31)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>12 to 14</td>
<td>37 (52.9)</td>
<td>3.23 (5.40)</td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>42 (44.2)</td>
<td>1.88 (3.31)</td>
</tr>
<tr>
<td>Medium</td>
<td>100 (43.9)</td>
<td>2.18 (4.31)</td>
</tr>
<tr>
<td>Low</td>
<td>61 (45.5)</td>
<td>1.65 (2.86)</td>
</tr>
<tr>
<td>All combined</td>
<td>203 (44.4)</td>
<td>1.96 (3.74)</td>
</tr>
</tbody>
</table>

<sup>a</sup>$P < 0.05$
3.4.3 Untreated decayed surfaces in either dentition

The prevalence of untreated decayed surfaces in either dentition (almost 45% overall) was higher among boys and those in the 12-14-year-old age group (Table 3.7). One in two children in the low-SES group had at least one untreated decayed surfaces in either dentition, while it was approximately two in five in the other two SES groups. There were no statistically significant sociodemographic differences with respect to the number of untreated decayed surfaces in either dentition.

Table 3.7 Number of untreated decayed surfaces present in either dentition, by sociodemographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th></th>
<th>Number of untreated decayed surfaces present in either dentition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>111 (50.5)</td>
</tr>
<tr>
<td>Female</td>
<td>141 (59.5)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
</tr>
<tr>
<td>10 to 11</td>
<td>216 (55.8)</td>
</tr>
<tr>
<td>12 to 14</td>
<td>36 (51.4)</td>
</tr>
<tr>
<td>SES</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>56 (58.9)</td>
</tr>
<tr>
<td>Medium</td>
<td>129 (56.6)</td>
</tr>
<tr>
<td>Low</td>
<td>67 (50.0)</td>
</tr>
<tr>
<td>All combined</td>
<td>252 (55.1)</td>
</tr>
</tbody>
</table>
Figure 3.1 shows the number of children with sound, decayed and filled deciduous teeth by tooth type. Overall, the $\text{F}^\text{D}$ component was slightly higher than the $\text{D}^\text{D}$ component. There were no children with retained deciduous maxillary central incisors. Most of the caries experience had occurred in the posterior teeth, particularly the first and second deciduous molars. Very little caries experience had occurred in the mandibular central incisors, while a moderate amount had occurred in the mandibular and maxillary deciduous canines.

Figure 3.1 Frequency distribution: number of children with sound, decayed and filled deciduous maxillary and mandibular teeth by tooth type (NB: *Data on missing deciduous teeth were not included as it was not possible to distinguish between those missing due to caries and those missing for other reasons)
Overall, the $D\delta$ component was higher than the $F\delta$ and the $M\delta$ component in the permanent dentition (Figure 3.2). The highest number of decayed, filled, and missing permanent teeth per child was 9, 11 and 5 respectively. There were no children with caries experience in the permanent maxillary and mandibular anteriors. Mandibular permanent first molars were the teeth most commonly affected by caries, followed by maxillary first molars and then by maxillary premolars.

Figure 3.2 Frequency distribution: number of children with sound, decayed, missing due to caries and filled permanent maxillary and mandibular teeth by tooth type
3.5 Malocclusion

The DAI scores were normally distributed, with a mean of 31.4 (sd, 8.6; Figure 3.3). About two-thirds of the participants had a score which was less than the mean score. Two participants had the most and one participant had the least socially acceptable dental appearance, with DAI scores of 17 and 91 respectively. On average, boys had a significantly greater mean DAI score than girls. There was little variation in mean DAI score by age group or SES group. When grouped according to the various malocclusion severity levels, almost one-quarter of the sample had a DAI score within the range from 17 to 25 (that is, not requiring treatment); about two-fifths had a severe/handicapping malocclusion, where orthodontic treatment is considered mandatory, while the rest of the participants had a dental appearance where orthodontic treatment was elective (Table 3.8).

**Table 3.8** Dental Aesthetic Index scores and DAI treatment need categories, by sociodemographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th></th>
<th>Mean DAI (sd)</th>
<th>Treatment Need Category</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minor/None</td>
<td>Definite</td>
<td>Severe/Handicapping</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>32.7 (9.8)a</td>
<td>50 (22.7)</td>
<td>65 (29.5)</td>
<td>105 (47.7)a</td>
</tr>
<tr>
<td>Female</td>
<td>30.2 (7.3)</td>
<td>60 (25.3)</td>
<td>104 (43.9)</td>
<td>73 (30.8)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 11</td>
<td>31.2 (8.5)</td>
<td>99 (25.6)</td>
<td>139 (35.9)</td>
<td>149 (38.5)</td>
</tr>
<tr>
<td>12 to 14</td>
<td>32.4 (9.6)</td>
<td>11 (15.7)</td>
<td>30 (42.9)</td>
<td>29 (41.4)</td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>32.1 (8.5)</td>
<td>18 (18.9)</td>
<td>39 (41.1)</td>
<td>38 (40.0)</td>
</tr>
<tr>
<td>Medium</td>
<td>31.2 (8.6)</td>
<td>55 (24.1)</td>
<td>87 (38.2)</td>
<td>86 (37.7)</td>
</tr>
<tr>
<td>Low</td>
<td>31.1 (8.7)</td>
<td>37 (27.6)</td>
<td>43 (32.1)</td>
<td>54 (40.3)</td>
</tr>
<tr>
<td>All combined</td>
<td>31.4 (8.6)</td>
<td>110 (24.1)</td>
<td>169 (37.0)</td>
<td>178 (38.9)</td>
</tr>
</tbody>
</table>

aP < 0.05
Figure 3.3 Distribution of DAI scores
3.6 The short-form Child Perceptions Questionnaire (CPQ$_{11-14}$)

There were 457 completed CPQ$_{11-14}$ questionnaires, and no missing data. The mean CPQ$_{11-14}$-ISF16 and CPQ$_{11-14}$-RSF16 were approximately normally distributed (Figure 3.4); and the two short-form versions of the CPQ$_{11-14}$ differed only slightly, as shown by their mean scores (Table 3.9). Both means were small in comparison with the possible maximum score of 64. The median of both short-form versions of the CPQ$_{11-14}$ was 16.0, with the overall score ranging from 0 to 43 and 0 to 41 for the CPQ$_{11-14}$-ISF16 and CPQ$_{11-14}$-RSF16 respectively. Minimum scores were observed for 5 (1.1%) children for the CPQ$_{11-14}$-ISF16 and 6 (1.3%) children for the CPQ$_{11-14}$-RSF16. There were no children with the maximum score for either version. There was no sex difference in CPQ$_{11-14}$ scores; however, there were apparent age group and SES group differences in the mean CPQ$_{11-14}$ in both versions, although those did not reach statistical significance.

**Table 3.9** Mean scores of the 2 short-form versions of the CPQ$_{11-14}$, by sociodemographic characteristics

<table>
<thead>
<tr>
<th></th>
<th>Mean CPQ$_{11-14}$-ISF16 (sd)</th>
<th>Mean CPQ$_{11-14}$-RSF16 (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16.9 (8.7)</td>
<td>16.7 (8.9)</td>
</tr>
<tr>
<td>Female</td>
<td>16.8 (8.7)</td>
<td>16.6 (8.7)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 11</td>
<td>16.6 (8.5)</td>
<td>16.3 (8.6)</td>
</tr>
<tr>
<td>12 to 14</td>
<td>18.1 (9.8)</td>
<td>18.4 (9.6)</td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>16.5 (8.1)</td>
<td>16.5 (8.2)</td>
</tr>
<tr>
<td>Medium</td>
<td>16.1 (8.7)</td>
<td>15.9 (8.7)</td>
</tr>
<tr>
<td>Low</td>
<td>18.2 (9.2)</td>
<td>18.1 (9.2)</td>
</tr>
<tr>
<td><strong>All combined</strong></td>
<td>16.8 (8.7)</td>
<td>16.7 (8.8)</td>
</tr>
</tbody>
</table>
Figure 3.4 Frequency distribution of CPQ11-14-ISF16 and CPQ11-14-RSF16
Positive and strong correlations were observed between the two short-form versions of the CPQ\textsubscript{11-14} (Figure 3.5).

\textbf{Figure 3.5} Correlation between scores of the 2 short-form versions of the CPQ\textsubscript{11-14} (Pearson\textdegree r = 0.98)

Because of (a) this very high correlation, and (b) the stronger theoretical basis for the ISF-derived short-form version, all subsequent CPQ\textsubscript{11-14} analyses use the CPQ\textsubscript{11-14}-ISF16 only.
3.6.1 Discriminant validity

CPQ_{11-14}-ISF16 data are presented in Table 3.10 by clinical characteristics. The CPQ_{11-14}-ISF16 detected differences in the impact of dental caries on QoL, with the greatest scores in the expected direction: children who presented with the highest caries burden had the highest scores. The differences for mean CPQ_{11-14}-ISF16 were not statistically significant, with the only exception being impact prevalence across the categorised numbers of untreated decayed surfaces. There was a descending gradient across ascending categories of orthodontic treatment need, whereby those in the ‘Severe/Handicapping’ category had the lowest and those in the ‘Minor/none’ category had the highest mean CPQ_{11-14}-ISF16 score and impact prevalence.

Table 3.10 CPQ_{11-14}-ISF16 mean scores and impact prevalence (‘often’ to ‘every day’), by clinical characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Clinical characteristic</th>
<th>Mean CPQ_{11-14}-ISF16 (sd)</th>
<th>Impact prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deciduous dentition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 dmfs</td>
<td>16.3 (8.7)</td>
<td>124 (41.5)</td>
</tr>
<tr>
<td>1+ dmfs</td>
<td>17.7 (8.7)</td>
<td>79 (50.0)</td>
</tr>
<tr>
<td>Permanent dentition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 DMFS</td>
<td>16.7 (8.7)</td>
<td>104 (40.9)</td>
</tr>
<tr>
<td>1+ DMFS</td>
<td>16.9 (8.7)</td>
<td>99 (48.8)</td>
</tr>
<tr>
<td>Number of untreated decayed surfaces present in either dentition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>16.2 (8.6)</td>
<td>97 (38.5)^a</td>
</tr>
<tr>
<td>1-3</td>
<td>17.4 (8.9)</td>
<td>59 (50.4)</td>
</tr>
<tr>
<td>4+</td>
<td>17.8 (8.8)</td>
<td>47 (53.4)</td>
</tr>
<tr>
<td>DAI treatment need category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor/None</td>
<td>17.5 (9.0)</td>
<td>54 (49.1)</td>
</tr>
<tr>
<td>Definite</td>
<td>17.0 (8.9)</td>
<td>73 (43.2)</td>
</tr>
<tr>
<td>Severe/Handicapping</td>
<td>16.2 (8.4)</td>
<td>76 (42.7)</td>
</tr>
<tr>
<td>All combined</td>
<td>16.8 (8.7)</td>
<td>203 (44.4)</td>
</tr>
</tbody>
</table>

^aP < 0.05
3.6.2 Construct validity

The construct validity of the CPQ11-14-ISF16 data was assessed by correlating the number of impacts and mean CPQ11-14-ISF16 score with the responses to the global oral health ratings and the effect of the oral condition on everyday life (Table 3.11). Both global ratings were significantly associated with mean CPQ11-14-ISF16 score. The mean CPQ11-14-ISF16 scores showed a consistent gradient across the categories of self-reported oral health. The score gradients across the categories of self-rated oral health were almost similar in magnitude to those observed across the categories of the impact of oral health on QoL, with the only exception being the mean score for those who responded ‘very much’ which was lower than expected.

