

**The Effect of an Intervention to Enhance Sense of
Coherence on Oral Health Related Quality of Life:
A Cluster Randomised Controlled Trial**

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Abbreviations

COHRQoL	Child Oral Health Related Quality of Life
OIDP	Oral Impact on Daily Performances
CPI	Community Periodontal Index
CPITN	Community Periodontal Index of Treatment Needs
CPQ ₈₋₁₀	Child Perceptions Questionnaire for 8-10 years old
CPQ ₁₁₋₁₄	Child Perceptions Questionnaire for 11-14 years old
DMFS	Decayed/Missing/Filled Surfaces
DMFT	Decayed/Missing/Filled Teeth
DT	Decayed Teeth
EW	Emotional well-being
FL	Functional limitation
FT	Filled Teeth
GHP	General Health Perception
GRRs	General Resistance Resources
HRQoL	Health Related Quality of Life
IOTN	Index of Orthodontic Treatment Needs
LOC	Locus of Control
OHB	Oral Health Beliefs
OHRQoL	Oral Health Related Quality of Life
QoL	Quality of life
SES	Socio-economic status
SOC	Sense of coherence
SW	Social well-being

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Abstract

Background: Psychological factors may influence oral health. One factor, sense of coherence (SOC) has been related to general and oral health, clinical status, oral health behaviours and oral health related quality of life (OHRQoL) in observational research with adults and children. Thus, improving SOC may be a way to improve OHRQoL.

Aims of the study: To evaluate the effect of an intervention to enhance SOC on OHRQoL in children.

Methods: Cluster randomised trial in twelve primary schools in Khonkaen, Thailand with 257 grade 5 students. Six schools were allocated randomly to the study and comparison groups respectively. Data included socio-demographic and clinical data. Self-report questionnaires assessed OHRQoL using the child perceptions questionnaire, CPQ₁₁₋₁₄ and SOC with the 13-item SOC scale. Data were collected at three time points; at baseline, two weeks after the intervention and at 3 month follow up.

Intervention: Seven 40-60 minute sessions over two months, focusing on child participation and empowerment. The first four sessions were classroom activities and included a mixture of didactic teaching, discussion, activities and games. The last three involved working on healthy school projects. The intervention was delivered by trained teachers who received an intensive one day course.

Results: The two groups were similar for all variables at baseline. The intervention group had significant improvements in SOC and CPQ₁₁₋₁₄ scores representing better OHRQoL at two weeks after the intervention and 3 month follow-up. SOC had a direct effect on symptoms and indirect effect on OHRQoL via symptoms.

Conclusions: As well as providing experimental evidence that OHRQoL is determined by SOC, these data show that school-based interventions to enhance SOC may be a useful way to improve OHRQoL.

Chapter One

Introduction

Oral health related quality of life (OHRQoL) is an aspect of health related quality of life. It is a multidimensional construct that refers to the extent to which oral disorders disturb individual's daily functioning, well-being or life quality (Locker and Allen, 2007). OHRQoL is an important outcome for evaluating the impact of oral conditions on quality of life and well-being, as well as for clinical care (Locker, 2004; Marshman and Robinson, 2007).

Wilson and Cleary proposed a theoretical model linking the traditional biomedical model which focuses on diseases and the psychosocial model which emphasises general well-being and functional ability (Wilson and Cleary, 1995). Within this model, a range of individual and environmental factors are outlined as influencing key outcomes.

One individual characteristic that has been found to be related to health, including oral health is sense of coherence (SOC). SOC is used to explain why people stay well despite stressful situations (Antonovsky, 1987, 1996) and has been linked to a range of health and oral health outcomes (Baker *et al.*, 2010; Eriksson and Lindstrom, 2006, 2007) .

Other studies have found that adolescents with higher SOC were more likely to visit dentists for checkups than those with lower SOC (Freire *et al.*, 2001). An eighteen month longitudinal study in adolescents showed that participants who had higher SOC reported gingivitis less than participants with lower SOC (Ayo-Yusuf *et al.*, 2008). Savolainen and colleagues' (2005a, 2005b) cross-sectional study in Finnish adults showed that higher SOC was related to fewer oral health problems. SOC is also concluded to be an essential factor influencing oral health behaviours and OHRQoL. One implication is that SOC can be used in health promotion because it appears to be linked with attitudes and behaviours in relation to health (Eriksson and Lindstrom, 2005).

Cumulatively, these data suggest that improving SOC may be a way to improve oral health related quality of life, and thus general well-being. Previous interventions to enhance SOC have mostly been related to mental health. Literature searches reveal no SOC interventions in relation to oral health or oral health related quality of life.

Therefore, this study aims to investigate the effect of a SOC intervention on oral health related quality of life of children. The Wilson and Cleary model was chosen as the theoretical framework guiding the selection of variables and outcome measures.

This thesis is structured as follows:

Chapter One overviews the research

Chapter Two reviews the relevant literature, which involves concepts of health, SOC, health promotion and health promoting schools. This Chapter also includes the rationale, aim and objectives of the study.

Chapter Three describes the methods and materials used in this study. The statistical methods and the data analysis are presented in this chapter.

Chapter Four presents the research results.

Chapter Five discusses of the research, its findings, limitations and strengths

Chapter Six draws conclusions and proposes recommendations arising from the research

The bibliography comprises all studies and reports cited in this study

The appendices contains all relevant documents associated with the study

Chapter two

Literature Review

This chapter reviews the relevant literature and articles in relation to the research, which involves the concepts of health, sense of coherence (SOC), health promotion and health promoting schools. It also includes the rationale, aims and objectives of this study.

2.1 Concepts of health

Health is defined in a variety of ways. In the past, medical research emphasised pathogenesis, with the belief that people stay well until they encounter a pathogen. As a consequence, clinical assessments are used to identify abnormalities and clinical variables are used to explain health. This is the biomedical concept of health.

2.1.1 The Biomedical model of disease

The biomedical model defines health as the absence of disease. It is widely accepted as the dominant model of health, constituted to understand causation in order to guide diagnosis and treatment. The biomedical model has developed into the premise that diseases are organ-specific, either intrinsically or extrinsically induced pathological processes that reduce the level of the function of cells and organs when compared with biostatistical norms (Boorse, 1997). Its main focus is clinical, physiological, biological and biochemical outcomes. The foundation of the biomedical model is in the basic sciences; for example, genetics, biology, physiology, biochemistry and molecular biology. Therefore, it dominates both clinical practice and medical health care research (Younossi and Guyatt, 1998), including dentistry.

The fundamental concept of the model embraces two things: reductionism and mind-body dualism. In relation to reductionism, physicalism is recognised as a reductionistic primary principle. It assumes that the explanations of chemistry and physics are sufficient to describe biological phenomena. As a result the conceptual and experimental instruments available to study these phenomena are physical in nature. Mind-body dualism, treats the mind and body separately, with no room for psychological and behavioural problems, which are classically deemed as

dimensions of psychiatry. Some physicians have argued that their responsibility is to treat only 'real diseases' and not to be concerned with psychological and social problems (Engel, 1977). For these reasons, physicians whose practice is based on the biomedical model have developed a number of theories of diseases to help them understand the aetiology and pathological processes. It is believed that every disease is caused by specific agents such as viruses, bacteria and parasites. The strength of this traditional biomedical model is that it has helped patients with a multitude of diseases and illnesses (Weiner, 2007). It can be seen as a roadmap for diagnosis and treatment for a number of diseases over the past two centuries.

Although the biomedical model has dominated clinical practice and health care research, it has been critiqued from both within medicine and the social sciences. First, the model is recognised as inadequate because it fails to describe all diseases, including mental illness. This model has encompassed the characterisation of specific diseases when their etiologic and pathogenic processes are obvious. Consequently, treatments are more likely to be relevant and specific to diseases. In fact, human illness is rarely a specific disease with a specific aetiology. For instance, the important factors influencing the development of schizophrenia are experiential factors that interact with biological vulnerability (Kety, 1974). Consequently, treatments are given only at the biochemical, biological and or physiological levels. These treatments may not recover patients to health even with the alleviation of the abnormalities (Engel, 1977). Furthermore, other factors may sustain patienthood even after biochemical recovery. Such discrepancies between clinical abnormalities and treatment outcomes are closely linked to psychological and social variables.

The biomedical model has given insufficient heed to psychological and behavioural factors. It has ignored patients' verbal accounts by having greater reliance on laboratory tests and other technical processes. Due to the specific criteria for diseases (the paraclinical data) pathology reports and results of laboratory tests may indicate the possibility of disease but not the actuality of disease at the time. People may not be ill, even though biological or physiological abnormalities may be present. The complex interaction of which may end in active disease or exhibit illness.

For example, to diagnose diabetes, the first suggestion is a definite clinical manifestation such as polyuria, polydipsia, polyphagia and weigh loss. Thereafter, it

is necessary to confirm these findings with laboratory tests of relative insulin deficiency. Moreover, reliable methods of clinical data collection and understanding of psychological, social and cultural factors of how patients communicate symptoms of diseases are required. In relation to oral health, clinicians are more likely to evaluate oral health by using clinical indicators such as caries indices, gingival assessment and plaque accumulation records. The impacts of oral diseases and oral conditions seem to be ignored despite having substantial effects on individual daily functioning, including the ability to eat, smile and talk to other people. Physicians need to be able to analyse the meaning of patients' reports of their illness experience in psychological, social and cultural terms, to compliment the physiological and biological terms (Engel, 1973).

A third critique of the biomedical model is the way in which it treats patients as passive objects rather than active human beings by ignoring their psychological, social and cultural contexts, which shape perception and experiences of illness. For example, women's experiences regarding childbirth were removed from homes to hospitals through the medical approach to obstetrics (Donnison, 1977). Childbirth was treated as a medical problem that required supervision and medical regulation, despite being a normal aspect of life. Women's bodies were described by medicine as fragile and needing to be routinely monitored and intervened on (Martin, 1989). Such cases medicalise by disempowering lay views. This results in an individual's loss of capability for self-care and places their health in the responsibility of professionals. Illich (1976) saw this as iatrogenic. He argued that medicine contributed to illness through these iatrogenic effects, for example, the side effects of drugs and by distracting from the real causes of health problems. Moreover, the relationship between clinician and patient strongly influences the quality of therapeutic outcomes for better or worse. The success of treatment is restricted by the clinician's ability to modify patient behaviours. Thus, physicians need psychological knowledge and skills such as communication skills to enhance treatment, not merely clinical expertise.

Fourthly, the biomedical model fails to account for social inequalities, which are recognised within the socio-environmental model of medicine. It is clear that health and illness are socially patterned, being influenced by gender, ethnicity, age and social class (Engel, 1980; NICE, 2007).

Another challenge to the biomedical model is its scientific method to identify the objective truth of diseases. Sociologists have postulated that diseases are products derived from social constructs. For example, an arbitrary threshold for diastolic blood pressure at 100 mmHg has been indicated as a threshold for hypertension. This arbitrary distinction can alarm people with higher values and falsely reassure those with low values (Rose, 1992). Social constructionists also claim that arbitrary values are the result of power relations and usually bias. Hence, they put forward the view that all knowledge of the product of social relations can be changed (Lupton, 2003).

To sum up, the biomedical model focuses on diseases. It ignores psychological, social and cultural contexts of people. Although it has been used widely in medicine, it has not wholly met the needs of people.

2.1.2 The Biopsychosocial model of health

The biopsychosocial model explains health according to the definition given by the World Health Organisation (WHO) (1948) as “*a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity*”. Engel (1977) claimed that the existing biomedical model does not take into account the determinants of health. Although it has led to successes in the treatment of many diseases, some difficulties and crucial medical problems have proven resistant to it. Some medical problems have no unique underlying pathological processes (e.g. multiple sclerosis and schizophrenia). As a result, treatment outcomes are less than expected. To provide a basis for a better understanding of health and its determinants, obtaining rational treatments as well as appropriate patterns of health care, a new model, namely the biopsychosocial model developed. It is recognised that primary factors of patient complaints and outcomes include psychological and social factors, for example, patient beliefs, coping strategies and emotional reactions such as depression and fear. In addition, the biopsychosocial model encourages medical interactions in homes and communities.

Although the model emphasises psychosocial factors, which are recognised as determinants of patient outcomes and complaints, the biopsychosocial model may have encouraged further medicalisation. While proponents of the biomedical model are criticised for unnecessary tests to seek some underlying uncommon pathologic lesion, the proponents of the biopsychosocial model have engaged psychologists to

address coping strategies, psychiatrists for depression, social workers for work satisfaction and physicians for pain management (Doley, 2006).

In conclusion, it is generally agreed that health and illness are the outcome of the interactions between physiological and biological, psychological and social factors. The discernible change from the biomedical to the biopsychosocial model can be seen in various fields in relation to health such as health psychology, health education, preventive medicine and public health.

2.1.3 Health related quality of life (HRQoL)

2.1.3.1 Concept of HRQoL

Health related quality of life (HRQoL) is increasingly used as a crucial outcome in medicine in clinical trials and research on quality of health care. The health domains span negatively valued facets of life such as death, to the positively valued aspects of life such as happiness. A wide range of domains of health related quality of life includes physical well-being measured with physical status and physical function, psychological well-being measured with indicators of anxiety and depression, emotional well-being measured with indicators of social networks and support, functioning in social roles and community integration and emotional well-being measured with indicators of life satisfaction and self-esteem (Bowling, 2004). Although some problems such as the lack of freedom, low income and low quality environment are often beyond health, they adversely affect health when people are ill or diseased. It can be concluded that all aspects of life can become health related.

Biological and physiological measures are more likely to provide information for clinicians but restrict interests of functional capacity and well-being with which patients are most interested and familiar. Functional capacity tested in a laboratory may relate poorly to functional capacity in daily life. Moreover, two patients with the same clinical status may have substantially different responses, for example, in terms of role function and emotional well-being. Some may continue to work, whereas some may quit their job and have major mental problems.

Interestingly, diseases may not be connected to quality of life. Patients who have diseases do not always have poor quality of life. The impact on quality of life is described by a relationship between experiences and expectations. Diseases and

illness may have an impact on patients' quality of life if their expectations and experiences are met (Carr *et al.*, 2001). In contrast, there is more likely an impact on quality of life when patients' expectations are higher than they experience. There is an attempt to explain how clinical status relates to other health outcomes such as functional status and quality of life. One model, which links clinical variables with other factors of health, influencing health related quality of life by Wilson and Cleary (Wilson and Cleary, 1995) (see section 2.1.5). HRQoL is commonly measured to evaluate these phenomena (Guyatt *et al.*, 1993).

Although clinicians can observe objectively signs of impairment and disability, only patients can report subjectively on their symptoms and quality of life (Black and Jenkinson, 2009). Patient reported outcome measures (PROMs) are validated and standardised questionnaires designed to measure either patient's perceptions of their functional status and well-being in general health or specific conditions (Dawson *et al.*, 2010). For example, SF-36 is a generic questionnaire assessing health status by using 36 items pertaining to eight broad domains of well-being (Sherbourne *et al.*, 1992) whereas CPQ₁₁₋₁₄ is a specific instrument measuring oral health related quality of life that consists of 37 items relating to four domains: symptoms, functional limitation, emotional and social well-being (Jokovic *et al.*, 2002).

Patient reported outcome measures consider the patient's perspective systematically. It can be seen as the first step toward incorporating patients into clinical practice (Black and Jenkinson, 2009) and research.

2.1.3.2 Measures of HRQoL in children

The challenges of HRQoL measures for children arise in three main areas as follows: concepts of HRQoL in children, the use of proxies and difficulties caused by cognitive and physical changes in children.