Table 3.11 CPQ11-14-ISF16 mean scores and impact prevalence (‘often’ to ‘every day’), by global questions (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th></th>
<th>Mean CPQ11-14-ISF16 (sd)</th>
<th>Impact prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-rated oral health</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>15.5 (7.4)</td>
<td>22 (44.9)</td>
</tr>
<tr>
<td>Very good</td>
<td>16.6 (8.9)</td>
<td>40 (39.2)</td>
</tr>
<tr>
<td>Good</td>
<td>15.7 (8.5)</td>
<td>62 (38.0)</td>
</tr>
<tr>
<td>Fair</td>
<td>18.1 (8.6)</td>
<td>72 (38.0)</td>
</tr>
<tr>
<td>Poor</td>
<td>29.3 (8.7)</td>
<td>7 (100.0)</td>
</tr>
<tr>
<td><strong>Impact on quality of life</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>13.8 (8.3)</td>
<td>42 (35.9)</td>
</tr>
<tr>
<td>Very little</td>
<td>16.4 (9.1)</td>
<td>35 (46.1)</td>
</tr>
<tr>
<td>Some</td>
<td>18.3 (7.7)</td>
<td>87 (48.1)</td>
</tr>
<tr>
<td>A lot</td>
<td>19.7 (9.7)</td>
<td>35 (53.8)</td>
</tr>
<tr>
<td>Very much</td>
<td>12.4 (8.6)</td>
<td>4 (22.2)</td>
</tr>
<tr>
<td>All combined</td>
<td>16.8 (8.7)</td>
<td>203 (44.4)</td>
</tr>
</tbody>
</table>

*P < 0.05
3.7 Multivariate analysis

Table 3.12 shows the outcome of multiple logistic and linear regression analyses with caries presence and severity as the dependent variables, respectively. The independent variables used were gender, age 12-14 years, and dummy variables for low and medium-SES (the reference category for both being high-SES). Logistic regression was used to calculate odds ratios, and these showed boys to have 2.2 and 1.2 times the odds (than girls) of having caries in the deciduous and permanent teeth. Children in the medium-SES group and those aged 12-14 years old had half the odds of having caries in the deciduous teeth than those in the high-SES group and younger children, respectively. In the permanent dentition, the odds ratios for age and SES were slightly higher, but similar patterns were observed. Linear regression analysis showed that boys, those aged 10-11 years old, and children from the high-SES group had significantly higher dmfs scores than those in their respective reference groups. However, when the mean DMFS score was assessed, the association with independent variables differed, with DMFS scores higher (on average) among older children and those of medium-SES, and lower among boys and those of low-SES.

Table 3.12 Multivariate models for dental caries experience

<table>
<thead>
<tr>
<th></th>
<th>Deciduous caries</th>
<th>Permanent caries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevalence (OR)</td>
<td>dmfs(^a) ((\hat{\beta}))</td>
</tr>
<tr>
<td>Male</td>
<td>2.20 (1.47, 3.28)(^c)</td>
<td>0.62 (0.46, 0.77)(^c)</td>
</tr>
<tr>
<td>12-14-yr-old</td>
<td>0.58 (0.32, 1.03)</td>
<td>-0.67 (-0.93, -0.42)(^c)</td>
</tr>
<tr>
<td>Low-SES</td>
<td>0.79 (0.45, 1.36)</td>
<td>-0.36 (-0.56, -0.17)(^c)</td>
</tr>
<tr>
<td>Medium-SES</td>
<td>0.51 (0.31, 0.86)(^c)</td>
<td>-0.61 (-0.79, -0.42)(^c)</td>
</tr>
</tbody>
</table>

\(^a\)Intercept = 0.54 (0.37,0.71)  
\(^b\)Intercept = 0.48 (0.32,0.65)  
\(^c\)\(P < 0.01\)
Table 3.13 presents logistic and linear regression analyses for impact prevalence and overall CPQ$_{11-14}$-ISF16 score, respectively. The participant characteristics entered into this model were the same as those entered for dental caries experience. Children from low-SES group were the only variable that showed significant association with the impact prevalence as the dependent variable. When gender alone was considered, boys were 1.37 times more likely than girls to report impacts of their oral conditions on their QoL. Linear regression analysis showed that, of all independent variables, children from low-SES group presented the highest regression coefficient (1.81), signifying a strong contribution to the model. Consistent with impact prevalence, children aged 12-14-year-old showed higher CPQ$_{11-14}$-ISF16 scores than those aged 10-11-year-old. No statistically significant associations between the independent variables and the overall CPQ$_{11-14}$-ISF16 score were observed.

**Table 3.13** Multivariate models for CPQ$_{11-14}$-ISF16 impact prevalence and overall score

<table>
<thead>
<tr>
<th>Impact prevalence (OR)</th>
<th>Overall CPQ$_{11-14}$-ISF16 score$^a$ ($\delta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1.37 (0.93, 2.00)</td>
</tr>
<tr>
<td>12-14-yr-old</td>
<td>1.32 (0.78, 2.23)</td>
</tr>
<tr>
<td>Low-SES</td>
<td>1.89 (1.09, 3.26)$^b$</td>
</tr>
<tr>
<td>Medium-SES</td>
<td>1.39 (0.84, 2.30)</td>
</tr>
</tbody>
</table>

$^a$Intercept = 16.32 (13.75,18.91)  
$^b$P < 0.05
4. DISCUSSION

The short-form CPQ_{11-14} has previously been developed and tested in a clinical convenience sample of children in Canada (Jokovic et al., 2006) and in a population-based sample of schoolchildren in New Zealand (Foster Page et al., 2008). To date, there are no systematic OHRQoL studies of a large population-based sample of children in Brunei. In particular, the OHRQoL of primary schoolchildren, who are the main target group for dental health services, has not been assessed. This study aimed to produce a Malay version of the short-form CPQ_{11-14}, and to evaluate its validity and reliability in a sample of schoolchildren in Brunei. Prior to investigation of its validity and reliability, the CPQ_{11-14} was translated, back-translated, and cross-culturally adapted in order to ensure its conceptual and functional equivalence.

Overall, these data suggest that the Malay short-form CPQ_{11-14} has excellent reliability, with values for internal consistency and test-retest reliability which are higher than those found in the original Canadian study. Construct validity was acceptable in relation to participants’ personal assessment of life overall and global oral health rating. The relationship between CPQ_{11-14} summary measures and dental caries experience appears to be acceptable, showing higher mean scores among children with greater dental caries experience. However, the relationship between mean CPQ_{11-14} scores and malocclusion is unexpected, showing a descending gradient across the malocclusion categories; that is, there were higher overall scores among children with no orthodontic treatment indicated.

4.1 The strengths and limitations of the study

Before discussing the findings, it is appropriate to consider the study’s strengths and limitations.

4.1.1 The study’s strengths

The present study has several strengths; these include: population-based rather than clinical sample, high participation rate, both clinical examination and a self-report OHRQoL scale were used, and examination of reliability.
Population-based sample

The sample for the present study was not a convenience sample of patients with a particular oral condition, as has been the case in most previous testing of the CPQ11-14 questionnaires. In contrast, this study aimed to obtain a more diverse sample of the general population. Validation of short-form measures of the CPQ11-14 at the population level is important, as clinical samples may give a misleading picture of their utility because of the biased nature of the sample (Locker, 2000).

High participation rate

Another strength of the present study is its high participation rate of 80.3%, which is higher than those obtained in other previous population-based studies on epidemiological validation of the CPQ11-14 (Table 4.1). The current study’s participation rate would be termed as ‘good’ using guidelines described by Locker (2000): rates of 80% or greater are described as being ‘good’, 70-79% as ‘acceptable’, 55-69% as ‘suspect’ and 55% or less as ‘unacceptable’. The number of participants involved is also the second highest than that used in any previous studies. This study required participants to commit time and effort to participate. They were therefore offered a small compensation as encouragement which of course could have some effect, especially to increase participation. The risk that the compensation influenced the answers to the CPQ11-14 is neither plausible nor likely.

Table 4.1 Response rates from population-based studies on epidemiological validation of the CPQ11-14

<table>
<thead>
<tr>
<th>Authors</th>
<th>Country</th>
<th>Response rate</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foster Page et al (2005)</td>
<td>New Zealand</td>
<td>74.1 %</td>
<td>430</td>
</tr>
<tr>
<td>Do and Spencer (2008)</td>
<td>Australia</td>
<td>65.7 %</td>
<td>468</td>
</tr>
<tr>
<td>Present study (2010)</td>
<td>Brunei</td>
<td>80.3 %</td>
<td>457</td>
</tr>
</tbody>
</table>
Clinical examination and self-report OHRQoL data

This study is the first to use both clinical indicators of oral health status and a multi-item self-report OHRQoL scale in Brunei. Two previous national oral health surveys included only the clinical status of oral diseases. Subjective assessments of oral health helped in the assessment of the impact of oral health problems on children’s physical, social, and psychological well-being. Clearly, knowing how much of an impact the various oral conditions make on Brunei children would help the Ministry in the evaluation of services’ effectiveness and also to prioritise its oral service delivery, thus ensuring that scarce oral health resources can be used to maximum effect. In addition, the design of this study was similar to that of other previous epidemiological validation studies of the short-form CPQ11-14; that is, the same age group was examined and all studies used both clinical examination and a self-report CPQ11-14. Thus, the general approach is consistent with that of those earlier studies.

Reliability

The other strength of this study was the inclusion of the examination of reliability: how repeatable were the data? It is the norm in oral health surveys to re-examine a proportion of participants so that the researcher can compare the measurements taken, not only by different examiners, but also among the different sets of data captured by individual examiners. Prior to data capture, ARM underwent a calibration session with an experienced dental epidemiologist (LFP), resulting in inter-examiner intraclass correlation coefficients (ICC) of 0.99 for the DAI score, and 0.96 for DMFS. Intra-examiner reliability was investigated by conducting replicate examinations on 48 individuals. An ICC of 0.94 was obtained for the DAI score, and 0.94 for DMFS. This suggests strongly that the clinical examinations were reliably conducted. The ICC on repeated application of the Malay short-form CPQ11-14 was 0.94, suggesting excellent test-retest reliability (section 4.3.3.3 discusses further the internal consistency and test-retest reliability of the CPQ11-14).
4.1.2 The study’s limitations

The following limitations should be pointed out; these include: the use of a convenience rather than random sampling, questions over the sample representativeness, the possibility of socially desirable answers, and issues to do with the clinical examinations.

The use of a convenience sample
As with many studies of this type, participants were a convenience sample of schoolchildren and not a random sample, making generalisation problematic. However, this is of secondary importance in tests of validation of a scale, where sampling should be more purposive and related to the needs of each element of the validation process (Streiner and Norman, 2003). In other words, the primary aim was to examine the validity of the CPQ11-14 rather than to obtain population estimates of the impact of oral conditions among young adolescents.

Sample representativeness
Although the current study’s participation rate was good, it does not ensure sample representativeness. Owing to the specific area of the country selected, the major limitation of the present study is that the findings may not be generalisable to the overall population of children in Brunei. Furthermore, given that this study assessed the oral health of children currently in schools provided with a school dental service (SDS), we may have inadvertently selected from a biased cohort of children who may have been dentally healthier than children in schools without access to the SDS. Comparison of the sample’s characteristics with the Brunei child population suggests that the sample was indeed not representative. The most recent Census data in 2001 indicate that the male-to-female ratio for 0-14-year-olds in 2001 as a whole was only slightly higher (51.9% vs. 48.1%) than that of the schoolchildren included in this study (48.1% vs. 51.9%). Moreover, the 0-14 age group Brunei population has 66.8% Malay, 11.1% Chinese and 22.1% Others (Department of Statistics, 2001); our sample group comprised 95.0% Malay, 1.3% Chinese, and 3.3% Others, suggesting that Malay were over-represented while Chinese and Others were under-represented in the present study. There were also differences between the sample and the Brunei child population in the proportion in each SES group. According to the 2001 Census data, 10.3% belonged to the high-SES group, 58.2% were medium-SES, and 31.5% low-SES (Department of Statistics, 2001); the study sample comprised 20.8% high-SES, 49.9% medium-SES, and 29.3% low-SES, suggesting that high-SES children were over-represented and those of medium-SES were slightly under-
represented. However, the main objective of the study was to validate the Malay version of the short-form \( \text{CPQ}_{11-14} \), rather than to obtain accurate estimates of population parameters.

Another minor limitation is related to the unequal distribution of age in the main study's sample. While it was intended that the data were collected on children aged 11 to 14 years, more than four-fifths of the sample was in the 10-11-year-old age group. However, the unequal age distribution was not a major problem, as this was a validation study and the sample size was large. Some studies on validation of the \( \text{CPQ}_{11-14} \) have had similar numbers (or even fewer) of participants in some age groups due to smaller sample sizes, although age was more equally distributed in their samples (Jokovic et al., 2002; Marshman et al., 2005; Barbosa et al., 2009). Again, the extent to which this compromises the study findings is unknown.

**Socially desirable answers**

All demographic and behavioural data collected were based on self-administered questionnaires. While all of the children responded to all \( \text{CPQ}_{11-14} \) questions, given that these were young adolescents, they may have given "socially desirable" answers or could have misinterpreted a particular question altogether. Social desirability and recall bias are known to be important sources of response bias and are likely threats to the validity of self-reported data. For example, an affirmative response to the question "Avoided smiling or laughing when around other children?" could reflect normal behaviour in some Asian societies where it is boorish to display teeth, but anxiety in Caucasian societies where there is a disturbing preoccupation with dental appearance (MacEntee, 2005).

**Clinical examinations**

Though the test-retest reliability data from the caries and malocclusion examinations were very good, the internal validity of the results can be questioned, as dental caries might have been misclassified and under-reported in the present study. The reasons for under-reporting were mainly that: the dental examinations were not performed under ideal clinical conditions; the study was conducted under field conditions without cleaning and drying of the teeth; and only a dental mirror, disposable millimetre ruler and lamp were used in the screens, without the aid of radiographic examinations. Nevertheless, in order to ensure high standards in the dental caries and malocclusion examinations, calibration exercises were performed prior to
the start of the fieldwork. Moreover, the diagnostic criteria selected for this study were based on the guidelines adopted by the WHO (1997), so as to make the data globally comparable.

4.2 The instrument

This section first discusses the reasons for choosing the CPQ_{11-14}, and then discusses the cross-cultural adaptation process.

4.2.1 Reasons for choosing the CPQ_{11-14}-ISF16

As described in Section 1.7, the only measures currently available for children are the Child Oral Health Quality of Life (COHQOL\(^\copyright\)), the Child Oral Health Impact Profile (COHIP) and the Child-Oral Impacts on Daily Performances (Child-OIDP). This study used a short-form version of the CPQ\(_{11-14}\), which has been demonstrated to be a valid and reliable instrument; it has relatively few items and is able to capture all of the dimensions related to OHRQoL, particularly in very young populations (Jokovic et al, 2006). The Child-OIDP was developed to detect only the ultimate impacts of dental conditions on daily performance and so is relatively insensitive to minor oral impacts. For this reason, it may be less useful as a discriminative measure of OHRQoL than the CPQ\(_{11-14}\), which is apparently more sensitive and precise (Masalu and Astrom, 2003; Robinson et al, 2003). On the other hand, there is yet no shorter version of the COHIP. The current COHIP instrument is lengthy, and it requires that both parents and children record responses, two features that were impossible to accommodate in the present study.

The 16-item short-form versions of the CPQ\(_{11-14}\) were previously developed by Jokovic et al (2006) using (a) item impact and (b) regression methods. The CPQ\(_{11-14}\)-ISF16 and CPQ\(_{11-14}\)-RSF16 are very similar, as they share 14 of their 16 items. A number of authors consider that measures derived from the item impact method are more appropriate than those derived from the regression method because the former method selects items of greater importance \(\tilde{\alpha}\) those that identify a greater impact on individuals (Coste et al, 1997; Juniper et al, 1997; Awad et al, 2008). It has also been suggested that the best short-form version for a population survey may be a measure consisting of items with the highest impact scores (Locker and Allen, 2007). The population-based study by Foster Page et al (2008) confirmed that the item-
impact-derived version performs well. For this reason, the item impact version was used (CPQ11-14-ISF16) for the assessment of reliability and validity in the present study, because of the stronger theoretical basis for the ISF-derived short-form version. However, both versions were able to be used and reported.

4.2.2 Cross-cultural adaptation of the CPQ11-14 into the Malay version

The CPQ11-14 was originally developed in English and, in order to make use of this instrument to measure the OHRQoL of children in Brunei, translation of the instrument was necessary. *Malay* or *Bahasa Melayu* is the official language of Brunei, and, although akin to the Malay language of Malaysia, it differs in colloquialisms and pronunciations. All of the 16 items of the original short-form versions of the CPQ11-14 were retained because of their universality and reported relevance in group discussion among the translators. Thus, the Malay version of the short-form CPQ11-14 produced from this process can be employed in cross-national comparisons because of its similarity to the English-language form.

There was a difficulty in locating native English-speaking back-translators in the present study. This was mainly due to time constraints. Instead for practical reasons, two independent translators who spoke and wrote English fluently were used as back-translators. This illustrates that a thorough cross-cultural adaptation process may be difficult to achieve if there are time or financial constraints. Regardless, the subsequent stages after the back-translation presumably detected any discrepancies that might have occurred in the back-translation process. However, it is important to acknowledge that it may have been more appropriate to use someone whose mother tongue is English.

The rephrasing of the CPQ11-14 questions made the translation culturally relevant to the local population, such that the participants were able to understand the questions without altering the meaning of the questions. However, a number of questions caused minor problems during the translation process; for example, *How often have you had a hard time biting or chewing food like apples, corn on the cob...* because *corn on the cob* is not a popular dish in Brunei. However, it was decided to retain *corn on the cob* in the question to make the translated version similar to the original; the word *biting* was omitted in the Malay version as it was thought that the use of both *biting* or *chewing* could leave children with a dilemma to either ignore one activity or the other, or to average out their problems by
selecting a middle response option. In order to facilitate the translation of the English version of the CPQ_{11-14} into a culturally relevant Malay version, a pilot study was conducted. Only one question “How often have other children teased you or called you names…” was misunderstood, and subsequently changed which resulted in the back-translated version “How often have other children teased you or called you irritable names…”.

Although some questions contained built-in problems, such as in the above examples, the present study found that all of the questions could be used in the Malay context. When comparing the backward-translated and the original English versions of the CPQ_{11-14}, most of the backward translated questions were worded exactly as the original ones. For those not having the exact same wording, the meanings were similar. More importantly, though, these procedures, and the respective changes, highlighted the challenges involved when applying subjective instruments in different cultural settings. In this study, it seems that the cross-cultural adaptation process was successful.

4.3 The findings of the study

There will be three main parts to this section: the occurrence of dental caries, the prevalence of malocclusion, and the study findings with respect to the Malay short-form CPQ_{11-14}. The discussion also compares the findings of this study with those of a number of key reports from the dental literature. Each will be discussed under appropriate headings.

4.3.1 The occurrence of dental caries

This section discusses the prevalence of dental caries in the deciduous and permanent dentition, and then examines the prevalence of untreated decayed surfaces in either dentition.

4.3.1.1 Deciduous dentition – prevalence

Declining caries prevalence and possible factors contributing to the caries reduction have been reported in other countries (Burt, 1994; Marthaler, 1994; Downer, 1995). Although some studies have found a levelling out of caries reductions in the deciduous dentition (Burt, 1994; Downer, 1994), in most of the developing countries in Southeast Asia, children were found to
have a high prevalence of caries in the deciduous dentition, in contrast to lower caries experience in the permanent dentition (Holm, 1990). This situation is not observed in the present study of Bruneian schoolchildren, the findings of which suggest that caries experience (both prevalence and severity) has declined in both deciduous and permanent dentitions, and that caries experience in the permanent dentition was higher than in the deciduous dentition (44.4% vs. 34.6% respectively). Children from the high-SES group had, on average, higher caries experience than the other two SES groups. Unfortunately, there are no previous reports on the risk factors of dental caries among schoolchildren in Brunei. However, according to Majid et al (1987), dental caries among schoolchildren in Malaysia is increasing and they blame the situation on easy access to confectionery and soft drinks. It would be expected that the situation in Brunei would be similar, as both countries share common cultural and lifestyle factors. It could explain the high caries experience among children in the high-SES group.

4.3.1.2 Permanent dentition – prevalence

More than two-fifths of the children in the current study had had permanent dentition caries experience, with a mean of 2.0 surfaces affected per child. Previous two national oral health surveys reported that the DMFT score for this age group in 1987 (Department of Dental Services, 1987) and 1999 (Department of Dental Services, 1999) was 4.9 and 4.8 respectively, about 3 teeth higher than the figure in the current study. This suggests a dramatic fall in DMFT in this age group (Figure 4.1). While it is difficult to compare findings because of sampling and clinical examination differences, the data suggest that, in the 11 years since the last national oral health survey, caries severity has decreased substantially. The decline in permanent dentition caries prevalence may be attributed to the effect of: water fluoridation which was introduced in 1987; an increase in the use of fluoridated products such as toothpastes; adoption of preventive dental health programmes by the government; and an increase in ‘dental awareness’ associated with a better educated population (although there is currently no evidence for the latter). Provision of free school-based dental care with an emphasis on preventive programmes has played an important role in promoting good dental health among schoolchildren in Brunei.
The findings in the permanent dentition were also comparable with 12-year-old DMFT values from other Southeast Asian Nations (Table 4.2). The DMFT index of 1.2 in the present study also compares favourable to those attained by other developed countries: 1.5 in New Zealand, 1.7 in Japan, and 3.1 in the Republic of Korea (CAPP database). The DMFT included in the estimation were the most recent values presented in the CAPP database. For some countries, the data are fairly old, as epidemiological studies are not performed annually. However, it should be said that the values represent the best information available to the CAPP database.

There were no significant differences in permanent dentition caries experience by gender or SES group, but there was a difference by age group, whereby it was higher among the older children. Dental caries is a multifactorial disease, and the teeth of the older group had been exposed to risk and protective factors for longer periods than in the younger group. In the present study, children from medium-SES had greater caries severity on average. These findings differ from the patterns reported in other international literature, whereby the children from low-SES group are associated with greater caries experience (Thomson et al, 2002; Thomson, 1993; Treasure and Dever, 1994; Kallestal and Wall, 2002; Mandall et al, 1998; Pitts et al, 2002; Chen, 2002; Edelstein, 2002).

Figure 4.1 Comparison of mean DMFT at age 12 with previous oral health surveys

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4 http://www.whocollab.od.mah.se/
Table 4.2 Dental caries status of ASEAN countries (ranked according to DMFT level)

<table>
<thead>
<tr>
<th>Countries</th>
<th>Population (Million)</th>
<th>Year</th>
<th>Mean DMFT (at age 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philippines</td>
<td>86.3</td>
<td>2005-06</td>
<td>2.9</td>
</tr>
<tr>
<td>Indonesia</td>
<td>228.9</td>
<td>1995</td>
<td>2.2</td>
</tr>
<tr>
<td>Vietnam</td>
<td>86.2</td>
<td>2001</td>
<td>1.9</td>
</tr>
<tr>
<td>Thailand</td>
<td>63.4</td>
<td>2006</td>
<td>1.9</td>
</tr>
<tr>
<td>Laos</td>
<td>5.8</td>
<td>2006</td>
<td>1.8</td>
</tr>
<tr>
<td>Malaysia</td>
<td>26.1</td>
<td>1997</td>
<td>1.6</td>
</tr>
<tr>
<td>Brunei (current study)</td>
<td>0.4</td>
<td>2010</td>
<td>1.2</td>
</tr>
<tr>
<td>Cambodia</td>
<td>14.2</td>
<td>2003-07</td>
<td>1.1</td>
</tr>
<tr>
<td>Myanmar (Burma)</td>
<td>48.4</td>
<td>1999</td>
<td>1.0</td>
</tr>
<tr>
<td>Singapore</td>
<td>4.4</td>
<td>2002</td>
<td>1.0</td>
</tr>
</tbody>
</table>


4.3.1.3 Untreated decayed surfaces in either dentition - prevalence

The present study also assessed the prevalence of untreated decayed surfaces in either dentition. Of 457 children examined, about 45% had at least one untreated caries surface, and about one-fifth had 4 or more decayed surfaces in either dentition. Overall, these findings indicate that the prevalence of untreated dental caries among this cohort of Brunei schoolchildren was high despite the free dental care provided through the SDS. The parent-occupation-based SES measure also showed a distinct gradient in the prevalence of untreated decayed surfaces, with children from the low-SES group having the highest prevalence of untreated decayed surfaces in either dentition. However, given that Brunei has a system of universal health care coverage which includes basic dental care, insurance is usually not a factor in health care coverage and the prevalence of untreated dental caries should (in theory) be more or less consistent across the SES groups. In the current study, the bulk of treatment need (as expressed by the decay component) was in the deciduous dentition (Figure 3.1). This suggests a need to extend dental health care with a strong prevention component downwards to pre-school children to prevent and control dental caries in the deciduous dentition. An extension of such programmes to all pre-school children could potentially reduce caries in addition to the effects of water fluoridation.