Concepts of HRQoL in children

In the past measures have been based on questionnaires designed for adults that are adapted for use in children. These measures may have lower validity because items in the questionnaire may not be relevant to children and may not address aspects of life valued by children. Measures developed especially for children are needed (de-Oliveira and Sheiham, 2004; Robinson *et al.*, 2003). To reflect children's lives,

factors regarding activities, family and social relationships and schooling should be included (Vincent and Higginson, 2003).

Cognitive and physical changes in children

HRQoL measures are complicated because of the changes as children develop (Ravens-Sieberer *et al.*, 2006). These changes involve reading ability, types of questionnaires and ability of comprehension. Although simple questionnaires, explanation and illustration may help to solve the difficulties in children's literacy and understanding, scales matched to child age groups have been suggested. For example, the CPQ₁₁₋₁₄ has been established for children aged 11-14 years (Jokovic *et al.*, 2002) whereas the CPQ₈₋₁₀ has been developed for 8-10 years old (Jokovic *et al.*, 2004).

Use of proxies

The use of proxy is a possible method for assessing OHRQoL in young people. However, there is the problem regarding agreement between the child and proxy. Children and parents may not necessarily share similar perspectives of HRQoL. Parents of children in a nonclinical sample tended to score their child HRQoL higher than children themselves, whereas parents of children with health problems are likely to underestimate the child's HRQoL. The extent of agreement depends on health domains (Upton *et al.*, 2008).

The accuracy of rating by parent proxies for non-observable well-being such as emotional and social well-being is lower than that for observable functioning such as physical well-being (Eiser and Morse, 2001). Congruently, some parents have limited knowledge concerning their children's OHRQoL, particularly impacts on social and emotional well-being (Barbosa and Gaviao, 2008a; Jokovic *et al.*, 2004). Although correlations between child and proxy have been found, the two should not be used interchangeably. Information from parents should be used for the purpose of complementing the views of children rather than replacing (Barbosa and Gaviao, 2008a).

2.1.3.3 Contemporary approaches to research with children

The recognition of children's rights has increased considerably in the society and research. It is important to consider children's views, desires and expectations in

whatever the children may be impacted such as treatment or any interventions relating health. This has had implications for the involvement of children in research. Child research has shifted from research on children involving ‘what adults think children think’ (Alderson and Morrow, 2004) towards research with children regarding children ‘as competent and reflexive in reporting their own experience’ (Mayall, 1996). Children are more likely to be seen as active participants rather than objects.

In the past researchers were more likely to rely on adults as proxies for children than asking children directly, particularly for very young children aged under 8 years (Anderson *et al.*, 2004). As discussed earlier, only modest agreement is found between children and parental reports (Jokovic *et al.*, 2004).

Regarding research with children, there may be problems obtaining understanding of children’s perspectives. These difficulties include the relationships between adult researchers and children with crucial factors of language use, research setting, analysis and data quality (Marshman and Hall, 2008). Solutions to these problems have involved using simple and relevant language to children, developing a rapport between researcher and child, providing the child with comprehensive and unambiguous instruction, asking questions appropriate to children’s experience and allowing ‘don’t know’ responses to avoid guesses (Punch, 2002).

In addition to the data, methods to access children’s perspectives by actively involving them in research are considerable. These have included quantitative approaches such as questionnaires, qualitative techniques including either individual or in group interviews and participatory methods such as drawings, time-lines and vignettes (Marshman and Hall, 2008; Punch, 2002). Questionnaires need to be developed especially for children, for example, the Child Perceptions Questionnaires (Jokovic *et al.*, 2002; Jokovic *et al.*, 2004) and Child Oral Impacts on Daily Performance (Gherunpong *et al.*, 2004).

As discussed before, health is influenced by various factors. The association between biological factors and health is weak. Health tends to be more influenced by personal and social circumstances (Locker and Slade, 1994) than clinical factors. How

individual factors influence health may guide researchers planning interventions to improve health.

2.1.4 The value of theoretical models

Theoretical models are fundamental to the development of science. They are constructed from theories on a set of ideas organised to describe natural phenomena. They become systems of mathematical equations, which model the behaviours of the particular theoretical system. While theories are ideas that have only logical consequences, theoretical models predict material consequences which can be measured and move to the application of theories (McLaren, 1998). These theoretical models are a practical method of matching a theory to reality. For example, in medicine, biological models can shape the practice of medicine and commonly used to explain natural processes of diseases. The merits of a theoretical model are set out below.

Firstly, theoretical models are commonly used to explain natural phenomena, to describe the relationships among variables. As such, theoretical model are used as explanatory tools. For instance, medical scientists established the biomedical model in order to study diseases. It explains diseases in terms of aetiology and pathological processes using technical terms. This model helps physicians better understand by connecting causes, pathological changes and clinical features (Quintner *et al.*, 2008). Another example, relationships between clinical and nonclinical variables on OHRQoL have been described by the Wilson and Cleary model and tested in relation to dentistry (Baker *et al.*, 2007; Baker *et al.*, 2010; Baker *et al.*, 2008).

Secondly, theoretical models are used for prediction. They can predict specific natural processes by using logical material consequences that can be measured empirically. For example, Janket and colleagues (2004) researched 256 Finnish cardiac patients from Kuopio University Hospital with angiographically confirmed chronic heart disease. All dental considerations expected to create inflammatory mediators, including pericoronitis, dental caries, root remnants, and gingivitis, were examined, and an asymptotic dental score (ADS) was developed by logistic regression analyses. ADS was a significant contributor to the explanatory ability as a predictor of chronic heart diseases (Janket *et al.*, 2004). Another example, Baker and colleagues (2010) tested the Wilson and Cleary model in relation to determinants of

children's oral health. The results showed that SOC predicted fewer symptoms, less functional impacts and better OHRQoL.

Thirdly, theoretical models can be used to guide further actions. For example, the model of health related quality of life is used to evaluate the relationships among clinical variables, symptoms, psychosocial factors, functioning and general health perceptions and then measure overall health related quality of life. Facilitating understanding of these associations, this model is useful to formulate strategies to improve function and health related quality of life (Wilson and Cleary, 1995).

Fourthly, theoretical models are used to analyse data systematically rather than on "a fishing trip". That is, they restrict analyses to hypothesised relationships (Boorse, 1997). Furthermore, the model can be developed into statistical models that can then be used to estimate the size of specified effects.

Overall, theory acts as a guiding framework to better understand relationships between key variables, guide statistical analyses and interpretation and facilitate the design and evaluation of interventions in the longer term.

2.1.5 The Wilson and Cleary model (Figure 1)

2.1.5.1 Description of the model

The main objective of this model is to link clinical factors with quality of life in a continuum of increasing biological or physiological, social and psychological factors. Biological measures, for instance, haematocrit, serum albumin level, dental plaque level and DMF (decayed, missing and filled teeth) are at the start of the continuum, whereas integrated measures which are more complex such as physical functioning, general health perceptions and life satisfaction are at the other end. These associations are exhibited in Figure 1.

2.1.5.2 Components of the model

The subsections of this model can be described at five levels: biological and physiological factors, symptoms, functioning, general health perceptions and overall quality of life. Each level explains concepts of health at that level with each level relating to the levels preceding it in the model.

Biological and physiological factors

Although molecular and genetic factors are determinants of clinical status, this model starts with the biological and physiological factors that are most commonly measured in clinical practice.

Biological and physiological factors represent the function of cells, organs and organ systems. At this level, the factors that affect health are primarily mediated by changes in the functions of those cells, organs and organs systems. For example, patients with dental caries usually have cavities due to demineralisation, patients with periodontitis have periodontal tissue inflammation, gingival attachment loss and pocket formation and patients with oral cancers have abnormal growth of oral tissues.

Symptoms

In assessing symptoms, the focus changes to the person. Symptoms are classified into three types: physical, psychophysical and psychological. Symptoms have been defined as a patient's perception of an abnormal physical, emotional and cognitive state. The magnitude of symptoms can vary dependently on severity and persistence (Ferrans *et al.*, 2005).

Within the model, symptoms are directly linked to biological factors. Nevertheless, this association is complex. Some patients have deviations of biological and physiological variables but have no symptoms; individuals with tooth decay may not have any symptoms at all (Gregory *et al.*, 2005). The relationship between biological and physiological factors and symptoms is therefore inconsistent. Accordingly, the treatments that usually target biological and physiological abnormalities may not reduce symptoms. Physicians must consider factors of patient reported symptoms, for instance, psychological factors and social factors that may help them to state better both clinical and non-clinical variables associated with patient symptom reporting (Baker *et al.*, 2007).

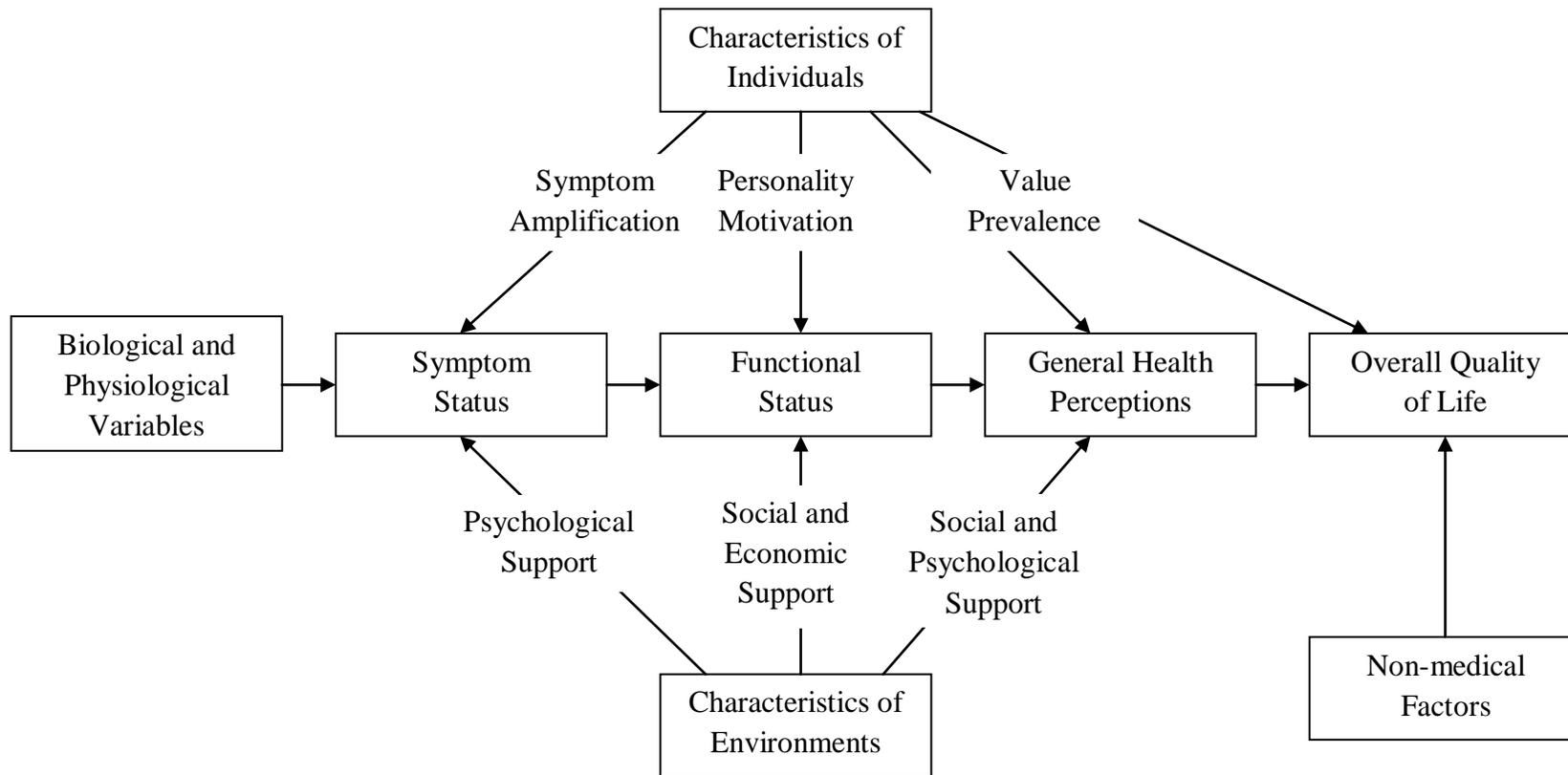


Figure 1 The Wilson and Cleary Model

Taken from Wilson IB and Cleary PD (1995): Linking clinical variables with health related quality of life: A conceptual model of patient outcomes. *Journal of the American Medical Association* 273, 59-65

Functioning

Functioning is defined as the ability of individuals to perform particular tasks. Four dimensions of functioning that are commonly evaluated are physical, psychological, social and role function. These domains are accepted generally as a minimum requirement that needs to be addressed.

Symptoms are hypothesised to directly determinate function. For example, patients with painful hip arthritis tend to have decreased ability to walk up stairs or bathe themselves. Another important factor is personality and motivation, which are patient specific factors. Interestingly, in patients with the same hip condition, one who has higher self-efficacy may function at a higher level than one with lower self-efficacy. Furthermore, individual's social environments may also influence functioning. Supportive family and friends, and easier access to medical care are considered to improve physical, social and role function (Wilson and Cleary, 1995).

It seems that the relationships between functional impairment and biological and physiological factors or symptoms are mediated by other factors (Gregory *et al.*, 2005). This has indicated the necessity to better understand how these conditions influence functioning.

General health perceptions

General health perceptions integrate all preceding health concepts including well being and functioning using subjective ratings; in other words, self rated health (Brodin and Opava, 2007). Functional status has been related to general health perception (Barsky *et al.*, 1992). A study in medical outpatients with hypochondriasis and somatisation found that general perceptions were predicted by a number of medical and psychiatric problems, including functioning (Barsky *et al.*, 1992). In oral health, general health perceptions (e.g. global oral health rating) can be changed in a positive way by improving functional status. Receiving prosthetic treatment, significantly improved oral functioning and global oral health ratings in housebound elders (Baker *et al.*, 2008).

Overall quality of life

Overall quality of life is influenced by several factors, for example, psychological factors, functional status and general health perceptions. It is subjective well-being

assessed via general measures of happiness and life satisfaction. Numerous classifications and theories of subjective well being have been developed and tested. Most theories are presumed to describe a synthesis of various experiences and feeling that individuals have. As a result, health related quality of life and other experiences influence overall quality of life. Interestingly, general measures of happiness and life satisfaction are not associated as powerfully to life circumstances as might be expected and lower levels of satisfaction are not necessarily linked to lower levels of functional status. Individuals may change their expectation when their circumstances change (Carr *et al.*, 2001).

Individual factors

Patients' preferences are recognised as crucial factors for better understanding general health perceptions and overall quality of life. Each patient has different levels of worry and limitation because they value symptoms differently.

Emotional or psychological factors such as self-esteem, self-efficacy, locus of control and sense of coherence may be related to other variables at every level of the model. These relationships can also be bidirectional. For example, depression may cause rising serum glucose if it renders patients unable to adhere to their insulin regimen. The deterioration of physical and social function may lead to worse general health perceptions and overall quality of life. In the opposite way, worsening physical symptoms, limitations of function and low quality of life can cause depression and anxiety (Kaplan, 1987). Pain can cause depression, in the mean time, depression can worsen pain (Kellner, 1985). Hence, the causal relationships between psychological factors and other factors in this model should be examined convergently.

Environmental factors

Environmental factors include socioeconomic status, often measure via household income, occupation and education. In the Wilson and Cleary model, these factors influence patient's symptoms, functioning, general health perceptions and thus their overall quality of life. Healthier environments can contribute to better quality of life. Poor living conditions dominate unhealthy lifestyles (i.e. poor diet, poor oral hygiene, high frequency of drug and alcohol use) and limited accessibility and availability of both general and oral health services (Petersen *et al.*, 2005). In relation

to oral health, children from low income families have worse oral health related quality of life (Locker, 2009).