In summary, the permanent caries experience of the sample was low in comparison to the findings of previous two national oral health surveys, and comparable with 12-year-old
DMFT values from other ASEAN countries. The low caries experience of the sample was reflected in the mean DMFT of 1.2, of which the decayed and filled components made substantial contributions towards that experience in most participants. The relatively high number of participants with untreated decayed surfaces in either dentition (44.9% overall), despite the free dental care provided through the SDS, suggests that preventive programmes in promoting good oral health should be extended to pre-school children.

4.3.2 Malocclusion

This section first discusses the mean DAI score by sociodemographic characteristics, and then compares the mean DAI score and treatment need categories with those of a number of key reports from the dental literature.

4.3.2.1 Malocclusion and sociodemographic characteristics

In the current study’s sample, boys had a significantly higher mean DAI score than their female counterparts. This study’s findings on sex differences in malocclusion agree with those of several previous investigations which have found that males have a higher mean DAI score than females (Esa et al, 2001; Spencer et al, 1992; Johnson and Harkness, 2000; Estioko et al, 1994). However, although the difference in mean scores was statistically significant, it was still minor, and its clinical significance remains unclear.

The mean DAI scores across SES groups were very similar, confirming that the need for orthodontic treatment is not related to any SES factors per se; that is, there is no evidence in this study that poorer people have worse malocclusions. This is similar to the findings reported by Foster Page (2004) and O'Brien et al (2006), in which mean DAI scores were unrelated to socioeconomic status.

4.3.2.2 Comparison of mean DAI score with other studies

The study findings indicated that schoolchildren in Brunei had significantly higher mean DAI scores than those found by Esa et al (2000) in a random sample of schoolchildren in Malaysia (31.4 and 24.6 respectively; P < 0.0001; one-sample t-test). Differences in mean DAI scores could be attributed to differences in sample sizes and ethnic compositions between the two
studies. The proportions of Malay, Chinese and Indians in a study by Esa et al (2000) were more or less equal, whereas the present study comprised children of predominantly Malay ethnic origin. The mean DAI scores among Bruneian schoolchildren were also higher than those of South Australians, Caucasian Americans, Poles, New Zealanders and Japanese students, as depicted in Table 4.3. Differences in DAI scores observed between countries could be attributed to genetic predisposition, cross-cultural differences in living standards, or variations in growth, facial skeleton development and occlusion. The mean age of the sample in the present study (11.1 years) is lower than that reported in any previous studies, and this could also explain the higher DAI scores recorded. The tendency for the DAI to overestimate treatment need is greater in the mixed dentition, because many children have temporary occlusal conditions, such as an edge-to-edge molar relationship, incisal spacing, or diastemata, all of which attract a score but may improve spontaneously in the transition to the permanent dentition (Johnson et al, 2000). Moreover, many children in this study had missing teeth due to their being in the mixed dentition; however, this was taken into account by asking the child about the missing teeth, and it is hoped that this adjustment helped to ameliorate some of that disadvantage.

Table 4.3 Comparison of findings from studies of malocclusion using the DAI

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Sample size</th>
<th>Age (yrs)</th>
<th>Mean DAI score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Native Americans</td>
<td>485</td>
<td>7-12</td>
<td>31.8</td>
</tr>
<tr>
<td>Spencer et al (1992)</td>
<td>Caucasian (South Australia)</td>
<td>5,000</td>
<td>13</td>
<td>28.1</td>
</tr>
<tr>
<td>Chen et al (1997)</td>
<td>Poles (Lodz)</td>
<td>1,000</td>
<td>12-13</td>
<td>24.5</td>
</tr>
<tr>
<td></td>
<td>Maori</td>
<td>88</td>
<td>12-13</td>
<td>26.8</td>
</tr>
<tr>
<td>Present study (2010)</td>
<td>Bruneians (Malay, Chinese, Others)</td>
<td>457</td>
<td>11-14</td>
<td>31.4</td>
</tr>
</tbody>
</table>
4.3.2.3 Comparison of treatment needs categories with other studies

Using the ‘definite’ and ‘severe/handicapping’ treatment need categories, about three-quarters of the children examined in the present study would be deemed to require orthodontic treatment based on their DAI score. The ‘definite’ malocclusion category implies that treatment is ‘elective’ whereas the ‘severe’ and ‘handicapping’ categories imply that treatment is ‘highly desirable’ and ‘mandatory’ respectively. This estimate appears to be high in comparison to the findings of Esa et al (2000), where only 38% of 1,512 participants were deemed to require some form of orthodontic treatment. Another Malaysian DAI study found that 49% of 12-13-year-olds required treatment using the ‘definite’, ‘severe’ and ‘handicapping’ categories. If only the ‘severe’ and ‘handicapping’ categories were included, 24% of the children were determined to be in need of treatment (Abdullah and Rock, 2001). In the Brunei sample, limiting the threshold to the ‘severe’ and ‘handicapping’ categories resulted in 39% requiring orthodontic treatment, which is higher than the estimate of Abdullah and Rock (2001). This estimate also appears to be higher than that reported by Foster Page et al (2005) where only 28% of 430 participants had a severe/handicapping malocclusion and Jenny and Cons (1996), who reported 29%. Again, these differences observed between countries could be attributed to genetic predisposition and cross-cultural differences.

In summary, it is difficult to compare findings from studies of malocclusion using the DAI because of differences in sample size and setting, but it appears that the DAI scores from Brunei sample were considerably greater than those of other studies. The differences observed might be because of genetic predisposition and cultural differences, or perhaps because the children in the present study were from a population-based setting where most of the children had not started orthodontic treatment.
4.3.3 The Child Perceptions Questionnaire (CPQ\textsubscript{11-14})

The first two parts of this section discuss briefly the mean CPQ\textsubscript{11-14} by sociodemographic characteristics, and then compares the mean CPQ\textsubscript{11-14} and the prevalence of oral impacts with other CPQ\textsubscript{11-14} validation studies. The other two parts of this section discuss two main issues of the present study. First, is the CPQ\textsubscript{11-14} a good measure for use in Brunei? Secondly, what are the study findings with respect to caries and malocclusion?

4.3.3.1 Mean CPQ\textsubscript{11-14} and sociodemographic characteristics

The present study suggested that mean scores of the 2 short-form versions of the CPQ\textsubscript{11-14} vary according to the characteristics of the child. In the present study, the mean CPQ\textsubscript{11-14-16} scores were almost the same for boys and girls, suggesting that there were no apparent sex differences in the effect of oral health on their QoL. The data from the regression analysis also reinforced these findings where there were no differences between sexes in terms of overall CPQ\textsubscript{11-14-16} score. Interestingly, boys were 1.37 times more likely than girls to report impacts of their oral conditions on their QoL. This finding is in contrast to the findings of O'Brien et al (1996) and Burden (1995), who found that girls were more likely to report negative oral impacts on their OHRQoL than were boys, and they suggested that girls have greater aesthetic concerns than boys. In the Foster Page et al (2008) study, the mean CPQ\textsubscript{11-14-16} score was higher for girls than for boys. One explanation for these variations may relate to the differences in the sample characteristics between the Foster Page et al (2008) study and the present study, and the different sampling approaches used in those two studies.

With regard to age, 12-14-year-old children showed higher CPQ\textsubscript{11-14-16} scores than 10-11-year-olds, although it did not reach statistical significance. The multivariate model explaining the mean CPQ\textsubscript{11-14-16} also indicated that the older age group was 1.32 times more likely to report impacts on their QoL as a result of oral diseases and disorders. This suggests that older children were more likely to report an effect of oral disease/disorder on their lives as a whole. That may be because perceptions about life change as people mature. Studies that have examined the child's concept of health have clearly demonstrated that it changes as he or she matures (Natapoff, 1978; Hergenrather and Rabinowitz, 1991). In particular, older and more cognitively mature children conceptualise illness in terms of specific symptoms and diseases rather than using a global, non-specific understanding (Natapoff, 1978; Hergenrather and
Rabinowitz, 1991; Millstein et al, 1981), and older children are more aware of psychological, emotional, and social implications of illness than younger ones (Bibace and Walsh, 1980). Thus, the age differences seen in the present study most likely represent different life stages, or perhaps the older children in this sample have more permanent caries experience than the younger children that may account for some of the age differences.

Low-SES children had higher scores on the CPQ11-14-ISF16 than children from high-SES groups, indicating poorer OHRQoL. Furthermore, low-SES remained a predictor of higher impact prevalence after controlling for the potential confounding effects of other sociodemographic characteristics ($P < 0.05$). Socioeconomic disparities in OHRQoL in a group of children were also found by Locker (2007), who found that children from low-income households had higher impacts on QoL than children from high-income households, indicating poorer OHRQoL. The links between socioeconomic status and health outcomes have been explained in three ways (Sanders and Spencer, 2005). First, income has a direct effect on the ability to access goods, services, and other resources that promote health. Second, there is an indirect mechanism in terms of differential exposure to risk factors and health behaviours. Third, the relationship between socioeconomic status and health outcomes may be the outcome of differences in psychological assets and psychosocial resources. Thus, given that Brunei provides free dental care through the SDS, the SES differences seen in the present study most likely represent differences on the ability to access goods that promote oral health, or differential exposure to risk factors and health behaviours.

In summary, although a number of studies have indicated that the mean CPQ11-14 scores are influenced by the patient’s characteristics, this finding should be regarded as tentative and not definitive. Further research needs to be conducted using larger samples recruited from different locations in order to elaborate on the findings reported here and to determine the characteristics of children that influence OHRQoL and therefore mean CPQ11-14-ISF16 scores.
4.3.3.2 Comparison of mean CPQ\textsubscript{11-14} and the prevalence of oral impacts with other studies

As the short versions of the CPQ\textsubscript{11-14} were only developed recently, the comparison of the results obtained in the present study is hindered by the lack of studies that have validated and administered the CPQ\textsubscript{11-14}-ISF16 and CPQ\textsubscript{11-14}-RSF16. In the present study, the mean CPQ\textsubscript{11-14}-ISF16 and CPQ\textsubscript{11-14}-RSF16 scores were 16.8 and 16.7, respectively. The mean scores were almost two times higher than those obtained in the Foster Page \textit{et al} (2008) study (mean = 9.6 for the CPQ\textsubscript{11-14}-ISF16 and 9.6 for the CPQ\textsubscript{11-14}-RSF16 respectively). This finding is also slightly higher to that described during the development and validity of the original short-forms (Jokovic \textit{et al}, 2006; Figure 4.2). The observed variation might be attributed to differential perceptions of oral health or to reporting biases. Although the Bruneian and New Zealand populations included in the study were derived from school-based surveys and were similar in gender mix, they may well have differed in other ways, such as age and socioeconomic status. The Bruneian children, for example, came from schools in a medium-SES area whereas the New Zealand children comprised a socioeconomically representative sample of the Taranaki population. In addition, comparisons between these studies must be made with care because the responses of individuals will be partly determined by their culture.

\textbf{Figure 4.2} Mean CPQ\textsubscript{11-14} scores by population
That the sample was drawn from the general population (that is, not from a clinical sample) was reflected in the findings with the CPQ\textsubscript{11-14}. Minimum scores were observed in 1.1\% of participants for the CPQ\textsubscript{11-14}-ISF16 and 1.3\% of participants for the CPQ\textsubscript{11-14}-RSF16. There were no children with the maximum score for either version. This is probably indicative of the participants having genuinely low levels of problems. The lower floor effect for the item-impact derived version means that the CPQ\textsubscript{11-14}-ISF16 would be of more value in clinical practice, clinical trials, and evaluative studies because it is better able to detect clinically meaningful change. This was also shown in a study by Foster Page \textit{et al} (2008): the item-impact-derived version showed greater sensitivity to change and lower floor effects than the regression-derived version (1.6\% vs. 1.9\% respectively). For this reason, the item impact version was used (CPQ\textsubscript{11-14}-ISF16) for the assessment of reliability and validity in the present study, which will be discussed further in the next section.

The prevalence of oral impacts experienced during the past three months by the sample was less than half (44.4\%). This is not surprising, in that this was a low caries population in an area with a free accessible SDS. Although there is no study using an OHRQoL measure with a population-based sample of 11-14-year-olds in Brunei with which to compare this, findings of previous OHRQoL studies using other COHRQoL measures suggest that oral impacts are very common in children of this age. The prevalence of impacts was 32\% in Brazilian adolescents (Goes, 2001; Cortes \textit{et al}, 2002) and 62\% in Uganda (Astrom and Okullo, 2003). In studies of child populations using single items rather than scales, an 88\% prevalence of dental pain was reported in South African 8-10-year-old schoolchildren (Naidoo \textit{et al}, 2001), and 73\% of New Zealand children with good oral status had at least one dental symptom in the past year (Chen and Hunter, 1996). The present study\textregistered estimate was also lower than the 60.1\% reported in Malaysian children who also had good oral status and received successful SDS care (Jaafar, 1999). A study using the CPQ\textsubscript{11-14} index with paedodontic patients found that all the children had experienced oral impacts in the previous three months (Jokovic \textit{et al}, 2002).