The relationships between socioeconomic status and oral health outcomes can be explained in three ways. First, income directly affects access to resources and services that promote health. A survey of patients with aesthetic dental problems showed that financial ability influenced the frequency of the dental visit (Nowakowska-Socha, 2007). Shavers (2007) also found that groups with low socioeconomic status experienced more oral disadvantages. Second, there is a difference in exposures to risk factors and health behaviours between individuals with high and low income. Third, psychosocial factors may be moderators between socioeconomic status and health (Sanders and Spencer, 2005; Sisson, 2007). Psychosocial factors such as coping strategy and social support may mediate the impact of socioeconomic status on health (Taylor and Seeman, 1999).

2.1.5.3 Testing the Wilson and Cleary model in relation to oral health

In dentistry, there are few studies investigating the relationships among variables within a theoretical model and, more specifically, the Wilson and Cleary model. Baker and colleagues (2007) conducted a cross-sectional study testing the model of direct and mediated pathways between clinical and nonclinical variables in relation to oral health related quality of life in 85 outpatients with xerostomia. The results supported the dominant direct and indirect pathways in the model with more severe clinical signs predicting worse patient reported symptoms and worse symptom perception was associated with a lower oral health related quality of life. There was, however, no relationship between global oral health perceptions and subjective well-being. Subjective well-being was related to earlier non-adjacent levels such as biological variables, symptoms and functional status. The authors concluded that the impact of clinical variables on oral health related quality of life is mediated by patient reported symptoms. Subsequently, Baker and colleagues (2008) investigated the Wilson and Cleary model of direct and mediated pathways between symptom status, functional status and general health perceptions in relation to oral health 133 housebound edentulous older people. Measures of self-reported symptoms, functional status and global oral and general health perceptions were collected from participants before treatment and at three month follow-up in a domiciliary denture service. The dominant pathways within the model such as worse patient reported symptoms

predicted lower functional status and worse functional status predicted lower global oral health perceptions. Furthermore, the impact of symptom status on oral health perceptions was mediated by functional status. These findings supported the model and helped clinicians and researchers to understand how oral health may impact on an individual's life. This study also provided theoretical development of the concept of oral health quality of life. Importantly, it showed the relationships between clinical and nonclinical variables in relation to oral health.

Baker and colleagues (2010) investigated determinants of children's oral health related quality of life. They tested the relationships between clinical and non-clinical variables hypothesised within the Wilson and Cleary model. In addition, they examined whether individual characteristics such as the sense of coherence, locus of control, self-esteem, oral health beliefs, gender and environmental factors such as parental education, income and work status influenced children's OHRQoL. Sense of coherence prospectively predicted symptoms, functional status and general health perceptions over a 6-month period. Moreover, parental income predicted symptom status, functional status and quality of life.

2.1.6 Oral health related quality of life (OHRQoL)

2.1.6.1 Definition of OHRQoL

Oral health can be defined as “*a standard of health of the oral and related tissues to eat, speak and socialize without active disease, discomfort or embarrassment, and contributes to general well-being*” (Department of health, 1994). This definition reflects the broader aspects of oral health compatible with the biopsychosocial model.

Locker and Allen defined oral health related quality of life (OHRQoL) as “*the impact of oral disease and disorders on aspects of everyday life that a patient or person values, that are of sufficient magnitude, in terms of frequency, severity or duration to affect their experience and perception of their life overall*” (Locker and Allen, 2007).

It is an important multidimensional outcome that is widely accepted to evaluate the impact of oral health problems on quality of life and well-being both in health care and research. Again it fits within the biopsychosocial approach.

Oral diseases and oral conditions may affect various aspects of an individual's life in terms of pain and discomfort. These oral health problems can cause a negative impact on quality of life because they dominate individual's speaking, eating, chewing, smiling and communicating with other people (Locker, 1997; Piovesan *et al.*, 2009). For instance, tooth decay can limit eating, leads to the complexity of health problems such as weight loss, sleep difficulty, behavioural changes and diminishes school performance (Feitosa *et al.*, 2005). Cortes and colleagues postulated that when compared to children without any fractured teeth, those who had fractured teeth tended to report the impacts for consuming and enjoying food, smiling, laughing and cleaning teeth with subsequent impacts for emotion and meeting other people (Cortes *et al.*, 2002). In this way OHRQoL is analogous to functional limitation within the Wilson and Cleary model.

Locker's original conceptual model of oral health (1988) (Figure 2) is compatible with the Wilson and Cleary model. His model was derived from the International Classification of Functioning, Disability and Health (ICF) to consider the relationship between oral disease, impairment, disability and handicap.

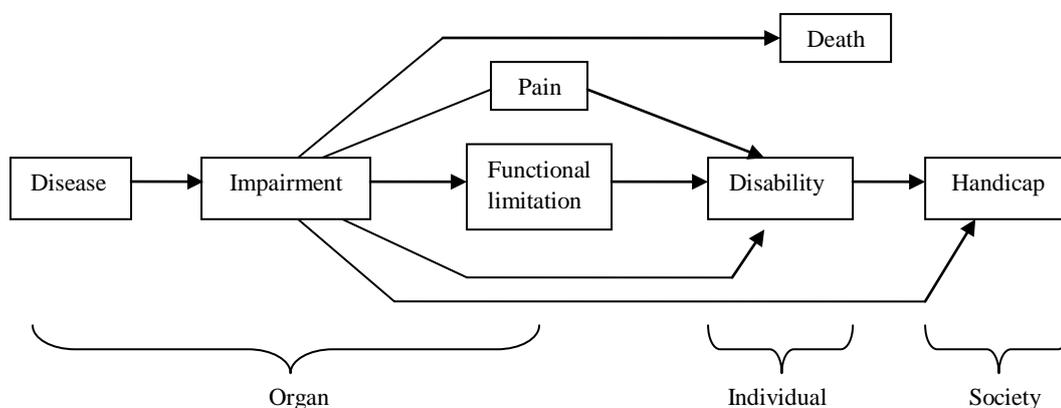


Figure 2 Locker's conceptual model of oral health

Impairment such as malocclusion, loss of periodontal attachment and missing tooth is an abnormality of physical, biochemical and mental function. Functional limitation is a restriction of the working of the body or its components such as the limitation of jaw movement. Disability is a limitation to perform socially defined tasks and roles that persons are expected to do. Handicap is a disadvantage experienced by impaired and disabled people because they do not meet the expectations of society. For instance, a missing tooth may cause a restriction of eating which can make people

avoid eating food in front of other people. This model represented a fundamental change in dentistry, from highlighting diseases in a medical model to one that included patients' perspectives and facilitated the development of oral health related quality of life measures (Daly *et al.*, 2002).

Baker (2007) tested the Locker model in a general population using the data from the UK adult dental health survey (n=5,268) before cross validating the results in two other samples: edentulous elders and xerostomia patients. The data showed significant support for the model, with both direct and indirect paths between nonadjacent paths within the model. The model was significant in all samples at population, individual and group levels.

However, the original Locker model did not include individual characteristics and environmental factors that were noted as likely to play important roles in oral health. Moreover, most oral health related quality of life research lacks a systematic application of a theoretical framework. To understand the dynamic of individuals' experiences of their oral health and how oral health influences well-being, theoretically driven research is required.

In this study, the Wilson and Cleary model is used for selecting relevant variables and explaining relationships among variables both adjacent and nonadjacent pathways and design analysis.

2.1.6.2 Measures of OHRQoL in children

The OHRQoL measures most often used in dentistry for children are the Child Oral Impact on Daily Performance (Child-OIDP) and the Child Oral Health Quality of Life (COHRQoL) questionnaires.

The Child Oral Impact on Daily Performance (CHILD-OIDP) questionnaire was adapted from the Oral Impact on Daily Performance scale (OIDP) (Adulyanon and Sheiham, 1997) by Gherunpong and colleagues (Gherunpong *et al.*, 2004). It was developed for use in 11-12 year old children. The properties of the questionnaire were satisfactory for use in children aged 10 years in France (Tubert-Jeannine *et al.*, 2005), 10-11 years old in the UK (Yusuf *et al.*, 2006) and 12 years old in Sudan (Arabic version) (Nurelhuda *et al.*, 2010). This instrument comprises eight items

assessing the impact of oral health on children's ability to perform activities in daily life such as eating and enjoying food, speaking and pronouncing clearly, cleaning teeth, sleeping, relaxing and enjoying contact with people. It includes three domains: physical, psychological and social dimensions and focuses on serious oral impacts matched for disability and handicap domains in Locker's model. The purpose of development of this instrument is very explicit, assessing dental needs in order to promote dental service planning in the population.

The Child Oral Health Quality of Life (COHQoL) questionnaire was developed for adolescents and children by Jokovic and colleagues (2002). It consists of Child Perceptions Questionnaires (CPQ) and a Parental - Caregiver Perceptions Questionnaire (P-CPQ). The Child Perception Questionnaire (CPQ) has two versions: CPQ₈₋₁₀ for 8-10 years old and CPQ₁₁₋₁₄ for 11-14 years old. The original version consists of 37 items whereas short forms are reduced to 16 and 8 items. It was designed to evaluate treatments for a wide range of oral conditions such as dental caries, malocclusions and orofacial anomalies.

CPQ₁₁₋₁₄ is divided into 4 domains: oral symptoms, functional limitations, emotional well-being and social well-being. The children are asked about the frequency of impacts on these four domains during the previous three months and respond to each item on a five point Likert scale ranging from never (0) to everyday or almost every day (4). The CPQ₁₁₋₁₄ also includes a global oral health rating and assesses the extent to which oral disorders or conditions disturb children's lives overall. The original CPQ₁₁₋₁₄ is for use as an outcome measure in clinical trials whereas two short forms are intended for clinical settings and population surveys (Jokovic *et al.*, 2006). The validity and reliability of the CPQ₁₁₋₁₄ have been tested in many settings (Bekes *et al.*, 2012; Do and Spencer, 2008; Foster-Page *et al.*, 2005; Goursand *et al.*, 2008; Gururatana *et al.*, 2011a; Jokovic *et al.*, 2002; Marshman *et al.*, 2005; McGrath *et al.*, 2004; McGrath *et al.*, 2008). It has shown acceptable reliability, criterion validity and construct validity in relation to global oral health rating and overall well-being (Bekes *et al.*, 2012; Do and Spencer, 2008; Jokovic *et al.*, 2002; Marshman *et al.*, 2005).

Although several instruments have been proposed to measure OHRQoL of children, clinicians and researchers must select an appropriate instrument depending on the

target population, desired outcomes, purposes of the study and previous validation. In this present study, the original version of CPQ₁₁₋₁₄ is used to measure OHRQoL of children because it has been found to be reliable and validated in general population samples (Do and Spencer, 2008) and be practical with regard to self administration.

2.1.6.3 Importance of measuring OHRQoL

The application of OHRQoL measures can be summarised in three groups (Locker, 1996; Robinson *et al.*, 2003).

Political applications

OHRQoL measures can provide comprehensive information on oral health that can be used for policy development by illustrating the importance of oral health to people's lives. Similarly, such emotive data can be used to secure public funds (Locker, 1996; Robinson *et al.*, 2003; Weintraub, 1998).

Theoretical applications

Measuring OHRQoL helps researchers to identify various factors involving oral health and thus general health and well-being. The data may therefore be useful to explore models of oral health to provide a greater understanding of the relationships among variables influencing oral and general health and quality of life (Robinson *et al.*, 2003).

Practical applications

OHRQoL measurement can be used as an outcome in clinical trials to evaluate changes of functions and therefore well-being. Furthermore, it can provide information about factors influencing oral health behaviours that is useful to promote appropriate behaviours in health promotion.

In public health, OHRQoL measurement is used to determine oral health needs in the population, to prioritise dental care and planning services.

In clinical practice, OHRQoL is employed to evaluate the changes brought about by interventions and facilitate the choice of treatments. Such evidence can help clinicians and researchers gain a greater understanding of the complexity of oral

health impacts. Interpretation of such results may guide the development of strategies and interventions to improve oral health related quality of life.

2.2 Sense of Coherence

Sense of coherence is a central construct of the salutogenic theory (Antonovsky, 1979). It is a personal orientation toward problem solving and the capacity to use the resources available (Antonovsky, 1979; Lindstrom and Eriksson, 2005). Therefore, it is an individual characteristic identified to influence health. It has become a fundamental concept in public health, particularly in health promotion. According to Antonovsky's perspective, health is seen as a movement on an axis between ease and dis-ease. The salutogenic idea focuses on what creates health; in other words, it seeks the origin of health. It contrasts with the pathogenic direction that searches for the causes of diseases and defines health as a dichotomous end: health and disease.

2.2.1 Definition and components of sense of coherence

SOC is a global orientation to view life as comprehensible, structural, manageable and coherent (Antonovsky, 1987). It can be seen as a way of thinking and acting which can lead people to distinguish, benefit from, use and re-use resources at their disposal. A person with strong SOC is more likely than one with a weak SOC to define stimuli as nonstressors or to appraise them as benign or irrelevant. Moreover, the former person tends to have a greater variety of coping strategies to select flexibly and appropriately to cope with stressors. The core components of SOC are defined in three elements: comprehensibility, manageability and meaningfulness. People who have a strong SOC are more likely to be high on these components. Adversely, those who have a weak SOC tend to be low on these. The original definition of SOC is as follows:

“the sense of coherence is a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable and explicable; (2) the resources are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement.” (Antonovsky, 1987)

Comprehensibility is the extent to which individuals perceive the stressors that they encounter, deriving from both internal and external environments as information that

is structured, consistent and clear rather than chaotic, disordered, random and enigmatic. Individuals with high comprehensibility believe that stressors can be predictable, ordered and explicit. This is the cognitive component of the SOC construct (Antonovsky, 1979, 1987).

Manageability is the extent to which individuals perceive their resources are suited to meet their needs or demands when they are confronted by stressors. Individuals with high manageability tend to accept events in their lives as experiences that challenge them and can be coped with. At personal disposal, resources are controlled by themselves and others such as friends, spouse, colleagues and physician whom they trust. The ability to manage these resources is recognised as the instrumental or behavioural component of the SOC construct.

Meaningfulness is the extent to which individuals feel that their lives make sense emotionally and that the difficulties and demand they face are worthy of effort, investing energy and engagement. Problems are seen as challenges instead of burdens. Individuals with high meaningfulness tend to seek the meaning in the challenges and try to overcome them. This is the motivational component of the SOC construct.

The three components of SOC are closely linked but remain three distinct concepts, so that different kinds of experiences may yield different responses. For instance, people may occupy a social role that provides the consistency and a reasonable underload-overload balance but may not afford participation in shaping outcomes. This might lead to high comprehensibility and manageability but low meaningfulness (Antonovsky, 1987).

General resistance resources (GRRs) are resources available that make such a continuum possible. Antonovsky explained GRRs as resources bound within people that can be used and re-used for intended purposes from an individual to communities. These resources may be genetic, biological and psychosocial factors which contribute to an individual's knowledge, ego identity, money, coping strategy, social support, cultural stability, religion and preventive direction. These sets of life experiences are "characterised by consistency, participation in shaping outcomes, and underload-overload balance" (Antonovsky, 1987) and can gradually enhance

SOC. Clearly, GRRs can promote and maintain a strong SOC whilst SOC reflects a person's view of life as well as the capacity to respond to stressful situations that confront people in everyday life.

According to the salutogenic theory, SOC is a major determinant of people's position on the health ease/dis-ease continuum and influences the movement toward the healthy end (Antonovsky, 1987).