In summary, the mean CPQ\textsubscript{11-14} of both versions was higher than those observed in the Canadian and New Zealand study. On the other hand, the prevalence of oral impacts among Bruneian schoolchildren was lower than findings from studies of COHRQoL using other children\textregistered measures. The study reported here also suggested that both short-form versions perform reasonably well; however, the lower floor effect for the item-impact derived version
means that the CPQ_{11-14}-ISF16 would be of more value in clinical practice, clinical trials, and
evaluative studies.

4.3.3.3 Is the CPQ_{11-14} a good measure for use in Brunei?

The main objective of the present study is to answer the question: is the CPQ_{11-14} a good
measure for use in Brunei? This is a key question which interests any investigator who has
cross-culturally validated this measure. This section will discuss 2 issues in relation to Malay
short-form CPQ_{11-14}. First, is it a valid measure: does it actually measure what it was intended
to measure? Secondly, is it a reliable measure: how repeatable were the data?

Is it a valid measure?
The findings presented in this study suggest that the Malay short-form CPQ_{11-14}-ISF16 is a
valid instrument for measuring OHRQoL in 11-14-year-old Bruneian children. Since no ‘gold
standard’ for measuring OHRQoL exists, a global self rating of oral health has been suggested
as a proxy gold standard because it is simple and yet a powerful measure of oral health
(Jokovic et al., 1995). The Malay short-form CPQ_{11-14}-ISF16 demonstrated good construct
validity, since it was significantly associated with global ratings of the children’s oral health
and overall well-being in the hypothesised direction, that is, the mean scale scores should be
higher among those who report poor OHRQoL using the global measure. The mean CPQ_{11-14}-
ISF16 scores showed a consistent gradient across the categories of self-reported oral health.
This consistent gradient is an interesting and strong finding, because rather than merely
observing a difference in CPQ_{11-14} scores between the worse off and the rest of the population,
there were appropriate gradients in the aforementioned associations, therefore highlighting the
close relationship between OHRQoL and self-reported oral health. The score gradients across
the categories of self-rated oral health were almost similar in magnitude to those observed
across the categories of the impact of oral health on QoL, with the only exception being the
mean score for those who responded ‘very much’ which was lower than expected instead of
being the highest. This was also shown in a study by Foster Page et al (2008): the mean
CPQ_{11-14}-ISF16 score for those who responded ‘very much’ was lower than those who
responded ‘a lot’ (Figure 4.3). This may simply be so because it can be semantically difficult
to distinguish between ‘a lot’ and ‘very much’ moreover, this may be unique to the Brunei
and New Zealand samples, or it may be due to the translation process. It is currently not
possible to tell.
This finding is in agreement with the original study on the short-forms by Jokovic et al (2006) and in a population-based study by Foster Page et al (2008). Both these studies demonstrated positive and significant associations with both global questions, so the smaller number of items in the 16-item did not diminish the measures’ construct validity. The differences observed with the global questions showed that the items in the questionnaires address issues and concerns that go beyond oral health and are of sufficient magnitude to have some effect on life as a whole (Locker and Allen, 2007) and are present regardless of whether it is being studied at a population level or at a clinical level. In the present study, mean CPQ_{11-14}-ISF16 score differences were greater for ‘self-rated oral health’ than for ‘impact on quality of life’ which is similar to the findings by Foster Page et al (2008), but opposite to what was reported in the study by Jokovic et al (2006). This may relate to the global rating of oral health being closer to construct of OHRQoL than the global rating of overall well-being in the present study.

Is it a reliable measure?
The Malay short-form CPQ_{11-14}-ISF16 also seems to be a reliable instrument for measuring OHRQoL in 11-14-year-old Bruneian children. Forty-eight children completed the Malay short-form CPQ_{11-14} two times and provided data for the assessment of test-retest reliability.
The internal consistency and test-retest reliability of the Malay short-form CPQ\textsubscript{11-14-ISF16} were both excellent, with a Cronbach\textalpha{} alpha and intraclass correlation coefficient (ICC) of 0.97 and 0.94, respectively.

Internal consistency (as assessed by Cronbach alpha values) examined the extent to which a number of items addressing the same concept are actually doing so, and this was tested for the overall scale (Cronbach, 1951). Cronbach\textalpha{} alpha coefficient for the total scores (0.97) revealed excellent homogeneity of the items on the Malay CPQ\textsubscript{11-14-ISF16}. This finding is higher than that described during the development and validity of the original short-forms (0.83; Jokovic \textit{et al}, 2006) and that validated in New Zealand (0.86; Foster Page \textit{et al}, 2008), whereas the original study on the full length version of the CPQ\textsubscript{11-14} achieved a value of 0.91 (Jokovic \textit{et al}, 2002). In subsequent validation of the full length version, the results were 0.87 in the U.K (Marshman \textit{et al}, 2005), 0.81 in Saudi Arabia (Brown and Al-Khayal, 2006), 0.86 in Brazil (Goursand \textit{et al}, 2008), 0.89 in Hong Kong (McGrath \textit{et al}, 2008) and 0.87 in Denmark (Wogelius \textit{et al}, 2009).

Test-retest reliability is the degree of agreement between two measurements taken at two different points in time using the same scale and with the same respondents; this provides an estimation of the degree to which the results are reproducible (Altman, 1999). The test-retest reliability for the Malay translation was excellent (ICC = 0.94), which was stronger than during the development and validity of the original short-forms (0.77; Jokovic \textit{et al}, 2006). Test-retest reliability was not assessed in the New Zealand study (Foster Page \textit{et al}, 2008). The ICC value obtained in the present study was also higher than the values obtained in any previous validation of the full length version of the CPQ\textsubscript{11-14}: 0.90 in Canada (Jokovic \textit{et al}, 2002), 0.83 in the U.K (Marshman \textit{et al}, 2005), 0.65 in Saudi Arabia (Brown and Al-Khayal, 2006), 0.85 in Brazil (Goursand \textit{et al}, 2008) and 0.88 in Hong Kong (McGrath \textit{et al}, 2008).

In most previous validation studies, the children fill in the questionnaire a second time 2-3 weeks later, but this was not feasible in the present study due to time and logistical constraints. Therefore, a compromise arrangement was devised by which the children were asked to do the retest near the end of the examination session. As a result, the time between filling the first and second questionnaire was very short. Consequently, this may have accounted for the high test-retest reliability. This is one of the limitations of the study. In
future studies, a strategy should be developed to standardise the time between completions of the test and retest.

Overall, all things considered, the translated Malay version of CPQ_{11-14} showed good construct validity and excellent reliability, and it could be used as a valuable instrument for measuring OHRQoL for the Bruneian children. While further testing of the measure is warranted, these data provide initial evidence that it has good technical properties.

4.3.3.4 The study findings with respect to caries and malocclusion

Discriminant validity was determined by comparing scores between caries experience and measures of occlusal traits using DAI scores. Caries and dental appearance are frequently used indicators of oral health and relate to OHRQoL. Use of these two clinical indicators in the evaluation of the CPQ_{11-14}-ISF16 helped increase the transferability of the study findings.

Mean CPQ_{11-14}-ISF16 scores and caries prevalence

The CPQ_{11-14}-ISF16 showed acceptable discriminant validity, despite the sample being a general sample rather than a sample of children with a specific oral condition. Analysis within caries prevalence in both dentitions was not statistically significant but provided some evidence to suggest that the CPQ_{11-14}-ISF16 scores were associated with the severity of this clinical condition in an expected direction. There was an ascending gradient with the number of untreated decayed surfaces in either dentition and the mean CPQ_{11-14}-ISF16 score (Figure 4.4), revealing that the CPQ_{11-14}-ISF16 was capable of clinically discriminating among children with different caries experience. The difference between groups was not statistically significant. A potential explanation may be the low disease levels in the sample. However, there was a significant association between impact prevalence and the number of decayed tooth surfaces in either dentition, indicating more child impact with more extensive untreated decay. This association can be explained as caries can cause pain and discomfort as well as time and financial problems for the family. Interestingly, these impacts occurred in children who have excellent access to SDS. It may be that this measure is very sensitive or that the novelty of research in these schoolchildren heightened the sensitivity of the children to their mouths. However, these data provide evidence of need for dental care among these schoolchildren.
Figure 4.4 Mean CPQ\textsubscript{11-14}-ISF16 scores by number of untreated decayed surfaces present in either dentition

Earlier validation of the short-form CPQ\textsubscript{11-14} in Canada has used an extreme group approach to compare the level of impacts among children attending different clinics (Jokovic \textit{et al}, 2006). They found that the mean score for children with 10 or more decayed tooth surfaces was higher than for children with fewer than 10 decayed tooth surfaces. The differences were 2.5 for the CPQ\textsubscript{11-14}-ISF16, although the difference was not statistically significant. The other study of a general population sample could detect significant difference only among groups with a high level of caries (Foster Page \textit{et al}, 2008).

Exact comparison with the results of other previous validation studies was difficult due to the use of different indices for evaluating and analysing caries status, and the use of the short-form CPQ\textsubscript{11-14} version in the present study. In validation of the original full length version, Jokovic \textit{et al} (2002) found a strong correlation in the Canadian paedodontic patients between the number of decayed tooth surfaces and overall scale scores ($r = 0.64; P = 0.007$). In Brazil, Goursand \textit{et al} (2008) showed that the long-form CPQ\textsubscript{11-14} was able to discriminate between children with and without untreated dental caries, that is, individuals with untreated caries had higher average total scores than individuals without untreated caries ($P < 0.05$). In the Saudi Arabian study, Brown and Al-Khayal (2006) found significant correlation only between the
DMFT and the oral symptom subscales, but not with other domains (functional limitations, emotional well-being and social well-being) in Arabic children.

The questionnaire has also been tested in the United Kingdom using the DMFT to quantify caries status. There, the investigators were unable to find any association between DMFT and CPQ11-14 scores (Marshman et al, 2005). Because evaluation of QoL is so strongly influenced by personality and standards of reference, poor correlation between clinical ratings and health-related QoL scores is not unusual (O’Connor, 2004). These contradictory outcomes suggest that cultural norms and expectations influence children’s perception of their oral health and its effect on their QoL. In communities where oral problems are widespread, it is possible that self-assessment differs from that in communities where oral health status and opportunities for treatment are better. In this way, studies of the relationship between the number of carious teeth and the OHRQoL are subject to criticism, as a result of the conceptual distinction between health and disease. Hence, while clinical indicators measure disease, OHRQoL indicators concentrate on health and well-being (Locker, 1992; Bowling, 1997). Consequently, although dental caries is relatively prevalent, it may not affect the child’s ability to perform daily activities in its early stages. This implies that the relationship between OHRQoL and clinical indicators should be interpreted with caution, as the inconsistencies found in the relationships between clinical data and OHRQoL may not be due to the psychometric properties of the measures, but due to the fact that impacts are mediated by other factors, such as personal, social, and environmental variables (Wilson and Cleary, 1995).

Mean CPQ11-14-ISF16 scores and malocclusion

It was hypothesised that children with more severe malocclusion would have higher scores. However, this was certainly not the case in the present study, with the gradient demonstrated across categories of orthodontic treatment need in the opposite direction, whereby those in the ‘severe(handicapping)’ category had the lowest and those in the ‘minor/none’ category had the highest mean CPQ11-14-ISF16 score (Figure 4.5). Malocclusion is as much a social phenomenon as an anatomical one, and the DAI was designed specifically to assess the relative social acceptability of dental appearance based upon public perceptions of dental aesthetics. It is surprising that descending gradients were observed (across the ascending DAI treatment-need categories), since being ‘eased’ or ‘avoiding smiling or laughing’ (social well-being) and ‘being upset’ or ‘worrying about being different’ (emotional well-being) are
known to be associated with malocclusion, and are important motivating factors in the uptake of orthodontic treatment (Plunkett, 1997).

![Figure 4.5 Mean CPQ_{11-14}-ISF16 scores by DAI treatment need categories](image)

The present study’s finding is in contrast to the finding by Foster Page et al. (2005), in which there was a distinct ascending gradient in mean CPQ_{11-14} scores across the categories of malocclusion severity, whereby those in the ‘handicapping’ category had the highest and those in the ‘minor/none’ category had the lowest CPQ_{11-14} score, on average. Such a gradient was also observed with respect to the emotional well-being and social well-being domain scores, but not with the other domains. The differences observed could be attributed to differences in the overall sample size, and the distribution of participants and sample sizes across the four treatment need categories. For example, in the Foster Page et al. (2005) population-based study, 39.5% were classified as ‘minor/none’ and 28.4% as ‘severe/handicapping’. In the present study, the corresponding figures were 24.1% and 38.9% respectively. In the Canadian study, they found significant differences within the orthodontic group, whereby those with Class II Division I occlusion had higher mean scores than those with Class I occlusion (Jokovic et al., 2006).
The findings of the present study also did not agree with several previous investigations that malocclusion has a significant impact on the OHRQoL of children as measured using the long-form CPQ11-14 (Kok et al., 2004; O'Brien et al., 2006, Wong et al., 2006; Johal et al., 2007; Brown and Al-Khayal, 2006). Only one study by Marshman et al. (2005) found no relationship between malocclusion and QoL in children. The differences between studies may reflect the difficulties that children may have with the concept of ‘oral health’ in relation to malocclusion (Locker, 2007). Moreover, different meanings of QoL vary between and within individuals (Gregory et al., 2005) according to culture and education (Krause and Jay, 1994), contributing to distinct impacts of malocclusion in OHRQoL. Other explanation for these variations is related to the differences in the characteristics of the selected samples among the studies, and the different sampling approaches used in these studies.

There are two ways in which the lack of a marked difference in OHRQoL of the malocclusion treatment need categories may be explained. First, it could be due to the cultural differences, in that the psychosocial characteristics of the children in Brunei are very different from other cities like Toronto, New Zealand, Saudi Arabia, Hong Kong and Denmark. One possible reason is that the children in Brunei may be more likely to accept their oral condition such that oral problems would not hinder their social life as much as respondents from a Western culture. Second, the results can also be interpreted in terms of the contemporary models of health outcomes as described in Section 1.3.2. The model by Wilson and Cleary (1995) indicates that health outcomes experienced by an individual are not determined only by the nature and severity of the disease/disorder, but also by the personal and environmental characteristics. Locker (1997) suggested that health problems may affect QoL but such a consequence is not inevitable, and that people with chronic disabling disorders often perceive their QoL as better than healthy individuals, that is, poor health or presence of disease does not inevitably mean poor QoL. This leads to the conclusion that, although children with severe/handicapping malocclusion may encounter more challenges in life, their overall QoL is no different from that of children with no malocclusion (or a very minor one).

In addition, most orthodontic conditions are asymptomatic and relate to aesthetics; therefore, generic OHRQoL measures may not be an appropriate instrument in many cases, particularly in relation to treatment needs and outcomes. The CPQ11-14 was not developed specifically to measure the impact of orthodontic problems and some of the questions in the functional and oral symptoms subscales are not necessarily relevant to children with malocclusion. For
example, questions about pain, bad breath, food being stuck in between teeth, and trouble sleeping might not address the concerns of children with malocclusion. Questions in the emotional and social subscales about shyness, embarrassment, being upset, avoided smiling or laughing are more relevant to the problems of malocclusion. Therefore, an OHRQoL measure specific to orthodontics would have the potential to be more responsive or sensitive to differences in malocclusion.

In summary, the findings of the present study suggest that the Malay short-form CPQ11-14 showed good discriminative validity in evaluating the effect of dental caries on COHRQoL in Brunei, but not with malocclusion. Its ability to discriminate between children across malocclusion treatment need categories seems to be limited. However, the relationship between COHRQoL and clinical indicators should be interpreted with caution, since the inconsistencies found in the relationships between clinical data and COHRQoL may be due to the fact that impacts are mediated by other factors, such as personal, social, and environmental variables. Therefore, further data are required from different locations and different patient populations to verify the discriminative properties of the Malay short-form CPQ11-14 and to confirm and extend the findings reported here.
5. CONCLUSION

This is the first study reporting on the psychometric properties of the Malay short-form CPQ_{11-14} and represents a further step toward the validation of the instrument. In conclusion, the Malay version of the short-form CPQ_{11-14} showed acceptable construct validity, excellent internal consistency and test-retest reliability but demonstrated moderate discriminative validity. There were significant associations between the mean CPQ_{11-14}-ISF16 scores and the global ratings of oral health and overall well-being. In addition, the CPQ_{11-14} scale was able to discriminate between different SES and varied significantly according to the number of untreated decayed surfaces in either dentition. However, its ability to discriminate among children across the malocclusion treatment need categories seems to be limited. Three principal explanations may account for the weak relationships between CPQ_{11-14} and clinical data: there were low disease levels in the sample; the conditions under investigation may have cause immeasurably low levels of impact; or the impacts were mediated by a variety of factors such as culture and deprivation (Marshman et al., 2005). Thus, the relationship between the Malay short-form CPQ_{11-14} and clinical indicators should be interpreted with caution, since the inconsistencies found in the relationships between clinical data and OHRQoL may not be due to the psychometric properties of the measure but due to the fact that impacts are mediated by other factors, such as personal, social, and environmental characteristics.

Considering the strengths, limitations, and findings of the present study, the short-form Malay CPQ_{11-14} version appears to be acceptable. This property facilitates its use in oral health surveys to identify children in need of targeted intervention, and it could be used as a valuable instrument for the investigation of OHRQoL in Bruneian children. However, this research is regarded as a first step, with the hope of serving to stimulate alternative thinking for dental professionals in Brunei, so that they might go beyond focusing on the contribution of clinical disease, and consider subjective perception of oral diseases influence on the patients’ lives, in their future studies on QoL. This is of particular importance in Brunei, where clinical oral health investigations are unable to be regularly conducted because of resource (or other) constraints, and may, in turn, help in the developing, testing and monitoring of oral health preventive programmes and encourage more appropriate distribution of oral health resources. By doing so, dental planning will be more closely meet the requirements of patients, and
create a more humane dental environment. It is hoped that this adaptation of the CPQ_{11-14} will also prove to be useful in other Malay-speaking Southeast Asian countries, such as Malaysia, Singapore and Indonesia.

6. FUTURE RECOMMENDATIONS

These are preliminary findings based on convenience sampling. Consequently, the findings reported here may not be generalisable to all children in Brunei. This means that the study needs to be repeated on different samples recruited from different locations in order to confirm the psychometric properties of the Malay short-form CPQ_{11-14}. Moreover, given the cross-sectional nature of the study, the observed findings could address only the descriptive and discriminative potential of the Malay short-form CPQ_{11-14} in relation to child oral conditions. Therefore, future research is required to examine the sensitivity to change of the Malay short-form CPQ_{11-14} in a longitudinal study design. In this sense, the psychometric properties of the Malay short-form CPQ_{11-14} would have been fully evaluated, thus also determining whether it could be useful for clinical trials and in clinical practice as an evaluative measure. This should be the next step in evaluating the Malay short-form CPQ_{11-14}.

It is worth noting that the data collection for the Malay version of CPQ_{11-14} in the present study was through a self-administered questionnaire supervised by the research assistants. The reliability and validity of the Malay version of CPQ_{11-14} when used in studies through face-to-face interviews might be different from those reported in this study. Therefore, it would be interesting to compare the effect of different modes of administration on the validity and reliability of the questionnaire in this patient population. Moreover, a strategy should also be developed to standardise the time between the completion of the test and retest to 2 weeks. The summary of conclusions and future recommendations for this study is provided in Table 6.1.
Table 6.1 Summary of conclusions and future recommendations

<table>
<thead>
<tr>
<th>Conclusions</th>
<th>Future recommendations</th>
</tr>
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<tbody>
<tr>
<td>The Malay short-form CPQ_{11-14} showed:</td>
<td>Larger, population-based epidemiological studies are needed</td>
</tr>
<tr>
<td>Acceptable construct validity</td>
<td>Standardise the time between the completion of test and retest to 2 weeks</td>
</tr>
<tr>
<td>Excellent internal consistency and test-retest reliability</td>
<td>Further research to assess the evaluative properties of the Malay short-form CPQ_{11-14}</td>
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<td>Good discriminative properties in terms of caries prevalence</td>
<td>Compare the effect of different modes of administration on the validity and reliability</td>
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<td>Poor discriminative properties in terms of malocclusion</td>
<td>of the Malay short-form CPQ_{11-14}</td>
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7. REFERENCES


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APPENDICES

1. Director of Schools approval
2. Ethical approval
3. Survey schedule
4. Child and parent information sheets and consent form (English and Malay version)
5. Examination form
6. The long-form CPQ\textsubscript{11-14}
7. Original version of the short-form CPQ\textsubscript{11-14}
8. Original and the back-translated English version of the short-form CPQ\textsubscript{11-14}
9. Malay version of the short-form CPQ\textsubscript{11-14} (Pilot Study)
10. Data collection pictures
Yang Mulia,
Dr Haji Amirul Rizan bin Haji Mohamed
No Kad Pintar: 00-278608 (Kuning)
Pegawai Pergian
Pusat Pergian Negara
Kementerian Kesihatan
Negara Brunei Darussalam

MEMOHON KEBENARAN MEMBUAT KAJISELIK KESIHATAN MULUT
MURID-MURID TAHUN 6
DI SEKOLAH-SEKOLAH RENDAH BRUNEI II(A) DAN (B)

Dengan hormat merujuk surat Dr bertarikh 17 Rabiulawal 1431H / 03hb Mac, 2010M mengenai perkara di atas adalah dirujuk.

Sukacita dimaklumkan bahawa Jabatan Sekolah-Sekolah tiada halangan bagi Dr Haji Amirul Rizan bin Haji Mohamed, No Kad Pintar: 00-278608 (Kuning) untuk membuat kajiselidik kesihatan mulut murid-murid tahun 6 bagi memenuhi keperluan kursus ‘Master of Community Dentistry’ di University of Otago, New Zealand serta mendapat maklumat yang diperlukan di Sekolah-Sekolah Rendah di Daerah Brunei II(A) dan II(B) bermula 5hb April hingga 12hb Mei 2010M seperti yang dipohonkan.

Walau bagaimanapun, sebelum memulakan penyelidikan, Dr hendaklah berunding dengan Guru Besar sekolah berkenaan untuk mengelak gangguan pada pihak sekolah. Dengan salinan surat ini Guru Besar adalah diminta memberikan kerjasama kepada beliau untuk membuat kajiselidik tersebut.

Sekian, Wassalam.

[DAYANG HAHAIS AISHAH BINTI HAJI MUHD HUSAIN]
Pengarah Sekolah-Sekolah
Appendix 2 Ethical approval

MHREC
Executive Screening Suite
Basement Carpark Level 1
Raja Isteri Pengiran Anak Saleha Hospital
Bandar Seri Begawan BA1710
Negara Brunei Darussalam

15th March 2010

Our Ref : MHREC/EDU/2010/7(7)
Dr Hj Amirul Rizan bn Hj Mohd
No 9 Spg 508, Kg Sungai Hanching,
Jln Muara,
Brunei, BC2115

Dear Dr Rizan,

Re: Epidemiological validation of a Malay Version of the Child Perceptions Questionnaire (CPQ11-14) in Brunei.

Thank you for applying for ethical review of your proposal which was considered by MHREC at its meeting on 15th March 2010. All documents that you have provided were reviewed.

MHREC approves your study from an ethical point of view. Please note that this approval is given for the proposed duration of your study or one calendar year from the date of this letter, whichever is shorter. If you are unable to complete your study within this period, you will need to apply for an extension. To avoid interruption of your study, you should submit the application for extension at least 2 months before the expiry of the original MHREC approval. Any complications or adverse events during the study must be immediately reported to MHREC. Any changes to be made in the study must be approved by MHREC.

Any publication from this research should be notified to MHREC.