2.2.2 Development and stability of sense of coherence

SOC develops at an early age during childhood. Crucial factors that may influence the reinforcement of SOC are experiences of childhood and adolescence, social role and work. Moreover, families, environments and interpersonal relationships are likely to be important factors that may affect the degree of SOC (Antonovsky, 1979; Volanen *et al.*, 2004).

In early childhood, SOC can fluctuate around a mean level but is fully developed at the age of thirty and then remains relatively stable. Slow or minor changes may occur with great changes of life events (Antonovsky, 1987). The stability of SOC remains an ongoing debate. Several studies have shown test-retest correlations of SOC measure to be high implying that SOC is relatively constant (Eriksson and Lindstrom, 2005; Schnyder *et al.*, 2000). One longitudinal study conducted over an eighteen month period on adolescents showed the level of SOC is stable in middle to late adolescence (Buddeberg-Fischer *et al.*, 2001).

In contrast, SOC of adults changed when work environments were altered (Feldt *et al.*, 2000). Furthermore, SOC was no more steady among older subjects than in subjects who are less than thirty years old in a five year follow up study (Feldt *et al.*, 2007). This is supported by a study carried out over a six month period in 74 Finnish unemployed people. SOC increased significantly in an intervention group to support re-employment. The changes of SOC in people less than thirty years old are not greater than other age groups (Vastamaki *et al.*, 2009). Richardson and colleagues' Canadian longitudinal study to investigate the stability of SOC across three age groups: 19-25 years (n=1,257), 30-55 years (n=5,326) and ≥ 60 years (n=2,213) collected data in 1994-1995 and 1998-1999. The results indicated that SOC increased slowly, into older age (Richardson *et al.*, 2007). Lindmark and colleagues

investigated the distribution of SOC in 910 Swedish population aged 20-80 years old. SOC was measured by 13-item SOC scale. They asserted that SOC increased with age. The 20 years old had significantly lower SOC than the other age groups (Lindmark *et al.*, 2010).

In regard to gender, studies have consistently indicated that males tend to have higher SOC than females (Buddeberg-Fischer *et al.*, 2001; Larsson and Kallenberg, 1999). Recently, the studies also supported that males have higher SOC than females (Lindmark *et al.*, 2010; Volanen *et al.*, 2004).

Cumulatively, it can be concluded that SOC may not be stable all the time but can be boosted by changing environments, improving interpersonal relationships and encouraging people to participate in the interventions that support their lives.

2.2.3 Measuring sense of coherence

After introducing the salutogenic theory, Antonovsky established a questionnaire based SOC scale; now accepted as a life orientation questionnaire, shifting from the focus on the risk factors of diseases to understanding determinants of health. To date, the scale has been used in at least 15 versions and 33 different languages in 32 countries (Eriksson and Lindstrom, 2005). It has been concluded that this scale is applicable cross culturally.

This orientation to life questionnaire is most commonly used in two forms; the original form of 29 items or a short form of 13 items (Antonovsky, 1987; Eriksson and Lindstrom, 2005). The longer version comprises 11 comprehensibility, 8 manageability and 10 meaningfulness items, whereas the short form is made up of 5 comprehensibility, 4 manageability and 4 meaningfulness items. This self-report questionnaire reflects the extent to which individuals view their lives as comprehensible, manageable and meaningful using items such as “When you talk to people, do you have the feeling they do not understand you?”, “Do you have the feeling that you have been treated unfairly?” and “Do you have the feeling that you do not really care about what goes on around you?”. Responses are made on 7 point semantic differential phrases with two anchoring phrases which are either “very seldom or never/very often” or “never happened/always happened”. Higher scores denote higher SOC (Antonovsky, 1987). The mean score of SOC-29 is from 100.50

(SD= 28.50) to 164.50 (SD= 17.10) whilst SOC-13 score is from 35.39 (SD= 0.10) to 77.60 (SD= 13.80) (Eriksson and Lindstrom, 2006).

For the 29-item version (SOC-29), reliability, as represented by Cronbach's alpha ranges from 0.85 to 0.95. The 13 item (SOC-13) version ranges from 0.74 to 0.91 (Antonovsky, 1987; Larsson and Kallenberg, 1999). Eriksson and Lindstrom (2005) systematically reviewed and analysed the reliability and validity of the SOC scale from research published between 1992 and 2003. In 124 studies the range of the reliability of the SOC-29 was from 0.70 to 0.95 whereas SOC-13 in 127 studies was between 0.70 and 0.92. Furthermore, in 60 studies using modified SOC scales of 3, 6, 10 and 16 items, the range was from 0.35 to 0.91.

A SOC questionnaire has also been adapted for children of 5-10 years of age; the Child Sense of Coherence Scale (CSOC). It is comprised a 16 item Likert scale with 4 point semantic phrases ranged from 1 (Never) to 4 (Always). The scale with Cronbach's alpha 0.74 for male and 0.73 for female was used to assess SOC among children with learning disorder (Margalit, 1998). In addition, CSOC with Cronbach's alpha 0.72 was used to appraise SOC in the study aimed to examine the association between reciprocal nominations, reciprocal rejections and loneliness among 2nd to 6th Grades Israel students (Margalit *et al.*, 1999). Furthermore, CSOC was used to measure SOC in the study on children with behaviour difficulties (Efrati-Virtzer and Margalit, 2009).

2.2.4 Sense of coherence and health

SOC is hypothesised to be an individual's resources influencing causes and healing from diseases through coping ability. This ability may include avoidance of personal habits that hinder better health such as excessive drinking, smoking and unhealthy diet. In addition, it may also influence health behaviours that can diminish the severity of diseases such as seeking early treatment and compliance with health professionals (Antonovsky, 1987). Over the past two decades, there have been a number of studies on the relationship between SOC and health.

2.2.4.1 Sense of coherence and physical health

Although a number of studies have associated SOC and various kinds of health measures, most have evaluated psychological health or incorporated psychological

facets into health measures. Few studies have investigated the direct relationships between SOC and physical health.

Kivimäki and colleagues (2000) postulated that SOC did not predict health. A cross-lagged longitudinal study with 5 year follow up was carried out in Finnish municipal employees and technical designers to investigate the stability of SOC and the correlations between SOC and health. Data were collected from 320 male technical designers using the 13-item SOC scale and health indicators including psychological complaints and physical symptom subscales (Feldt, 1997). No predictive relationships between SOC and health were found at five year follow-up (Kivimäki *et al.*, 2000). Likewise, SOC could not predict a positive outcome of health in Swedish patients and American veterans (Atroshi *et al.*, 2002; Coe *et al.*, 1988).

In contrast, Suomainen and colleagues (2001) found SOC to be related to subjective states of health in a 4 year follow-up study. Data were obtained from 1976 participants divided into three groups: 15-34, 35-49 and 60-64 years by using 16 item SOC scale and a single item questionnaire about subjective well-being ranging from 'very poor' to 'very good' health. Low SOC was significantly related to poor subjective state of health.

Agardh and colleagues (2003) examined relationships among work stress, type 2 diabetes and SOC. This case-control study was carried out in 4,821 healthy Swedish female aged 35-56 years. Fifty-two women were diagnosed to have type 2 diabetes using an oral glucose tolerance test. Data were collected by using a 3-item SOC scale, glucose tolerance test and body measures. Patients with low decision latitude and low SOC were more likely to have type 2 diabetes.

Surtees and colleagues determined the associations between SOC and the reduction of mortality in 20,579 cardiovascular and cancer patients aged 41-80 years old in the EPIC-Norfolk in the UK. Prospective cohort data were collected using the Health and Life Experiences Questionnaire (HLEQ) (Surtees *et al.*, 2000) that included 3-item SOC scale during 1996-2002. Higher SOC was associated with a 30% decrease of mortality from cancer and cardiovascular diseases (Surtees *et al.*, 2003). A systematic review identified both direct and indirect relations between better health and higher SOC.

Although there are significant relationships between SOC and physical health in some studies, these correlations are subtle and typically cross-sectional. SOC can be seen as only a weak predictor of physical health (Flensburg-Madsen *et al.*, 2005).

2.2.4.2 Sense of coherence and mental health

People with higher SOC tend to have better mental health in terms of lower stress, depression and distress (Hood *et al.*, 1996). Low SOC is associated with life dissatisfaction, depression and poorer psychosomatic health (Myrin and Lagerstrom, 2008). In other words, a high SOC may be a buffer against stress (Pallant and Lae, 2002).

Wiesmann and Hannich (2008) investigated relationships among SOC, subjective well-being and general resistance resources (GRR) such as age, education, physical health, social support and personality variables in 170 elderly persons with psychosomatic problems. SOC mediated the relationships between mobilising resources and well-being. Self-efficacy, self-esteem and education were strongly linked to SOC. This finding confirmed the salutogenic idea that SOC plays a key role for psychological adaptation (Tanga and Li, 2008 ; Wiesmann and Hannich, 2008).

2.2.4.3 Sense of coherence and quality of life

In regard to health related quality of life (HRQoL). Drageset and colleagues (2009) evaluated the impact of social support and SOC on health related quality of life among 227 nursing home residents. Data were collected using the SF-36 health survey, social provision scale and SOC scale. SOC influenced all SF-36 subscales and appeared to be a crucial factor for better health related quality of life. In a two year longitudinal study of self -reported health related quality of life and SOC in 104 HIV- infected patients, HRQoL was assessed by the HIV-symptom scale, the Health Index and the well-being scale. SOC was measured by the 29-item SOC scale. Patients with higher SOC rated their HRQoL better than those with lower SOC (Langius-Eklöf *et al.*, 2009). Ekwall and colleagues (2007) examined coping strategies and SOC regarding gender, care giving activities and health related quality of life in 171 older caregivers in a postal survey. Self-sustainment, coping strategies and high SOC predicted better health related quality of life. A systematic review of SOC and its relation to quality of life (QoL) was conducted by Eriksson and Lindstrom (2007). This review included 458 scientific publications and 13 doctoral

theses regarding SOC published in 1992-2003. The finding indicated that higher SOC was associated with better QoL.

2.2.4.4 Sense of coherence and behaviours

A cross-sectional study of residents of Norfolk (UK) found that participants with higher SOC were 28% less likely to be current smokers, 36% less likely to be physically inactive, consumed more fruit, vegetables and fibre than those with weaker SOC (Wainwright *et al.*, 2007).

Kuuppelomäki and Utriainen, (2003) investigated the relationships between SOC and health related behaviours including smoking, drinking and physical exercise in 287 health care students. Students with higher SOC were more likely to take physical exercise.

Electronic searches of the MEDLINE via OvidSP (from 1946 to May 2012), PsycINFO (from 1987 to May 2012), and CINAHL (from 1982 to May 3 2012) databases were performed using and combining the terms ‘sense of coherence or salutogen*’, ‘relat* or associat*’ and ‘health or health behavio*’. Three-hundred and eighty-one articles were identified and scanned. Exclusion criteria included not being published in English, not being relevant and did not clearly measure SOC. Articles related to oral health were also excluded at this point as they are reviewed in section 2.2.5. There were 18 papers that were considered potentially relevant. Those papers clearly examined and summarised relationships between SOC and health or health behaviours and were longitudinal in design (Table 1). Table 1 outlines these studies in relation to sample size, age of participants, variables and key findings.

Table 1 Studies of sense of coherence and health or health behaviours

Authors	Study description	Research design	Sample size	Age of samples	Variables	Key findings
Kuuppelomäki <i>et al.</i> (2000)	The stability of SOC and relationships between SOC and health in two cross lagged samples	Longitudinal (5 yrs)	<u>Study 1</u> n = 577 municipal employees <u>Study 2</u> n = 320 technical designers (male only)	<u>Study 1</u> 20-56 yrs (mean age = 40, SD 7.7) <u>Study 2</u> 25-40 yrs	<u>Study 1</u> • 6-item adapted SOC scale • Sickness absence data involving day absent and frequency due to health problems were recorded <u>Study 2</u> • 13-item SOC scale • Health was assessed by a psychological complaint subscale (e.g. depression, tiredness and weakness) and a Symptom Checklist involving heartburn, stomachache and irregular abdominal functioning	<u>Study 1</u> • SOC was stable over the period of the study • SOC predicted the absence due to sickness over the 4 year follow-up period in women <u>Study 2</u> • No differences in the development of health between individuals with high, moderate and low SOC • Low SOC predicted more adverse expectation and psychological complaint
Suominen <i>et al.</i> (2001)	Prediction of SOC on subjective state of health	Longitudinal (4 yrs)	1976	15-64 yrs	• 16-item SOC scale • Subjective state of health assessed by a single question and categorised into 4 classes: very good, good, mediocre and poor/very poor	• Strong SOC predicted good health
Kuuppelomäki and Utriainen (2003)	Relationships among SOC, smoking, drinking and physical exercise in 3 groups of Finnish polytechnic students	Longitudinal (3 yrs)	<u>At baseline</u> n= 287 <u>At 3 yrs</u> n = 63 (only in health care students)	NA	• 28-item adapted SOC scale • Health behaviours (e.g. frequency of smoking and drinking and physical activities)	<u>At baseline</u> • Physical activity was related to strength of SOC but not related to smoking and drinking <u>At 3 yrs follow up in health care students</u> • No relationships among SOC, physical activity, smoking and drinking

Table 1 Studies of sense of coherence and health or health behaviours (continued)

Authors	Study description	Research design	Sample size	Age of samples	Variables	Key findings
Amirkhan and Greaves (2003)	SOC and stress	Longitudinal	75	48-49 yrs	<ul style="list-style-type: none"> • 29-item SOC scale • Coping strategy, efficacy beliefs and locus of control 	<ul style="list-style-type: none"> • SOC associated with less stress related illness via coping behaviours
Surtees <i>et al.</i> (2003)	Sense of coherence and mortality in men and women in the EPIC-Norfolk United Kingdom	Longitudinal (6 yrs)	20,579	41-80 yrs	<ul style="list-style-type: none"> • 3-item SOC scale • Clinical variables (e.g. diabetes, cardiovascular disease and cancer) • Social and psychological circumstances assessed by Health and Life Experiences Questionnaire (HLEQ) 	<ul style="list-style-type: none"> • SOC associated with a 30% reduction in mortality from cardiovascular disease and cancer
Richardson and Ratner (2005)	SOC as a moderator of the effects of stressful life events on health	Longitudinal (1 yr)	6,505	≥ 30 yrs	<ul style="list-style-type: none"> • 13-item SOC scale • Recent life events e.g. abortion and physical abuse were recorded • Visits to doctors • Self-reported health status; poor, fair, very good and excellent 	<ul style="list-style-type: none"> • SOC buffered the impact of stressful life events on self-reported health
Zirke <i>et al.</i> (2007)	SOC in psychosomatic patients	Longitudinal (3.3 yrs)	1403	16-82 yrs	<ul style="list-style-type: none"> • SOC-L9 (the Leipzig short scale) • Perceived stress by PSQ-20 • Depression and psychosocial stress by patient health question (PHQ) • Coping strategies using the 28-item Brief Cope 	<ul style="list-style-type: none"> • SOC related to subjective well-being, favourable coping strategies and lower perceived stress
Wainwright <i>et al.</i> (2008)	Associations between SOC, lifestyle choices and mortality in residents of Norfolk, UK	Longitudinal (8.3 yrs)	18, 287 (7,863 men, 10,424 women)	41-80 yrs	<ul style="list-style-type: none"> • Food Frequency Questionnaire (FFQ) was used to measure consumption of foods such as fruit, vegetables, saturated fat, sugar and alcohol • Social and psychological circumstances assessed by Health and Life Experiences Questionnaire (HLEQ) • 3-item SOC scale 	<ul style="list-style-type: none"> • Higher SOC less likely to be current smokers and less physical inactive, including more fruit, vegetables and fibre consumption • SOC associated with 20% reduced risk mortality

Table 1 Studies of sense of coherence and health or health behaviours (continued)