Yours sincerely,

Dr Alice Yong Moi Ling
Deputy Chairperson of
Medical and Health
Research & Ethics Committee

cc 1. Director of Medical Services, Dr Hjh Norlila DP Hj Abd Jalil

TAT/JAY
## Appendix 3 Survey schedule

<table>
<thead>
<tr>
<th>No.</th>
<th>Primary School</th>
<th>Date (Days)</th>
<th>Total Classes</th>
<th>Total Participants</th>
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<tr>
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<td>SR Suas Muara</td>
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<tr>
<td>9.</td>
<td>SR Mentiri</td>
<td>10 May 2010 (1 day)</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
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<td>457</td>
</tr>
</tbody>
</table>
Appendix 4 Child and parent information sheets and consent form (English version)

DEPARTMENT OF DENTAL SERVICES
MINISTRY OF HEALTH
NEGARA BRUNEI DARUSSALAM

ORAL HEALTH SURVEY OF THE DENTAL HEALTH OF BRUNEI 11-14-YEAR-OLDS

Information Sheet and Consent Form for children and families involved in oral health survey

Dear Parents/Guardians,
We would like to invite your child to be part of this research study. This consent form tells you about the study.

What is this study about?
We are looking at the oral health of Year 6 schoolchildren in Brunei. We will come to your child’s school between April-May 2010. The entire study will only take about 5 minutes. The procedures are described below:

- First, we need your child to fill in short questionnaire. This questionnaire is called the ‘Child Perception Questionnaire’ and has been used in many studies in other countries.
- Next, we are going to count the number of teeth and fillings your child have.
- We are also going to check whether your child needs orthodontic treatment.

Your child will be given a toothbrush, disposable dental mirror and treatment advice after completion of dental examination.

Any information your child give us will be kept secret.

Study findings
These will be useful for the Research Unit, Department of Dental Services for future planning of the dental services.

Participation is voluntary
Your child’s participation is entirely voluntary, and your child can change his/her mind at any time.

Ethical approval
This study has sought ethical approval from Medical and Health Research and Ethic Committee, Ministry of Health.
Principal Investigator: Dr. Haji Amirul Rizan Bin Haji Mohamed
Department of Dental Services
Ministry of Health
Brunei Darussalam

Co-Investigator(s): Professor W. Murray Thomson
Department of Oral Sciences
School of Dentistry
The University of Otago, New Zealand

Dr. Lyndie Foster Page
Department of Oral Rehabilitation
School of Dentistry
The University of Otago, New Zealand

Please feel free to contact Dr. Rizan if you have further questions about this study at 8928970.

CHILD’S NAME: ________________________________________________________
D.O.B: ______________ I.C.NO (if any): ______________________________
SEX: ______________ RACE: _______________________________________
SCHOOL: __________________________ YEAR: ________________

Parent/Guardian Name: _____________________________________________
Occupation: _______________________________________________________

*Consent / Do not consent to my child to take part in this study.

Signature: _______________________________ Date: ___________________

Note: * Please indicate accordingly by circling the appropriate response.

Please return the form signed to class teacher by 3rd April 2010

Thank you very much – your participation will be greatly appreciated
Appendix 4 Child and parent information sheets and consent form (Malay version)

JABATAN PERKHIDMATAN PERGIGIAN
KEMENTERIAN KESIHATAN
NEGARA BRUNEI DARUSSALAM

KAJI SELIDIK KESIHATAN MULUT MURID-MURID SEKOLAH
BERUMUR 11-14 TAHUN DI NEGARA BRUNEI DARUSSALAM

Surat Pemberitahuan dan Borang Kebenaran bagi Murid-Murid dan Ibubapa

Kepada Ibubapa/Penjaga,
Pihak Pergigian ingin menjemput anak awda mengambil bahagian dalam kaji selidik ini. Surat pemberitahuan dan borang kebenaran ini akan menerangkan mengenai dengan kaji selidik ini.

Apakah kaji selidik ini?

- Pertama, pihak pergigian memerlukan anak awda mengisi borang soal selidik ‘Child Perception Questionnaire’ yang telah digunakan di negara-negara lain.
- Kemudian, pihak pergigian akan memeriksa gigi anak awda.
- Pihak pergigian juga akan memeriksa samaada anak awda memerlukan rawatan ortodontik.

Anak awda akan diberikan berus gigi, cermin pergigian dan juga nasihat mengenai dengan gigi selepas pemeriksaan tersebut.

Semua maklumat yang anak awda berikan akan dirahsiakan.

Hasil kaji selidik
Hasil kaji selidik itu nanti akan digunakan oleh Unit Kaji Selidik, Jabatan Perkhidmatan Pergigian untuk perancangan di masa akan datang.

Penyertaan adalah sukarela
Penyertaan anak awda adalah dengan sukarela, anak awda boleh menukar fikiran pada bila-bila masa.

Kebenaran kaji selidik
Kaji selidik ini telah pun mendapat kebenaran daripada Medical and Health Research and Ethic Committee, Kementerian Kesihatan.
Penyelidik Utama: Dr. Haji Amirul Rizan Bin Haji Mohamed
Jabatan Perkhidmatan Pergigian
Kementerian Kesihatan
Brunei Darussalam

Penyelidik bersama: Professor W. Murray Thomson
Department of Oral Sciences
School of Dentistry
The University of Otago, New Zealand
Dr. Lyndie Foster Page
Department of Oral Rehabilitation
School of Dentistry
The University of Otago, New Zealand

Jika awda mempunyai sebarang pertanyaan lanjut, sila hubungi
Dr. Rizan di talian 8928970.

NAMA MURID: ___________________________________________________
TARIKH LAHIR: ____________ NO. K.P. (jika ada): ____________________
JANTINA: ___________________ BANGSA: ____________________________
SEKOLAH: _____________________________ TAHUN: ________________

Nama Ibubapa/Penjaga: ___________________________________________
Pekerjaan: ________________________________________________________

* Membenarkan / Tidak membenarkan anak saya mengambil bahagian
dalam kaji selidik ini.

Tandatangan: ____________________________ Tarih: ________________

P/s: * nyatakan persetujuan awda dengan membulatkan jawapan awda.

Sila kembalikan borang ini kepada Guru Kelas sebelum 3 April 2010

Terima kasih atas kerjasama awda
**EXAMINATION FORM**

**SCHOOL**

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td></td>
</tr>
<tr>
<td>School Code</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td></td>
</tr>
<tr>
<td>Month / Day</td>
<td></td>
</tr>
</tbody>
</table>

**GENERAL INFORMATION**

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td></td>
</tr>
<tr>
<td>Sex (M=1, F=2)</td>
<td></td>
</tr>
<tr>
<td>Ethnic Group</td>
<td></td>
</tr>
</tbody>
</table>
## CARIES FORM

**First quadrant**  
(upper right)

<table>
<thead>
<tr>
<th>Tooth</th>
<th>P</th>
<th>O</th>
<th>M</th>
<th>B</th>
<th>D</th>
<th>L</th>
<th>Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

For column P:
- Present = 1
- Missing = 2
- Deciduous = 3

**Surface status codes**
- 0 = sound
- 1 = decayed
- 2 = filled
- 3 = filled and decayed
- 4 = crown or bridge abutment
- 5 = missing due to caries
- 6 = missing other reason
- 7 = unerupted
- 8 = excluded
- 9 = fissure sealant

**Second quadrant**  
(upper left)

<table>
<thead>
<tr>
<th>Tooth</th>
<th>P</th>
<th>O</th>
<th>M</th>
<th>B</th>
<th>D</th>
<th>L</th>
<th>Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

**Third quadrant**
(Lower left)

For column P:
Present = 1
Missing = 2
Deciduous = 3

Surface status codes
0 = sound
1 = decayed
2 = filled
3 = filled and decayed
4 = crown or bridge abutment
5 = missing due to caries
6 = missing other reason
7 = unerupted
8 = excluded
9 = fissure sealant

<table>
<thead>
<tr>
<th>Tooth</th>
<th>P</th>
<th>O</th>
<th>M</th>
<th>B</th>
<th>D</th>
<th>L</th>
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</thead>
<tbody>
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</tbody>
</table>

**Fourth quadrant**
(lower right)

<table>
<thead>
<tr>
<th>Tooth</th>
<th>P</th>
<th>O</th>
<th>M</th>
<th>B</th>
<th>D</th>
<th>L</th>
</tr>
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<tbody>
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<td></td>
<td>5</td>
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</tbody>
</table>
### DENTAL AESTHETIC INDEX (DAI)
#### RECORDING FORM

<table>
<thead>
<tr>
<th>ID Number</th>
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<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>A No, or Score</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CONSTANT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Missing incisor, canine and premolar teeth--</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maxillary and Mandibular Enter total #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Crowding in the incisal segments</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 = no segment crowded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1 = 1 segment crowded</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 = 2 segments crowded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Spacing in the incisal segments</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 = no spacing</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1 = 1 segment spaced</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 = 2 segments crowded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Diastema in mm</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Largest anterior irregularity--Maxilla (upper) in mm</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Largest anterior irregularity Mandible (lower) in mm</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Anterior Maxillary Overjet (upper) in mm</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Anterior Mandibular Overjet (lower) in mm</td>
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<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Vertical anterior openbite in mm</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Antero-posterior molar relation</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>TOTAL (add lines 1 through 11)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CODES & CRITERIA FOR RECORDING THE ORAL HEALTH DATA ON THE EXAMINATION FORM

1. Identification and general information sections of the examination form
   • Fill in the name of the school at the top of the form in BLOCK LETTERS.

   • Identification number
     Each participant examined should be given an identification number. If 600 participants are to be examined, the first participant is to be numbered 101 and the last participant 700. Each identification number is to be used only once. Fill the participant’s identification number in boxes 1–3.

   • Boxes 4–5 are for the School’s codes which are as follows:
     o 01 SR Amar Pahlawan
     o 02 SR Pulaie
     o 03 SR Anggerek Desa
     o 04 SR DMW Lambak
     o 05 SR Dato Marsal
     o 06 SR Delima Satu
     o 07 SR Suas Muara
     o 08 SR Serasa
     o 09 SR Mentiri

   • Date of examination
     o Fill in boxes 6-7 for the year
     o Fill in boxes 8-11 for the month & the day of the examination.
     Complete this only on the day of the actual examination.

   • Age
     Age should be recorded as age at last birthday. The age in years should be entered in boxes 12-13.
- **Sex**
  
  Use code 1 for male and 2 for female and enter in box 14.

- **Ethnic Group**
  
  Enter the following codes to indicate the various ethnic groups in box 15:
  - 1: Malay
  - 2: Chinese
  - 3: Others (e.g. Indians, Eurasians, etc)

2. **Caries form**

   The examination for dental caries should be done visually only with the aid of a mouth mirror. Adopt a systematic approach to the examination for dental caries starting from the upper right quadrant and moving on to the upper left quadrant, lower left quadrant and lower right quadrant. The codes and criteria for the dental caries of permanent teeth are as given in the screening form.
Appendix 6 The long-form CPQ\textsubscript{11-14}

LONG-FORM CHILD PERCEPTIONS QUESTIONNAIRE (CPQ\textsubscript{11-14})

ID Number

These next few questions are about how you feel about your teeth. There are no “right” or “wrong” answers - please answer as best you can. Please tick the box which applies to you.

1. Would you say the health of your teeth, lips, jaws and mouth is:
   Excellent Very Good Good Fair Poor

2. How much does the condition of your teeth, lips, jaws or mouth affect your life overall?
   Not at all Very little Some A lot Very much

In the past 3 months, how often have you had:

3. Pain in your teeth, lips, jaws or mouth?
   Never Once or twice Sometimes Often Every day or almost every day

4. Bleeding gums?
   Never Once or twice Sometimes Often Every day or almost every day

5. Sores in your mouth?
   Never Once or twice Sometimes Often Every day or almost every day

6. Bad Breath?
   Never Once or twice Sometimes Often Every day or almost every day
7. Food stuck in between your teeth?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

8. Food stuck in the top of your mouth
    Never  Once or twice  Sometimes  Often  Every day or almost every day

For the next questions

Has this happened because of your teeth, lips or mouth?

In the past 3 months, how often have you had:

9. Breathed through your mouth?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

10. Taken longer than others to eat a meal?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

11. Had trouble sleeping?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

In the past 3 months, because of your teeth, lips, mouth or jaws, how often has it been:

12. Difficulty to bite or chew food like apples, corn on the cob or steak?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

13. Difficult to open your mouth wide?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

14. Difficulty to say any words?
    Never  Once or twice  Sometimes  Often  Every day or almost every day
15. Difficult to eat foods you would like to eat?

Never   Once or twice   Sometimes   Often   Every day or almost every day

16. Difficult to drink with a straw?

Never   Once or twice   Sometimes   Often   Every day or almost every day

17. Difficult to drink or eat hot or cold foods?

Never   Once or twice   Sometimes   Often   Every day or almost every day

QUESTIONS ABOUT FEELINGS

Have you had feelings because of your teeth, lips or mouth? If you felt this way for another reason, answer ‘Never’.

In the past 3 months, how often have you had:

18. Felt irritable or frustrated?

Never   Once or twice   Sometimes   Often   Every day or almost every day

19. Felt unsure of yourself?

Never   Once or twice   Sometimes   Often   Every day or almost every day

20. Felt shy or embarrassed?

Never   Once or twice   Sometimes   Often   Every day or almost every day

21. Been concerned what other people think about your teeth, lips, mouth or jaws?

Never   Once or twice   Sometimes   Often   Every day or almost every day

22. Worried that you are not as good-looking as others?

Never   Once or twice   Sometimes   Often   Every day or almost every day
23. Been upset?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

24. Felt nervous or afraid?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

25. Worried that you are not as healthy as others?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

26. Worried that you are different than other people?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

QUESTIONS ABOUT SCHOOL

Have you had these experiences because of your teeth, lips or mouth? If it was for another reason, answer ‘Never’.

In the past 3 months, how often have you had:

27. Missed school because of pain, appointments or surgery?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

28. Had a hard time paying attention in school?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

29. Had difficulty doing your homework?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

30. Not wanted to speak or read out loud in class?
   Never  Once or twice  Sometimes  Often  Every day or almost every day
QUESTIONS ABOUT YOUR SPARE-TIME ACTIVITIES AND BEING WITH OTHER PEOPLE

In the past 3 months, how often have you had:

31. Avoided taking part in activities like sports, clubs, drama, music, school trips?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

32. Not wanted to talk to other children?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

33. Avoided smiling or laughing when around other children?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

34. Had difficulty playing a musical instrument such as a recorded, flute, clarinet, and trumpet?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

35. Not wanted to spend time with other people?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

36. Argued with other children or your family?
    Never  Once or twice  Sometimes  Often  Every day or almost every day

In the past 3 months, because of your teeth, lips, mouth or jaws, how often have:

37. Other children teased you or called you names?
    Never  Once or twice  Sometimes  Often  Every day or almost every day
38. Other children made you feel left out?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once or twice</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every day or almost every day</th>
</tr>
</thead>
</table>

39. Other children ask you questions about your teeth, lips, jaws or mouth?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once or twice</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every day or almost every day</th>
</tr>
</thead>
</table>

*Thank you for having taken the time to complete the Questionnaire*
Appendix 7 Original version of the short-form CPQ$_{11-14}$

SHORT-FORM CHILD PERCEPTIONS QUESTIONNAIRE (CPQ$_{11-14}$)

ID Number

These next few questions are about how you feel about your teeth. There are no “right” or “wrong” answers- please answer as best you can. Please tick the box which applies to you.

40. Would you say the health of your teeth, lips, jaws and mouth is:
   Excellent  Very Good  Good  Fair  Poor

41. How much does the condition of your teeth, lips, jaws or mouth affect your life overall?
   Not at all  Very little  Some  A lot  Very much

In the past 3 months, how often have you had:

42. Sores in your mouth?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

43. Bad Breath?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

44. Food stuck in between your teeth?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

45. Difficulty biting or chewing food like apples, corn on the cob or steak?
   Never  Once or twice  Sometimes  Often  Every day or almost every day
In the past 3 months, how often have you had:

46. Difficult to drink or eat hot or cold foods?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

47. Difficulty saying any words?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

48. Trouble sleeping?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

49. Pain in your teeth, lips, jaws or mouth?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

50. Taken longer than others to eat a meal?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

51. Felt irritable or frustrated?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

52. Felt shy or embarrassed?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

53. Been upset?
   Never  Once or twice  Sometimes  Often  Every day or almost every day

54. Been concerned what other people think about your teeth, lips, mouth or jaws?
   Never  Once or twice  Sometimes  Often  Every day or almost every day
In the past 3 months, how often have you had:

55. Avoided smiling or laughing when around other children?
   Never | Once or twice | Sometimes | Often | Every day or almost every day

56. Not wanted to speak or read out loud in class?
   Never | Once or twice | Sometimes | Often | Every day or almost every day

57. Other children teased you or called you names?
   Never | Once or twice | Sometimes | Often | Every day or almost every day

58. Had other children ask you questions about your teeth, lips, jaws or mouth?
   Never | Once or twice | Sometimes | Often | Every day or almost every day

59. Argued with other children or your family?
   Never | Once or twice | Sometimes | Often | Every day or almost every day

Thank you for having taken the time to complete the Questionnaire
### Appendix 8 Original and the back-translated English version of the short-form CPQ_{11-14}

<table>
<thead>
<tr>
<th>Qu.</th>
<th>Original English version</th>
<th>Malay version</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Would you say the health of your teeth, lips, jaws and mouth is:</td>
<td>Adakah anda memikirkan mengenai kesihatan gigi, bibir, rahang dan mulut anda:</td>
</tr>
<tr>
<td>2.</td>
<td>How much does the condition of your teeth, lips, jaws or mouth affect your life overall?</td>
<td>Adakah keadaan gigi, bibir, rahang atau mulut anda memberi kesan kepada keseluruhan kehidupan anda?</td>
</tr>
<tr>
<td>3.</td>
<td>Sores in your mouth?</td>
<td>Kesakitan dalam mulut anda?</td>
</tr>
<tr>
<td>4.</td>
<td>Bad Breath?</td>
<td>Nafas berbau?</td>
</tr>
<tr>
<td>5.</td>
<td>Food stuck in between your teeth?</td>
<td>Makanan melekat di celah gigi anda?</td>
</tr>
<tr>
<td>6.</td>
<td>Difficulty biting or chewing food like apples, corn on the cob or steak?</td>
<td>Kesukaran mengunyah makanan seperti epal, gandum atau daging?</td>
</tr>
<tr>
<td>7.</td>
<td>Difficult to drink or eat hot or cold foods?</td>
<td>Kesukaran minum minuman atau makan makanan panas atau sejuk?</td>
</tr>
<tr>
<td>8.</td>
<td>Difficulty saying any words?</td>
<td>Kesukaran menyebut sebarang perkataan?</td>
</tr>
<tr>
<td>9.</td>
<td>Trouble sleeping?</td>
<td>Kesukaran tidur?</td>
</tr>
<tr>
<td>10.</td>
<td>Pain in your teeth, lips, jaws or mouth?</td>
<td>Sakit gigi, bibir, rahang atau mulut?</td>
</tr>
<tr>
<td>11.</td>
<td>Taken longer than others to eat a meal?</td>
<td>Mengambil masa yang lama ketika makan jika dibandingkan dengan rakan yang lain?</td>
</tr>
<tr>
<td>12.</td>
<td>Felt irritable or frustrated?</td>
<td>Rasa marah atau kecewa?</td>
</tr>
<tr>
<td>13.</td>
<td>Felt shy or embarrassed?</td>
<td>Rasa segan atau malu?</td>
</tr>
<tr>
<td>14.</td>
<td>Been upset?</td>
<td>Rasa sedih?</td>
</tr>
<tr>
<td>15.</td>
<td>Been concerned what other people think about your teeth, lips, mouth or jaws?</td>
<td>Perasaan bimbang akan pendapat orang lain mengenai gigi, bibir, mulut atau rahang anda?</td>
</tr>
<tr>
<td>16.</td>
<td>Avoided smiling or laughing when around other children?</td>
<td>Mengelak daripada senyum atau ketawa ketika bersama rakan-rakan yang lain?</td>
</tr>
<tr>
<td>17.</td>
<td>Not wanted to speak or read out loud in class?</td>
<td>Tidak mahu bercakap atau membaca dengan kuat di dalam kelas?</td>
</tr>
<tr>
<td>Qu.</td>
<td>Original English version</td>
<td>Malay version</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>18.</td>
<td>Other children teased you or called you names?</td>
<td>Rakan-rakan yang lain mengusik atau memanggil anda dengan nama-nama yang tidak sopan?</td>
</tr>
<tr>
<td>19.</td>
<td>Had other children ask you questions about your teeth, lips, jaws or mouth?</td>
<td>Ada rakan-rakan yang lain bertanya tentang gigi, bibir, rahang atau mulut anda?</td>
</tr>
<tr>
<td>20.</td>
<td>Argued with other children or your family?</td>
<td>Pertengkaran dengan rakan-rakan yang lain atau keluarga anda?</td>
</tr>
</tbody>
</table>
Appendix 9 Malay version of the short-form CPQ_{11-14} (Pilot Study)

Borang Kaji Selidik Tanggapan Kanak-Kanak

Nombor Pengenalan [ ] [ ] [ ]


1. Adakah anda memikirkan mengenai kesihatan gigi, bibir, rahang dan mulut anda:
   Cemerlang       Sangat Baik       Baik       Sederhana       Tidak baik
   Saya tidak faham dengan soalan ini

2. Adakah keadaan gigi, bibir, rahang atau mulut anda memberi kesan kepada keseluruhan kehidupan anda?
   Tidak sama sekali       Sangat sedikit       Sedikit       Banyak       Sangat banyak
   Saya tidak faham dengan soalan ini

Dalam masa 3 bulan lepas, berapa kerapakah anda mengalami:

3. Kesakitan dalam mulut anda?
   Tidak Pernah       Sekali atau dua kali       Kadang-kadang       Selalu
   Setiap hari atau hampir setiap hari       Saya tidak faham dengan soalan ini

4. Nafas berbau?
   Tidak Pernah       Sekali atau dua kali       Kadang-kadang       Selalu
   Setiap hari atau hampir setiap hari       Saya tidak faham dengan soalan ini

5. Makanan melekat di celah gigi anda?
   Tidak Pernah       Sekali atau dua kali       Kadang-kadang       Selalu
   Setiap hari atau hampir setiap hari       Saya tidak faham dengan soalan ini
**Dalam masa 3 bulan lepas, berapa kerapkah anda mengalami:**

6. Kesukaran mengunyah makanan seperti epal, gandum atau daging?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>

7. Kesukaran minum minuman atau makan makanan panas atau sejuk?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>

8. Kesukaran menyebut sebarang perkataan?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>

9. Kesukaran tidur?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>

10. Sakit gigi, bibir, rahang atau mulut?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>

11. Mengambil masa yang lama ketika makan jika dibandingkan dengan rakan yang lain?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>

12. Rasa marah atau kecewa?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>

13. Rasa segan atau malu?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setiap hari atau hampir setiap hari</td>
</tr>
</tbody>
</table>
Dalam masa 3 bulan lepas, berapa kerapkah anda mengalami:

14. Rasa sedih?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setiap hari atau hampir setiap hari</td>
<td>Saya tidak faham dengan soalan ini</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. Perasaan bimbang akan pendapat orang lain mengenai gigi, bibir, mulut atau rahang anda?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
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</thead>
<tbody>
<tr>
<td>Setiap hari atau hampir setiap hari</td>
<td>Saya tidak faham dengan soalan ini</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16. Mengelak daripada senyum atau ketawa ketika bersama rakan-rakan yang lain?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setiap hari atau hampir setiap hari</td>
<td>Saya tidak faham dengan soalan ini</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

17. Tidak mahu bercakap atau membaca dengan kuat di dalam kelas?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
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</thead>
<tbody>
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<td>Saya tidak faham dengan soalan ini</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18. Rakan-rakan yang lain mengusik atau memanggil anda dengan nama-nama yang tidak sopan?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
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<td>Saya tidak faham dengan soalan ini</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. Ada rakan-rakan yang lain bertanya tentang gigi, bibir, rahang atau mulut anda?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setiap hari atau hampir setiap hari</td>
<td>Saya tidak faham dengan soalan ini</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. Pertengkaran dengan rakan-rakan yang lain atau keluarga anda?

<table>
<thead>
<tr>
<th>Tidak Pernah</th>
<th>Sekali atau dua kali</th>
<th>Kadang-kadang</th>
<th>Selalu</th>
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<td>Saya tidak faham dengan soalan ini</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Terima kasih atas kerjasama anda melengkapkan borang kaji selidik ini.
Appendix 10 Data collection pictures

Figure 1 Incentive (toothbrush and disposable dental mirror)

Figure 2 Materials used in the study

Figure 3 Administration of the CPQ$_{11-14}$
Figure 4 Clinical examination

Figure 5 Calibration session