Authors	Study description	Research design	Sample size	Age of sample	Variables	Key findings
Ignatova <i>et al.</i> (2008)	Relationships between SOC and smoking	Longitudinal	697	40-79 yrs	<ul style="list-style-type: none"> • Demographic factors such as age, marital status, education and smoking habits • 12-item SOC scale 	<ul style="list-style-type: none"> • Current smokers had lower SOC than non-smokers in women at baseline but in men at follow-up
Skarsater <i>et al.</i> (2009)	SOC and recovery from major depression	Longitudinal (4 yrs)	33	19-61 yrs	<ul style="list-style-type: none"> • 29-item SOC scale • Severity of depression by 10-item MADRS • HRQoL measured by SF-36 	<ul style="list-style-type: none"> • Higher SOC related to better QoL and less depressive symptoms
Langeland <i>et al.</i> (2009)	Relationships between SOC, social support and mental symptoms in patients with mental problems	Longitudinal (1 yr)	107	18-80 yrs	<ul style="list-style-type: none"> • 29-item SOC scale • Social support measured by the Revised Social Provision scale (SPS) • Mental symptoms measured by the Symptoms Checklist-90-Revised (SCL-90-R) 	<ul style="list-style-type: none"> • Social support (social provision of opportunity for nurturance and social integration) predicted SOC • Mental health symptoms did not predict SOC •
Edbom <i>et al.</i> (2010)	Relationships between SOC and the development of Attention Deficit Hyperactivity Disorder (ADHD)	Longitudinal	312	16 yrs	<ul style="list-style-type: none"> • 13-item SOC scale • Kiddie-SADS-Present and Lifetime version to assess ADHD 	<ul style="list-style-type: none"> • Higher SOC associated with lower ADHD
Gauffin <i>et al.</i> (2010)	SOC in young people with uncomplicated epilepsy	Longitudinal (5 yrs)	97	13-22 yrs	<ul style="list-style-type: none"> • 29-item SOC scale • Epilepsy measured using a 4-degree scale (good, partial, poor and very poor control) 	<ul style="list-style-type: none"> • Growing up with epilepsy led to impairment of SOC but SOC uncorrelated with epilepsy related factors
Binkowska-Bury and Januszewicz (2010)	SOC on health related behaviours among university students	Longitudinal	521	≥ 20 yrs	<ul style="list-style-type: none"> • 29-item SOC scale • Intensity of pro-health behaviours; nutrition habits (type of food, balance diet), prophylaxis (health and disease information), positive attitudes (stress and anxiety) and health practice (sleep habits and physical activity) 	<ul style="list-style-type: none"> • SOC correlated with a tendency to positive health behaviours

Table 1 Studies of sense of coherence and health or health behaviours (continued)

Authors	Study description	Research design	Sample size	Age of sample	Variables	Key findings
Arvidsson <i>et al.</i> (2011)	Factors promoting HRQoL in patients with rheumatoid disease	Longitudinal	185	18 yrs	<ul style="list-style-type: none"> • HRQoL measured by SF-36 • 13-item SOC scale 	<ul style="list-style-type: none"> • Higher SOC related to better HRQoL
Mattila <i>et al.</i> (2011)	SOC and health behaviours in adolescence	Longitudinal	NA	15 yrs	<ul style="list-style-type: none"> • 13-item SOC scale • Health behaviours (e.g. use of alcohol, smoking and oral care) 	<ul style="list-style-type: none"> • Strong SOC related to less use of alcohol, less smoking and better care of oral health
Myers <i>et al.</i> (2011)	Prediction of SOC to leisure time physical activity (LTPA) in post-myocardial infarction	Longitudinal	643	≤ 65 yrs	<ul style="list-style-type: none"> • 29-item SOC scale • Clinical variables (e.g. diabetes, hypertension and cardiovascular risk factors) • Self reported leisure time physical activity (LTPA) (regular, irregular and none) 	<ul style="list-style-type: none"> • SOC related to more physical activity
Gustavsson-Lilius <i>et al.</i> (2012)	SOC as a predictor of distress in cancer patients	Longitudinal (8 months)	147	58 (SD 8.7)	<ul style="list-style-type: none"> • Depression measured by the Beck Depression Inventory • Anxiety measured by the Endler Multidimensional Anxiety scale • 12-item Finnish SOC scale 	<ul style="list-style-type: none"> • Higher SOC related to lower depression and anxiety

Overall, from the tables above, SOC is strongly associated with better health, health behaviours and subjective well-being. It appears to have a mediating or moderating role in terms of psychological integrity even though it does not describe overall health alone (Eriksson and Lindstrom, 2006).

2.2.5 Sense of coherence and oral health

Studies have investigated the relationships between SOC and oral health using outcomes that have encompassed oral health status, oral health behaviours and OHRQoL. Electronic searches of the PsycINFO (from 1987 to May 2012), MEDLINE via OvidSP (from 1946 to May 2012) and CINAHL (from 1982 to May 2012) databases were performed using and combining the terms ‘sense of coherence or salutogen*’, ‘oral or dental’ and ‘health or health behavio*’. Twenty-seven articles were identified. Systematic reviews of SOC regarding oral health were also searched. Articles that were not written in English and not relevant were excluded. There were no systematic reviews of SOC and oral health. The twenty identified studies are summarised in Table 2.

A cross sectional study of 664 15-year-olds and their mothers in Brazil investigated the association between mothers’ SOC and their children’s oral health. Two main outcome variables were oral health status (tooth decay, oral hygiene and periodontal diseases) and oral health related behaviours (frequency of tooth brushing, sugar consumption and pattern of dental attendance). Adolescents whose mothers had higher SOC had lower tooth decay, gingival bleeding and a tendency for dental visits when in trouble than those whose mothers had lower SOC (Freire *et al.*, 2002). In another study, although adolescents’ SOC was related to their caries experience in anterior teeth, this association did not remain after controlling for other factors. Other measures of oral health status and oral health related behaviours were not associated significantly with SOC (Freire *et al.*, 2001). These two studies pioneered investigations of the relationships between SOC and oral clinical status and found the relationships to be inconsistent.

Ayo-Yusuf and colleagues (2009) determined the correlation between adolescents’ SOC and tooth brushing using an integrated behaviour change model. Self-administered questionnaires were used to collect data in this 18 month longitudinal study. Participants living with their mothers significantly increased in SOC over the

period of the study. Additionally, they were more likely to brush their teeth twice a day. It is concluded that children's psychological faculties and families should be considered when promoting tooth-brushing behaviour. In another study, Ayo-Yusuf and colleagues investigated the effect of SOC, a personal stress coping resource and smoking on self-reported gingival health in 970 South African adolescents. The main findings of this eighteen month study showed that subjects who had higher SOC reported less gingivitis than those who had lower SOC (Ayo-Yusuf *et al.*, 2008).

Savolainen and colleagues (2005a) asserted that oral health behaviours such as dental attendance and the frequency of tooth brushing were related to SOC. Their cross-sectional study investigated the links between SOC, socioeconomic status, demographic factors, oral health related behaviour and OHRQoL in 4,039 dentate adults. The 12-item SOC scale, Oral Health Impact profile (OHIP) and questionnaires including socio-economic and demographic information were used to obtain data. Oral health problems in patients with weaker SOC were higher. In addition, SOC was related to all subscales of OHIP, particularly psychological discomfort, psychological disability and handicap. They concluded that SOC was an essential factor influencing oral health status and oral health behaviours. Furthermore, stronger SOC was connected with better OHRQoL (Savolainen *et al.*, 2005a; Savolainen *et al.*, 2005b).

A cross-sectional study carried out by Savolainen and colleagues investigated relationships between oral and general health behaviours and oral and general subjective health in 4096 dentate adult aged 30-64 years. Questionnaires and home interviews were used to obtain data about socio-economic status, demographic factors, behaviours and psychosocial factors. Oral health behaviours involved regular dental attendance, twice daily tooth brushing, twice weekly physical activity and smoking habits. Oral and general subjective health was determined. SOC was measured by use of the 12-item scale. SOC was strongly associated with positive oral and general health behaviours and subjective oral and general health, compatible with SOC as a psychosocial factor that plays an important role in health promotion (Savolainen *et al.*, 2009).

Bernabe and colleagues (2009a) conducted a cross-sectional study in 5318 Finnish adults aged 30 years and investigated SOC in relation to childhood SES, parental education and adult oral health behaviours. Childhood SES was correlated with adult

oral health behaviours indirectly via adult SES and SOC. The effect on adult behaviours was stronger for adult SES than via SOC. However, after controlling for demographic factors and adult SES there was a substantial relationship between SOC and better adult oral health behaviours. Another study evaluated relationships among SOC, SES and oral health behaviours in 5,399 Finnish dentate adults. The findings contributed strong support for a correlation between higher SOC and more favourable oral health related behaviours, independent of current SES and demographic factors. The results support the moderating role of SOC on the relationship between SES and oral health related behaviours (Bernabe *et al.*, 2009b).

Dorri and colleagues' cross-sectional assessed the relationship between SOC and tooth brushing behaviours in Iranian adolescents using the 13-item SOC scale and questionnaires on socio-demographic data and the frequency of tooth brushing. SOC was significantly correlated to tooth brushing frequency (Dorri *et al.*, 2010a).

da Silva and colleagues investigated the relationships of low SES, mother's SOC and their child's utilisation of dental care services in Southeast Brazil. Mothers' SOC was measured using the 13-item SOC scale. Children's oral health including DMFS, dental pain, plaque and gingivitis were registered. This cross-sectional study showed that mothers with higher SOC were likely to take their children to dentists and visited dentists mainly for check-ups than those with weaker SOC (da Silva *et al.*, 2011).

Only one longitudinal study (Baker *et al.*, 2010) has studied relationships between SOC and oral health using the Wilson and Cleary model in children. It examined whether individual characteristics such as SOC, locus of control, self-esteem, oral health beliefs, gender and environmental factors such as parental education, income and work status predicted 12-13 year children's OHRQoL over a 6-month period. In structural equation models, SOC at baseline was the most consistent predictor of OHRQoL. Greater SOC was linked to fewer symptoms, less impact on everyday life and better general health perceptions in Malaysian children.

Table 2 summarises the 20 studies of SOC and oral status, oral health behaviours and OHRQoL with regard to study design, sample size, age of participants, variables, key findings and statistical analysis. The search for these studies was described at the beginning of section 2.2.5.

Table 2 Studies of sense of coherence and oral health

Authors	Study description	Research design	Sample size	Age of sample	Variables	Key findings	Statistical analysis
Freire <i>et al.</i> (2001)	Adolescent's SOC, oral health and oral health behaviours	Cross-sectional	664 (320 men, 344 women)	15 yrs	<ul style="list-style-type: none"> • 13-item SOC scale • Clinical examination including dental caries, oral hygiene and periodontal disease • Questionnaire about frequency of sugar consumption and tooth brushing and dental visit pattern 	<ul style="list-style-type: none"> • Adolescents with high SOC tended to visit dentist for check up than those with lower SOC • No significance between oral health status, oral health behaviours and SOC 	Multiple logistic and polytomous ordered regression
Freire <i>et al.</i> (2002)	Mother's SOC and their children's oral health status and behaviours	Cross-sectional	664 adolescents and their mothers	15 yrs (adolescents) Mother (mean age = 40.1 (SD 25.3))	<ul style="list-style-type: none"> • Mother's SOC:13-item SOC scale • Adolescents' caries was measured by Caries Severity Index (adapted from Poulsen and Horowitz, 1974) • Plaque Index adapted from Silness and Loe (1964) • Periodontal status was assessed using CPITN 	<ul style="list-style-type: none"> • Adolescents whose mothers had higher SOC had fewer caries, gingival bleeding after probing and were less likely to visit dentists when in trouble • No association between mother's SOC and adolescent' plaque 	Multiple logistic and polytomous ordered regression
Savolainen <i>et al.</i> (2004)	Relationships between SOC and dental attendance pattern	Cross-sectional	4,263	30-64 yrs	<ul style="list-style-type: none"> • Questionnaires and home interview about socio-economic and demographic factors, oral health behaviours and dental attendance pattern • SOC was measured by 12-item SOC scale 	<ul style="list-style-type: none"> • Subjects with higher SOC had more regular dental attendance • Strong SOC was associated with middle and high education, household income, marital status and urbanization 	Chi-square test and logistic regression
Savolainen <i>et al.</i> (2005a)	Relationships among socio-economic status, demographic factors, oral health status, oral health behaviours, OHRQoL and SOC	Cross-sectional	4,039 (1,899 men, 2,140 women)	30-64 yrs	<ul style="list-style-type: none"> • Questionnaires and interview data on demographic factors, dental attendance and tooth brushing frequency • SOC measured by 12-item scale • OHRQoL assessed by OHIP14 	<ul style="list-style-type: none"> • Subjects with higher SOC had fewer oral health problems • SOC associated with all subscales of OHIP esp. psychological discomfort, psychological disability and handicap subscales 	Unadjusted cumulative odds ratio and adjusted logistic regression

Table 2 Studies of sense of coherence and oral health (continued)

Authors	Study description	Research design	Sample size	Age of sample	Variables	Key findings	Statistical analysis
Savolainen <i>et al.</i> (2005b)	Relationships between SOC, tooth brushing frequency and oral hygiene in Finnish dentate adult	Cross-sectional	4,131	30-64 yrs	<ul style="list-style-type: none"> • Socio-economic and demographic factors , dental attendance and tooth brushing frequency • SOC measured by 12-item SOC scale • OHRQoL assessed by OHIP14 	<ul style="list-style-type: none"> • Subjects with higher SOC had more often 2 or more times tooth brushing • Subjects with higher SOC had better oral hygiene 	Chi-square test and logistic regression
Ayo-Yusuf <i>et al.</i> (2008)	The influence of SOC and smoking on gingival health of grade 8 th black South African adolescents	18 month longitudinal	970	12-19 yrs	<ul style="list-style-type: none"> • Questionnaires about socio-economic and demographic factors, smoking status, dental attendance, frequency of tooth brushing, gingival bleeding and readiness to tooth brushing behaviours change • 6-item SOC scale 	<ul style="list-style-type: none"> • Living in poor household, high plaque levels and regular smoking associated with gingivitis • Subjects with higher SOC reported better gingival health 	Generalised estimation equation
Ayo-Yusuf <i>et al.</i> (2009)	Relationships between adolescent' SOC and their tooth brushing behaviours in grade 8 th South African students	18 month longitudinal	1,025	12-19 yrs (mean 14.4, SD 1.5)	<ul style="list-style-type: none"> • Questionnaires about socio-economic and demographic factors, smoking status, dental attendance, frequency of tooth brushing, gingival bleeding and readiness to tooth brushing behaviours change • SOC was measured by 6-item SOC scale 	<ul style="list-style-type: none"> • Subjects living with mothers had a greater SOC • Subjects who increased in SOC were more likely to brush their teeth more often • Increase in SOC, living with mother and in the preparation stage were associated with the transition to tooth brushing twice daily 	Chi-square test, T-test, Multiple regression
Savolainen <i>et al.</i> (2009)	Relationships SOC and general and oral health behaviours	Cross-sectional	4,096	30-64 yrs	<ul style="list-style-type: none"> • Questionnaire and interview data on demographic factors, regular dental attendance, tooth brushing frequency, physical activities and smoking habits • SOC measured by 12-item scale 	<ul style="list-style-type: none"> • SOC was strongly associated with positive oral and general health behaviours and subjective oral and general health 	Chi-square test and logistic regression

Table 2 Studies of sense of coherence and oral health (continued)

Authors	Study description	Research design	Sample size	Age of sample	Variables	Key findings	Statistical analysis
Bernabe <i>et al.</i> (2009a)	The role of SOC on the relationships between childhood and adult oral health behaviours	Cross-sectional	5,318	30 yrs	<ul style="list-style-type: none"> • Childhood SES (parental education) and adulthood SES (number of years of education and income) • Adult oral health behaviours including pattern of dental attendance, tooth brushing frequency, sugary consumption and smoking habit • 13-item SOC scale 	• Childhood SES was associated with adult oral health behaviours indirectly through adult SES and adult SOC	Structural equation modelling (SEM)
Bernabe <i>et al.</i> (2009b)	Relationships among SOC, SES and oral health related behaviours	Cross-sectional	5,399	Mean 49.60, SD 12.78)	<ul style="list-style-type: none"> • Socio-economic and demographic factors • Oral health behaviours (regular dental attendance and twice daily tooth brushing) and general health behaviours (non-smoking habit) • 13-item SOC scale 	<ul style="list-style-type: none"> • SOC strongly associated with oral health behaviours, independently of SES and demographic factors • Limited support for SOC on the relationship between SES and oral health behaviours 	Logistic regression
Bonanato <i>et al.</i> (2009)	Relationships between mother's SOC and oral health status of preschools children	Cross-sectional	546 mothers and their children	Mothers and 5-year old children	<ul style="list-style-type: none"> • Clinical data included dmft, dental pulp exposure due to caries, root fragment, visible plaque, gingivitis and supragingival calculus (children) • 13- item SOC scale 	• Mothers with lower SOC were more likely to have children with dental problems regardless of child's social class and gender	Multiple logistic regression

Table 2 Studies of sense of coherence and oral health (continued)

Authors	Study description	Research design	Sample size	Age of sample	Variables	Key findings	Statistical analysis
Baker <i>et al.</i> (2010)	Determinants of OHRQoL in children	6 month longitudinal	439	12-13 yrs	<ul style="list-style-type: none"> • Socio-economic and demographic factors • DMFT, gingival health, malocclusion, dental trauma • OHRQoL measured by CPQ₁₁₋₁₄ • 13- item SOC scale • Self-esteem (Rosenberg's 10-item scale), health locus of control (Parcel and Meyer's) and oral health beliefs (Broadbent's) • GHP measured by SF36v2 • Overall QoL measured by the student life satisfaction scale 	<ul style="list-style-type: none"> • SOC was the most consistent psychosocial factor predicting OHRQoL 	Structural equation modelling (SEM)
Bernabe <i>et al.</i> (2010)	Relationships between SOC and oral health and the role of oral health behaviours in this relationship	Cross-sectional	5,401	30-99 yrs	<ul style="list-style-type: none"> • 13-item SOC scale • 4 oral health outcomes; perceived oral health, No. of teeth, decayed teeth and extent of periodontal pockets. 	<ul style="list-style-type: none"> • SOC linked to more teeth, less caries, fewer pockets and better perceived oral health 	Linear and logistic regression
Dorri <i>et al.</i> (2010a)	Relationships between SOC and tooth brushing in Iranian adolescents	Cross-sectional	1,054	11-16 yrs (Mean 12.4, SD 0.7)	<ul style="list-style-type: none"> • 13-item SOC scale • Questionnaire asking about socio-demographic data and frequency of tooth brushing 	<ul style="list-style-type: none"> • Higher SOC was associated with more frequent tooth brushing behaviours 	Logistic regression
Dorri <i>et al.</i> (2010b)	Testing a theoretical model of factors influencing oral and general hygiene behaviours in adolescents in Mashhad, Iran	Cross-sectional	1,132	12.4 (SD 0.8)	<ul style="list-style-type: none"> • Socio-demographic factors, education, frequency of tooth brushing, general hygiene (frequency of taking shower and changing underwear), peer social networks (e.g. club membership, frequency of meeting friends and strengths of ties between friends) • 13-item SOC scale 	<ul style="list-style-type: none"> • The model of factors influencing oral and general hygiene behaviours was valid • Oral and general hygiene behaviours were strongly related • Close relationships between SOC and oral and general hygiene behaviours 	Confirmatory structural equation modelling

Table 2 Studies of sense of coherence and oral health (continued)

Authors	Study description	Research design	Sample size	Age of sample	Variables	Key findings	Statistical analysis
Emami <i>et al.</i> (2010)	The effect of types of prosthesis and SOC on OHRQoL	Cross-sectional	173	Edentulous elders aged \geq 65 yrs	<ul style="list-style-type: none"> • Socio-economic and demographic factors • 20-item Oral Health Impact Profile (OHIP-20) • 13- item SOC scale 	• SOC did not mediate the effect of prosthetic treatment on OHRQoL	General linear modelling
Vilela and Allison (2010)	Relationships between SOC and head and neck cancer in Brazilian adults (cancers were mainly in oral cavity)	Cross-sectional	162	Mean 57.5 yrs	<ul style="list-style-type: none"> • Socio-economic and demographic factors • 13- item SOC scale • Clinical characteristics • Tobacco and alcohol consumption • Social support 	• Strong correlations between SOC and SES including marital, occupational and educational status and social support	Multiple regression
da Silva <i>et al.</i> (2011)	Relationships between mother's SOC and their children's utilisation of dental services	Cross-sectional	190	Children aged 11-12 and their mothers	<ul style="list-style-type: none"> • Mother's SOC:13-item SOC scale • Children's use of services • Children's DMFS, pain, plaque and gingivitis 	<ul style="list-style-type: none"> • Mothers with higher SOC took children to visit dentist mainly for check-up • SOC was linked to more utilisation of dental services 	Multiple logistic regression
Lindmark <i>et al.</i> (2011)	SOC, oral health status and positive oral health behaviours in Swedish adults	Cross-sectional	525	20-80 yrs	<ul style="list-style-type: none"> • 13-item SOC scale • clinical outcomes such as DMFS and periodontal health 	• SOC was linked to fewer decayed teeth, more filled teeth, higher teeth without calculus and better periodontal health	Bivariate and multivariate analyses
Bernabe <i>et al.</i> (2012)	Relationships between parental education and tooth retention in adults	Cross-sectional	5,401	Dentate adults aged 30 and over	<ul style="list-style-type: none"> • Socio-economic and demographic factors • Regular dental attendance, tooth brushing and general health behaviours (smoking habit) • 13-item SOC scale 	• SOC was associated with tooth retention through oral health related behaviours, but contributes little to the relationships between parental education and tooth retention	Structural equation modelling

In summary, from the studies in Table 2, SOC seems to be an important factor associated with better clinical status, favourable oral health behaviours and oral health related quality of life. However, most studies investigating relationships between SOC and oral health outcomes were cross-sectional. Thus, experimental or longitudinal studies are needed to confirm cause-effect relationships between SOC and indicators of oral health.

2.2.6 Psychological factors relevant to sense of coherence

SOC is an individual's general life orientation. It mirrors the quality of an individual's life, internal resources and adaptive coping ability. It appears to be a highly complex construct which reflects diverse personality domains (Feldt, 2000; Strümpfer *et al.*, 1998). These dimensions may refer to individuals' self-esteem and internal locus of control, which are the sense of self-reliance when they face challenges and also refer to personal' self-efficacy, which is a sense of confidence in the form of efficacy and potency to deal with problems (AbuSabha and Achterberg, 1997).

2.2.6.1 Self-esteem

2.2.6.1.1 Definition of self-esteem

Descriptions of self-esteem vary dependent on the researcher's field of interest. Rosenberg explained self-esteem as an attitude towards self, involving both positive and negative attitudes (Rosenberg, 1965) whereas Fowler and Fowler (1996) defined self-esteem as '*favourable opinion of one's own character and abilities*' (Fowler and Fowler, 1996 : p. 760). Self-esteem tends to be difficult to separate from other relevant concepts such as self concept (Butler and Gasson, 2005) self image (Hughes, 1984) and self acceptance (Meggert, 2000).

2.2.6.1.2 How self-esteem relates to sense of coherence

Rosenberg (1965) postulated that individuals with high self-esteem respect and consider themselves at least at an equal level with others. Moreover, they recognise their own limitations and anticipate the improvement. These aspects of personality are an important part of SOC in terms of the sense of trust. Pallant and Lae (2002) carried out a cross-sectional study exploring the relationships between SOC-13 and health in 439 adults aged 18-82 years, but partial correlation coefficients were calculated with various measures of physical and psychological health including self-

esteem. Participants with higher SOC scores tended to have higher self-esteem. Causality may not be relevant. They may be the same thing (Pallant and Lae, 2002). People with high self-esteem are more likely to interpret negative situations more kindly, perceive greater control, experience less stress and have better health than those with low self-esteem (Baumeister *et al.*, 2003). These are also features of people who have high SOC. Sagy and Antonovsky (2002) claimed that children's active participation in decisions and emotional closeness to their family are necessary for development of SOC. In addition, they suggested that courses providing a basic trust in life and in oneself follow by self-reliance, an orientation towards their interests, the high value placed by parents on individual effort and space for initiative are more likely to become internalised by children. These characteristics form the structures of self-esteem and precede a higher SOC (Sagy and Antonovsky, 2000). Self-esteem is important for experiences of meaningfulness, developing from consistent and friendly responses (Antonovsky, 1987).

2.2.6.1.3 Relationships between self-esteem and oral health

Several studies have considered the relationship between self-esteem and oral health, most of which are cross-sectional. Agou and colleagues (2008) examined the association between self-esteem and oral health related quality of life (OHRQoL) in children aged 11-14 years, using CPQ₁₁₋₁₄, the self-esteem subscale of the child health questionnaire and the dental aesthetic index (DAI). CPQ₁₁₋₁₄ scores were related significantly to self-esteem scores and DAI ratings. The impact of malocclusion on quality of life was considerable in children with low self-esteem (Agou *et al.*, 2008).

High self-esteem can be related to favourable oral health behaviours. Koerber and colleagues (2006) investigated which covariates predicted frequency of tooth brushing in 575 African-American students in urban and suburban areas. The covariates included peer influence, self-esteem, attitude towards tooth brushing, oral health knowledge, self-efficacy and parental attitude. The data were collected from the children five times, from the beginning of grade 5 until grade 8, and were obtained from parents at the beginning of grade 5 (baseline). Self-esteem at baseline related to tooth brushing in grade 8 independent of peer influence. Knecht and colleagues' (2001) cross-sectional study in 149 independent diabetes mellitus patients investigated the relationship between self-esteem, oral health behaviours and

diabetes control adherence. Data were collected by self-esteem questionnaires, patient records about HbA_{1c} and clinical oral examinations for plaque accumulation and gingival bleeding. The results showed a link between self-esteem, good adherence with exercise regimen and the frequency of tooth brushing. Boosting patients' self-esteem may help patients sustain daily self care.

A cross-sectional study in 3370 12-year olds in 1995 examined the association between self-esteem and oral health behaviours. Very poor self-esteem was associated with poor social support, having less interest in politics, poor adaptation in schools and poor oral health behaviours (Kallestal *et al.*, 2000).

Two and four years later the study group were followed up (3105 14-year-olds in 1997, 2836 16-year-olds in 1999) using of the same questionnaires and clarifying oral health behaviour as tooth brushing. The assessment of self-esteem included two cognitive questions "How do you think your teacher would rate your school work?" "How do you think you are performing in school?" and one emotional item "How content are you with your body/looks?". The relationship between self-esteem and the tooth brushing behaviour changed over time, with self-esteem related to tooth brushing in 12 years old but not in 14 years old. The emotional component of self-esteem increased whereas the cognitive component such as knowledge became less crucial (Kallestal *et al.*, 2006).

Cumulatively, self-esteem is related to oral health behaviours in a positive way. Individuals with low self-esteem are likely to have poor oral health behaviours when compared to those with higher self-esteem. Boosting self-esteem may help individuals develop favourable health behaviours.

2.2.6.2 Self-efficacy

2.2.6.2.1 Definition of self-efficacy

Self-efficacy is a construct of the Social Cognitive Theory (Bandura, 1982) proposed by Bandura (2006) to explain and predict behaviours. It refers to an individual's belief in his or her ability to conquer the difficulties inherent in performing tasks in particular situations. It can be seen as related to sense of confidence in terms of dealing with problems.

Bandura proposed that “efficacy involves a generative capability in which cognitive, social and behavioural subskills must be organised into integrated courses of action to serve innumerable purposes” (Bandura, 1997: p. 391). Individually, personal environment and cognitive and emotional processes interact mutually to influence behaviours. Hence, behaviour can shape cognition and environment, in turn, cognition and environment can shape behaviours. It can be seen that changing behaviour is more complex than a simple linear action. Additionally, Bandura claimed the judgments of self-efficacy affect choices of behaviours such as the adopting new behaviours and inhibiting existent behaviours. Individuals are more likely to perform tasks they think they can attain and tend to avoid those that they believe surpass their capability. Moreover, self-efficacy has influenced the amount of effort of people when they adopt new behaviours and persist in the face of hindrance.

Self-efficacy consists of three dimensions: magnitude, strength and generality (AbuSabha and Achterberg, 1997). Magnitude refers to the judgment individuals have on performing a number of tasks at different levels of difficulty. People with lower self-efficacy only expect to be able to perform the simplest tasks whereas people with higher self-efficacy feel more likely to achieve the most difficult task. Strength refers to the level of confidence people have on doing specific tasks. Generality is the number of areas of functioning which individuals judge themselves effective. It is noted that efficacy to do one behaviour may increase or prohibit other behaviours. For instance, high efficacy about increasing apple consumption may be a good predictor of increasing intake of oranges but a poor predictor of milk consumption.

Self-efficacy can be influenced by various methods. The most powerful method to increase self-efficacy is enactive mastery, in other words, experiencing success. Another means is vicarious learning. People may avoid poor health if they have learnt from other’s experiences. Verbal persuasion and emotional arousal are another ways to enhance self-efficacy. Adversely, affective states, for instance, pain or fatigue may deplete self-efficacy (Hollister and Anema, 2004).

2.2.6.2.2 How self-efficacy relates to SOC

Personal self-efficacy is a sense of confidence in the form of efficacy and potency to deal with problems (Pallant and Lae, 2002) and the beliefs in one’s effectiveness in performing specific tasks (Zimmerman and Cleary, 2006). The concept of self-

efficacy is similar to SOC in terms of the confidence of individuals to mobilise resources they have to cope with problems (Antonovsky, 1991).

2.2.6.2.3 Relationships between self-efficacy and oral health

Self-efficacy is related to oral health behaviours (Stewart *et al.*, 1997; Syrjälä *et al.*, 2001). For example, Syrjälä and colleagues' (2004) study of 149 insulin-dependent diabetic patients aimed to identify psychological characteristics related to diabetes adherence, dental caries, deepened periodontal pockets, the metabolic parameter HbA1c (glycosylated hemoglobin) and oral health behaviours involving tooth brushing, dental visiting and using xylitol products. The data were collected by self-completed questionnaires: dental self-efficacy (Syrjälä *et al.*, 1999) and diabetes self-efficacy scales (Knecht *et al.*, 1999a), dental locus of control and diabetes locus of control scales (Knecht *et al.*, 1999b) and the self-esteem scale (Knecht *et al.*, 2001). Self-efficacy was related to oral health behaviours and diabetes adherence. It was the best predictor for oral behaviours among these diabetes patients (Syrjälä *et al.*, 2004).

A cross-sectional study of Turkish children aged 10-12 years (n=611) aimed to assess the relationships between dietary and tooth brushing self-efficacy and oral health status, including oral health behaviours such as regular tooth brushing habits and dental attendance. The data were obtained by oral examination and self-administered health questionnaires, which included modified diet (DSES) and new tooth brushing self-efficacy (TBSES). Self-efficacy was related to oral health and oral health behaviours among these Turkish pre-adolescents (Basak *et al.*, 2005).

A study conducted in African-American families with at least one child aged less than six investigated the relationship between maternal cognition, behavioural and psychosocial factors and brushing practices in low income children. The data collected from mothers included oral health related self-efficacy, knowledge of appropriate bottle use, children's oral hygiene, oral health fatalism and their tooth brushing behaviours, depression symptoms, parental stress, social support and dental history of their children. The main outcome was tooth brushing frequency. Maternal oral health self-efficacy was a significant and powerful prediction of children's tooth brushing frequency independent of mother's knowledge about children's oral hygiene (Finlayson *et al.*, 2007).

Kakudate and colleagues (2008) studied prediction of oral health care specific to the completion of periodontal treatment in 140 subjects with mild to moderate chronic periodontitis. The self-efficacy scale (SESS) which comprised three subscales: self-efficacy for dental consultation, tooth brushing and dietary habits and general self-efficacy scale (GSES) were used to assess self-efficacy. Oral health specific self-efficacy predicted the completion of the periodontal treatment.

Philippot and colleagues' (2005) clinical trial in 30 patients with periodontitis evaluated a behavioural educational intervention for autoregulation of compliance with proper dental care. The experimental group received information about symptoms, causes consequences of periodontitis and were requested to keep a daily record of the effect of dental prophylaxis on their symptoms whereas the control group received the instruction as usual. Data were self-administered questionnaires and plaque records (Silness and Loe, 1964). The behavioural educational intervention was more effective than a classical one, helping patients to maintain plaque at normal levels. Patients' self-efficacy could be developed through their own experiences.

In summary, self-efficacy is associated with oral health behaviours. To enhance self-efficacy, individuals need to be encouraged, motivated and to participate in activities that allow them to gain experiences and belief in their capability to overcome the difficulties inherent in performing tasks in particular situations. Although there are efforts to predict specific oral health behaviours by the use of self-efficacy, most studies are cross-sectional. Longitudinal data and more rigorous methodology are needed to confirm predictions.

2.2.6.3 Locus of control

2.2.6.3.1 Definition of locus of control

Locus of Control was introduced to explain a set of beliefs that are relatively stable in people. It is regarded as internal or external if the person believes the achievement of particular outcomes as a result of their actions and their control (internal) or out of their control (external) (Rotter, 1966). Levenson (1974) asserted that external locus of control could be separated into two beliefs: control by chance such as fate and luck and control by powerful others such as friends, parents and physicians. Thus, people who believe that events in their lives occur because of chance may think and

act differently from those who believe that others are in control of their lives. Rotter (1966) developed the internal and external scale that is a standard measure for evaluating generalised locus of control beliefs. Later, Wallston and colleagues (1978) developed the health locus of control scale specifically related to health but within the same construct.

2.3.6.3.2 How locus of control relates to SOC

Locus of control, particularly internal locus of control, can be seen as a part of SOC; as a sense of reliance when people encounter difficulties.

Self-efficacy is closely linked to specific tasks and behaviours, whereas locus of control is more general. For instance, patients with heart disease may have high internal locus of control if they believe that increasing healthier food intake such as fruit, vegetables and fibres and decreasing fat consumption depends on their own abilities. The same patients, nevertheless, they may score high on external locus of control on another domain of health because they believe that their health depends on physicians' knowledge and expertise (Levenson, 1974). Internal locus of control is related to more readiness to take responsibility for actions in health promoting behaviours such as increasing breast self examination and oral health care such as tooth brushing (Luszczynska, 2004; Steptoe and Wardle, 2001). Although there are associations between locus of control and health behaviours, some research has failed to find such relationships, leading to confusing findings (Read *et al.*, 1991; Steptoe and Wardle, 2001).

2.3.6.3.3 Relationships between locus of control and oral health

A small number of studies have evaluated relationships between locus of control, oral health outcomes and oral health behaviours.

Harris and colleagues (1987) found that locus of control was not significantly related to oral health care or knowledge in 200 adult periodontitis patients. Regis and colleagues (Regis *et al.*, 1994) found subtle associations between locus of control and tooth brushing frequency. Knecht and colleagues (1999b) found a significant correlation between dental locus of control and plaque in diabetic patients whereas there was no relationship between diabetic locus of control and plaque, concerning behaviours-specific measure. Wolf and colleagues (1996) examined the relationship

between locus of control, self-efficacy oral health beliefs and oral hygiene behaviours in 100 veterans. They found that only external locus of control was related significantly to oral hygiene behaviours. However, this study failed to state the type of external locus of control beliefs that related to behaviours.

Bajwa and colleagues (2007) examined the changes of health locus of control and oral health impacts in 127 patients who received a periodontal treatment in a dental school. The data were obtained by using the questionnaires: dental multidimensional locus of control (LOC) and oral health impact profile (OHIP) at two time points when they attended an initial periodontal consultation and at six month after receiving an oral hygiene instruction, scaling and root planning respectively. The results showed no change in locus of control before and after receiving periodontal treatment but showed improved OHRQoL.

In summary, it appears that locus of control is related to oral health behaviours but is not a potent predictor of oral health behaviours (Renz *et al.*, 2009). Due to the weaknesses of diverse measures and the need for behaviour specific measures, the application of locus of control alone in a study may not be sufficient to identify change of oral health behaviours. Instead, locus of control should be considered alongside other relevant psychological factors such self-efficacy and self-esteem.

2.2.6.4 Relationship between self-esteem, self-efficacy, locus of control and SOC in health and oral health studies

Several studies have investigated relationships among psychological factors such as self-esteem, self-efficacy, locus of control and SOC.

Johnson (2004) conducted a study in 109 undergraduate students at the University of York to examine the constitution of SOC, particularly in relation to general health among other adaptive variables such as self-esteem, locus of control, fighting spirit and coping style. Internal locus of control and self-esteem were related significantly to SOC. Moreover, they suggested that self-esteem may be a contributory factor of SOC (Johnson, 2004). Wiesman and colleagues' (2009) cross-sectional study explored relationships among a wide range of resources, SOC and subjective health in 387 elderly people with mean aged of 73.8 (SD=7.58). Biological resources in terms of morbidity and experiences of illness were evaluated by a checklist of

chronic diseases such as heart disease, diabetes, cancer and respiratory diseases. The Neuropsychological Aging Self-Rating Scale for Activities of Daily Living (NASA) was used to assess daily life activities such as shopping, watching TV and reading newspapers. Social support was evaluated by the use of social support scale. Emotional resources involving self-esteem and depression were assessed via the self-esteem scale (Rosenberg, 1965). Health locus of control, self-efficacy and life orientation were assessed by the modified German version of the multidimensional health locus of control scale, generalised self-efficacy scale respectively (Wiesmann *et al.*, 2009).

SOC was assessed by SOC-29 (Antonovsky, 1987). Physical health and mental health were assessed by the SF-36 scale and symptoms were evaluated by the BL symptom checklist. SOC was associated significantly with high self-esteem, self-efficacy, social support, low depression and optimistic orientation of life. There was no relationship between SOC and physical health but SOC mediated resistance resources, psychological health and symptoms. However, cause-effect relationships among variables in this cross-sectional study are not possible.

In relation to oral health, Regis and colleagues' (1994) cross-sectional study investigated the association between self-esteem, health locus of control and oral health behaviours (e.g. tooth brushing frequency, motivation of mouth care and frequency of dental visits) in schoolchildren aged 14-15 years old from 131 secondary schools in England. Tooth brushing and dental visit frequency were associated with high self-esteem. Moreover, frequency of tooth brushing correlated with more internal locus of control in males but was inconsistent in females. Health locus of control was less strongly associated with tooth brushing and dental visits compared with self-esteem. Regis and colleagues concluded that self-esteem may have more potential for predicting dental health behaviours such as tooth brushing and dental visit patterns than health locus of control.

A study carried out in 41142 12-16 year old children from 244 secondary schools across England examined the relation between oral health behaviours (frequency of tooth brushing, use of dental floss, dental attendance) and two measures of self concept: self-esteem and health locus of control. Self-esteem was positively associated with tooth brushing frequency at ages 12-15 years. There was no relation

between use of dental floss and any self concepts. Participants with more favourable self concepts were more likely to visit dentists frequently. Subjects with lower self-esteem and external locus of control tended to recall advice about tooth brushing than those with high self-esteem and internal locus of control. Self-esteem and internal locus of control were concluded to mediate the positive changes in dental behaviours (Macgregor *et al.*, 1997).

Wolfe and colleagues (1996) evaluated the effect of oral hygiene interventions on dental beliefs via 44 item dental coping beliefs scale (DCBS) comprising internal locus of control, external locus of control, self-efficacy and oral health beliefs in 100 subjects aged 41-66 years. One control group received no intervention was compared with three different experimental groups. Participants in an educational intervention (EI) group received two 20-min sessions with dentists who showed them material on plaque control, tooth brushing and flossing. A cognitive behavioural intervention (CBI) group, received two 45 minute sessions: comprising the 20 min session as in the EI group and a 25 min session conducted by psychologists that highlighted developing and practicing cognitions through self-implemented plans and self-established patterns. An additional intervention (AI) group had extra time than the CBI group and was taught about various dental procedures by the use of a chair side instruction. The greatest change was in the CBI group. Internal locus of control and self-efficacy increased whereas external locus of control decreased significantly toward beliefs in personal control and prevention of oral disease by tooth brushing and flossing.

In conclusion, these three psychological factors may be related to SOC which may, in turn, influence behaviours and health outcomes. It is difficult to separate these psychological constructs completely from each other and SOC because they are not discrete and overlap with SOC (Antonovsky, 1987; Antonovsky, 1991). In order to facilitate understanding of these psychological factors and how they might be applied to promote oral and general health, these interrelationships need to be recognised. Given that each of the constructs overlap, interventions may need to incorporate self-esteem, locus of control and self-efficacy development in order to change SOC.

The relationships between self-esteem, self-efficacy, locus of control and SOC should be regarded as relationships between constructs (Figure 3). That is to say that they have been constructed to help us understand and explain how people think. These constructs represent our understanding rather than existing in real terms. It may therefore not be necessary to consider whether they are causally related. Self-esteem is a personal trait that may relate to SOC in terms of sense of trust in individuals' characters and abilities. Self-efficacy is related to SOC, reflecting individuals' beliefs and confidence to perform specific tasks by mobilising resources to cope with problems. Internal locus of control is connected with SOC in terms of self-reliance.

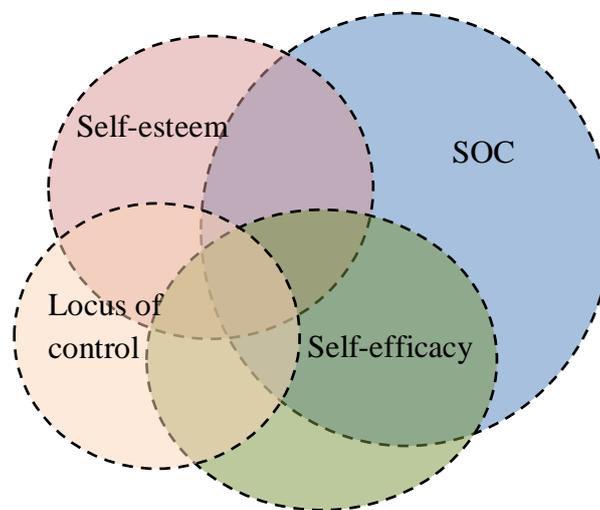


Figure 3 Relationships among self-efficacy, self-esteem, locus of control and sense of coherence

2.2.6.5 Oral health beliefs

According to the health belief theory, it is suggested that health beliefs are related to health behaviours. Bandura (1997) described 'beliefs' as a potential individual resource dominating personal life at any time. They make a difference in how people feel, think and act. Beliefs not only affect individual behaviours but also give them more confidence in what they believe or perceive. It means that people are likely to perceive information that supports what they believe. For this reason, beliefs can change expectations (Dweck, 2008).

Although there are previous studies examining the relationships between oral health beliefs and oral health outcomes, involving oral health status and oral health behaviours, they use a variety of conceptual models to explore this area.

Nagazono and colleagues (1997) explored oral health beliefs using the Health Belief Model (HBM), consisting of beliefs in five domains: susceptibility to oral disease, seriousness of oral disease, importance of oral health, benefits and barriers of preventive practice and motivation. They also used efficacy of dentists to be a construct of oral health beliefs to supplement the dimensions in HBM. Another exploration of oral health beliefs, Stoke and colleagues (2006) explored oral health beliefs by using social cognitive models including the Health Belief Model (HBM), the Theory of Planned Behaviour (TPB) and Health Locus of Control (HLC). HBM informed the questions on perception of susceptibility, severity, motivation, benefits and barriers. TPB considered beliefs about outcomes, attitudes toward behaviours, subjective norms and perceived behavioural control whereas HLC provided questions on subject's perception of control behaviours.

Wolf and colleagues (1991) investigated dental beliefs using locus of control, self-efficacy and self instruction techniques, focusing on the role of thought in the regulation of behaviours. These three models guided the development of the Dental Coping Beliefs scale (DCBs), comprising 44-items in four subscales: internal locus of control, external locus of control, self-efficacy and oral health beliefs. Oral health beliefs were self-statements addressed by participants to themselves about facilitation of good oral care. Kwan and Holmes (1999) explored oral health beliefs and attitude among Chinese residents in West Yorkshire. Oral health beliefs were perceptions of susceptibility and seriousness of tooth loss, perception of benefits and barriers of dental care. Self-efficacy beliefs were seen in terms of things that people can do to keep their teeth for life. Broadbent and colleagues (2006) explored oral health beliefs in adolescence by using a 6-item questionnaire regarding the importance of preventive behaviours.

Thus oral health beliefs have been explored variously depending on the purpose of the study. They have been inextricably connected with some psychological factors such as self-efficacy and locus of control. Perceived self-efficacy has influenced health behaviours in adolescence (Bandura, 2006). Wolf and colleagues (1996)

evaluated the effect of oral hygiene interventions on oral health beliefs in adults aged 41-66 years showed that participants in a group having the highest scores of oral hygiene increased significantly in internal locus of control and self-efficacy toward beliefs in control and prevention of oral disease by tooth brushing and flossing. Broadbent and colleagues (2006) investigated the stability of oral health beliefs from adolescence to adulthood and investigated whether favourable and unfavourable beliefs were associated with different oral health behaviours. Individuals with stable favourable dental beliefs from adolescence through adulthood had fewer teeth missing due to caries, less gingivitis, better oral hygiene and more restorations (Broadbent *et al.*, 2006).

In summary, these data suggest that measuring oral health beliefs may help researchers to explain changes in oral health.

2.3 Health promotion

Health promotion was developed within public health in the late of 20th century. Health promotion arises from changed concepts of health, from emphasising biochemical factors to stressing environmental and social conditions. In 1974, Marc Lalonde, a Canadian minister of health proposed ‘a new perspective on the health of Canadians’ and argued that the major causes of diseases and death were environmental factors, individual behaviours and lifestyles rather than biological and physiological factors (Lalonde, 1974). This document has been enormously forceful in public health and led the WHO to organise successive international conferences to promote the health promotion movement. The first conference was organised in Ottawa in 1986.

2.3.1 Definition and principles of health promotion

The definition of health promotion arose during the Ottawa Charter as “the process enabling individuals and communities to increase control over the determinants of health thereby improving health to live an active and productive life” (WHO, 1986). Health promotion represents mediating strategies between people and their environments, mobilising personal choices and social responsibility in relation to health to create a healthier future. It comprises three important elements: a focus on tackling the determinants of health, working in partnership with a range of sectors

and adopting strategic approaches to promote the health of population (Daly *et al.*, 2002).

Tackling the determinants of health

Health promotion emphasises the determinants of health such as environmental factors, socio-economic status, cultural factors and education as well as individual lifestyle factors (Tones and Tilford, 2001). It attempts to avoid victim-blaming by recognising the limited control people have over their health. For example, health workers usually ignore factors that dominate health behaviours and always think that individuals can modify elements of their lifestyle. Positive health behaviour changes are unlikely without consideration of social and environmental modification. A restricted approach solely using legislation has not often changed behaviours. It is noted that health promotion highlights improving the environment to making healthy choices the easy choices through numerous approaches, considering social, environmental, political and individual factors (Koelen and Lindstrom, 2005; Milio, 1981).

Working in partnership

Community participation is a vital element of health promotion. The active and participatory involvement of all sectors of the community such as government departments, agriculture, health services, voluntary sectors and agencies can identify health issues and initiate changes. It is necessary for these different sectors to work together to assure that healthy policies are developed, implemented, monitored and evaluated (Daly *et al.*, 2002).

Strategic actions

A strategic approach is needed for effective health promotion. It should be based on assessments of needs and resources in order to identify aims and targets. Several health problems share a small number of common risk factors, for instance, eating high fat and sugars and low fibre can lead to obesity, diabetes and coronary heart disease as well as dental caries. Strategies based on these common risk factors therefore provide potential methods to deal with several health problems (Sheiham and Watt, 2000). In addition, health promotion focuses on the population as a whole in everyday life rather than stressing individuals at risk for specific diseases. Influencing social norms is said to promote beneficial health behaviours. Health promotion can also combine whole-population strategy and high risk strategies to

enable people to take control over and responsibility for their health (Koelen and Lindstrom, 2005). These elements indicate that people are active participants, respected on a basis of participation, equity, empowerment and human rights, as concepts of health promotion.

The Ottawa Charter outlines five key areas of action: creating supportive environment, promoting health through public policy, strengthening community action, developing personal skills and re-orienting health services (see section 2.3.3).

2.3.2 Health promotion and sense of coherence

According to the Ottawa Charter, the concept of health promotion originates from a broad idea of health and its determinants (WHO, 1986). For instance education, work, diet and nutrition, sanitation, the physical environment and social support for both individuals and families are crucial factors that can influence health and quality of life. This concept is consistent with the mechanisms of the salutogenic theory and its core construct of SOC that sees health as health ease/dis-ease continuum rather than a false dichotomy of health and diseases. As a result the factors that promote and support health may be different from those that cause diseases. Thus, reducing exposures to risk factors or eliminating diseases tends to be neither sufficient nor necessary for health promotion because individuals are more likely to keep healthy by controlling their lives even though they encounter risk factors. Significantly, the strategies of health promotion are the processes that enable people to increase control over their lives by managing, identifying and organising the health resources in order to effectively find solutions. Making the healthy choices the easiest choices through the alteration of policies and environment that facilitate people to have more chances to choose a healthier lifestyle (Eriksson and Lindstrom, 2007). This idea can strengthen and create health promoting abilities that result in a better life.

SOC can be considered as a theoretical framework for health promotion on account of three aspects of salutogenesis. First, it emphasises finding solutions, in other words, problem solving. Greater SOC helps people identify and employ resources needed to overcome arising problems. Second, according to Antonovsky, GRRs are a tool that helps people move in the positive direction of health. Finally, it is recognised as a global sense in individuals, groups or communities and populations that serves the overall mechanism of SOC (Lindstrom and Eriksson, 2006). It may be

that all the following steps are necessary to improve health: creating healthy environments where people can realise themselves as active and participating subjects to investigate both internal and external resources, use and re-use these resources to satisfy needs, to perceive meaningfulness and to alter or cope with these circumstances (Eriksson and Lindstrom, 2007).

A common metaphor for health promotion is ‘the river’. Eriksson and Lindstrom cited ‘Health in the river of life’ to demonstrate the change in focus from medicine to health promotion. It can be seen as the steps of development of health promotion (Eriksson and Lindstrom, 2008) as follows:

In the first stage, treatment of disease is compared to ‘saving people from drowning’ by the use of high technology and professions to cure diseases. The second stage can be divided into protective and preventive phases. In the protective view, interventions are confined to risk factors for disease. In the metaphor of the river, these interventions aim to prevent people falling into the river by ‘building fences’. The preventive view focuses on the use of active interventions that empower people to prevent diseases. People are ‘supplied with a life vest’.

People are more actively involved in the third stage. Health education and health promotion help people learn to make their own decision to live their lives supported by professionals. Health education can be seen as ‘teaching people how to swim’ in the river, whereas health promotion is compared to human rights. People are more likely to be active and participative. Professionals provide options and enable individuals to make sound choices they indicate determinants of health to make individuals aware of and benefit from them (Lindstrom and Eriksson, 2006). The salutogenic ideas can be applied in this stage.

In the fourth stage, enhancing health perceptions, well being and quality of life are the ultimate goals of health promotion activities. Perceived health is a determinant of quality of life. It is necessary for people to learn what creates health and enhances quality of life so that they can reflect on the choices of their life situation. The river comprises risks and resources. The mechanism of SOC can help people to identify resources and use them in order to improve their choices for health and a productive life.

Eriksson and Lindstrom (2008) have provided examples of the implementation of the salutogenic theory and SOC such as implementing it into healthy public policies, using SOC as a health indicator, using the SOC instrument and its perspective in treatments and interventions and using the salutogenic perspective in school development (Eriksson and Lindstrom, 2008). For example, Myrin and Lagerstrom investigated the relationships between health behaviours and SOC in 387 primary children aged 14-15 years in a cross-sectional study. Girls had lower SOC in relation to several habits such as having breakfast and going to bed. These findings seem to be an important indicator for school health services (Myrin and Lagerstrom, 2006).

In conclusion, health promotion is a strategy for improving the health of populations. It involves the population as a whole in terms of communities and organisations rather than focusing on individuals who are at risk for specific diseases. SOC can be applied to health promotion by identifying resources and the use of a comprehensive set of diverse and complementary approaches to make the healthy choices the easiest choices through legislation, taxation and alteration of environment that facilitate people to choose healthier lifestyle.

2.3.3 Salutogenesis in oral health promotion

Oral health promotion is an attempt to improve and maintain oral health by direct attention to improving the environments in which target groups are placed (Pine and Harris, 2007). It considers how organisations and institutions such as schools, hospitals, leisure centres, colleges and workplaces provide their students, staff and clients with a range of activities and healthy environments which are conducive to health (Grossman and Scala, 1994).

The salutogenic theory sees factors promoting oral health as extending beyond those, which generate oral diseases. Rather than emphasising how low exposure to risk factors for oral diseases. It highlights the ability of individuals to retain health despite exposure to these risk factors. To keep healthy, people are more likely to identify and organise health resources to promote their oral health. This oral health promoting ability can be seen as an important strategy that is consistent with health promotion. The salutogenic theory and the five areas of actions within the Ottawa Charter can be applied to oral health promotion set out below by da Silva and colleagues (2008).

Creating supportive environments

Environment impacts on oral health in different places such as houses, schools and workplaces (Jurg *et al.*, 2006). The salutogenic approach can help people identify resources that may generate the conditions of living and working that are secure, pleasant and stimulating. These can make healthy choices the easy choices for adopting healthier lifestyles. Supportive environments can be created in various ways. For example, an increase in affordability of sugar free beverages, sufficient sinks for tooth brushing in schools and psychological support from parents and friends are healthier environments (da Silva *et al.*, 2008).

Healthy public policy

Healthy public policies, legislation and regulation can be used to promote oral health by using salutogenesis as a theoretical foundation to make healthy choices the easiest choices. There are many examples of healthy public policies related to oral health: the restriction of sugar production, controlling the amount of sugar added to foods, drinks and medicines; replacing sugar with healthier products or removing tax on oral health care products. These policies have usually involved diet, nutrition and oral health guidelines in nurseries, hospitals workplaces and schools where healthy food and drink choices are broadly available. Additionally, healthy public policies can allow choices at a community level (Watt, 2007).

Health promoting schools are a salient example of healthy public policy. They can facilitate learning processes and address oral issues and resources to promote the oral health and well-being of students, school staff, families and community members. They provide a healthy setting for living, learning and working (WHO, 2010). The policies in schools may involve daily tooth brushing, a ban on unhealthy foods and harmful substances such as confectionary, alcohol and drugs. These policies may enhance the ability of people to use and re-use resources that generate health and may provide a meaningful improvement of health and well-being.

Strengthen community action

The salutogenic idea might motivate the participation of communities in identifying problems, setting priorities, making decisions, planning effective methods and implementing appropriate solutions. Control over one's own life from a community empowerment perspective requires individual and collective competence such as

self-esteem and self confidence, critical analysis of political and social environments and the development of sets of resources for political and social action to obtain better health (da Silva *et al.*, 2008). This can result in an increase in the distribution of promoting factors which are assets for individual and community health (Morgan and Ziglio, 2007).

Developing personal skills

Health professionals are generally accepted as persons who can play an important role to encourage people to make sound choices. They should facilitate individuals to develop essential skills by supplying health information (Koelen and Lindstrom, 2005). It is difficult to make healthy choices if people do not recognise that they can control their personal conditions. Significantly, control can reflect the ability of people to access resources, make decisions, act confidently and cope with the stresses in daily life: an empowerment process and imperative in health promotion. Health education is a basic approach to help people understand and identify harmful situations when information is interpreted, structured and meaningful. Salutogenesis can promote learning and promote health concurrently. Accordingly, oral health education can promote oral health in terms of, facilitating learning, for instance, by motivating oral self examination to detect problems, to make people aware of oral health care by encouraging effective tooth brushing with fluoridated toothpaste (da Silva *et al.*, 2008) and reducing sugar intake. However, an important consideration is the process of empowerment that should be relevant to historical and political context in which people live (Wallenstein, 1992).

Reorienting health services

Within a health ease and dis-ease continuum, the direction of health services should be changed from the investigation of risk factors and provision of treatment to the creation of people's resources to improve health. This new direction can bring communities and health professionals closer through practices. Community participation is necessary in the process of decision making, planning and implementing dental services (Watt, 2005). Such co-operation between dental services and other settings such as schools, workplaces, manufacturers and merchants is intended to help attain better oral health at the community level.

In summary, the salutogenic approach is a promising concept that can be applied to oral health promotion because it emphasises individual and environmental factors rather than individual risk factors. It focuses on the development of abilities that encourage people to deal with challenges and demands of everyday life and therefore maintain and ameliorate their health. It acts as a theoretical framework for oral health promotion actions which aim to promote people's ability to control determinants of health involving personal, social and environmental factors, individuals and communities' empowerment, and increases in internal and external salutogenic resources.

2.3.4 Interventions that have applied psychological factors in health studies

The psychological context is a widely accepted influence on people's health and behaviours. Several kinds of psychological factors have been applied in past studies to improve health and promote healthy behaviours. Although several studies have used psychosocial approaches to promote health, their findings are inconsistent. Poor designs, many confounding factors, bias and lack of evidence supporting a particular model are seen in these studies (NICE, 2007). NICE (2007) suggested that training programmes or interventions based on psychological theory should focus on generic competencies and skills with greater methodological rigour in the design, interventions and outcome measures of evaluation studies (NICE, 2007; Renz *et al.*, 2007).

This section reviews examples of interventions that have used salutogenic ideas or related psychological factors. An electronic search of the PsycINFO, MEDLINE and CINAHL databases between 1946 and May 2012 was performed using and combining the terms 'health', 'sense of coherence or salutogen* or self esteem or self efficacy or locus of control', 'intervention or program*' and 'systematic review'. Exclusion criteria included not being published in English and not using these psychological factors to develop the interventions.

Most of the identified systematic reviews were conducted in relation to specific treatments/therapies for health conditions, for example, of interventions for weight loss (Poobalan *et al.*, 2010), to reduce alcohol consumption during pregnancy (Gilinsky *et al.*, 2011), to reduce fear of falling in community-living older people (Zijlstra *et al.*, 2007) or to prevent eating disorders in children and adolescents (Pratt

and Woolfenden, 2002). However, the reviews provided few details of how the psychological factors had informed the interventions. Adding the search term of 'psychological interventions' identified systematic reviews of psychosocial interventions for quality of life in gynaecological cancer patients (Hersch *et al.*, 2009), for siblings of paediatric cancer patients (Prchal and Landolt, 2009) and for Rheumatoid arthritis (Astin *et al.*, 2002). Again these systematic reviews did not reveal sufficient details of the psychological factors, but provided an overview of evidence and were a good source to identify the primary studies.

To understand in greater detail the components of the interventions, the original articles cited within the systematic reviews and published subsequent to the systematic reviews were located.

2.3.4.1 Interventions that have applied sense of coherence or salutogenic principles

Only a few primary studies have applied salutogenic principles to health interventions. The interventions that have applied salutogenic principles or SOC in health studies were identified. An electronic search of the PsycINFO, MEDLINE and CINAHL databases between 1946 and May 2012 was performed using and combining the terms 'health', 'sense of coherence or salutogen*', 'intervention or program*'. Eighty-nine studies were identified. Exclusion criteria included not being published in English, not being relevant or not clearly using salutogenic principles or SOC to develop the interventions. The remaining four studies that have applied SOC or salutogenic principles to promote health are detailed below.

Hillert and colleagues (2002) delivered a short-term group intervention programme with a salutogenic approach involving both somatic and psychological reactions in environmental illness patients who were deemed as hypersensitive to electricity (HE). Four groups of approximately six people were formed with two acting as waiting list control groups.

The other groups took part in group meetings and physiotherapy as the intervention. Three hour group sessions were arranged weekly over eight successive weeks. The first were led by psychologists and medical social workers who reviewed and discussed previous meetings with patients, encouraged them to express their

experiences, introduced a new theme for the present session and assigned homework for them. This part of the sessions aimed to help patients resist normal environments in their every life. In addition, a cognitive-therapeutic approach was employed to help patients interpret situations they confront, improve self knowledge and awareness of interpersonal relationship that led to alternative coping skills. The sessions lasted one and a half hours. A physiotherapy intervention focused on the increase of bodily consciousness, bodily control and physical fitness using an exercise programme for an additional 30 minutes once a week where possible. Themes for the eight group sessions included a presentation of group projects, scientific information concerning hypersensitivity to electricity and patients' experiences, difficulties affecting well-being, stress and coping, work capacity, social support, summary and evaluation. The main outcomes measures were medical assessment using self-administered questionnaire and medical examination. Additionally, a semi-structured interview stressed current life situations, a 23 item SOC scale was employed for psychological assessment, a fitness test and the body awareness scale were assessed for physiotherapy. Most participants achieved better self knowledge and ability to cope with stress. In addition, the intervention seemed to help to identify underlying causes that might influence health perceptions as well as motivation for additional therapy (Hillert *et al.*, 2002).

Langeland and colleagues (2006) investigated the effect of a talk therapy group intervention applying a salutogenic principle on 106 patients with mental health behaviour problems. The aim of this study was to increase patients' consciousness of potential, internal and external resources such as coping ability and social support as well as patients' abilities to use them. The programme comprised sixteen weekly meetings of ninety minutes. Each group contained between five and nine participants, led by a mental health professional. In the first part of two programmes, subjects explained their situations and exchanged experiences, involving the context of coping relating to their mental problems. In the second part, patients discussed a reflective note one of four important aspects of human life according to the salutogenic theory: inner feeling, major activity, interpersonal relationship and existential issues. The SOC questionnaire (29 items) and the Symptom Checklist-90-Revised (SCL-90-R) were used to assess the main outcome. There was an increase in the SOC score in sixty-nine percent of the subjects in the intervention group with a significant improvement in SOC score compared to the untreated control group. In

addition to the global severity index of SCL-90-R, more than 80% of the intervention group had scores higher than the critical cut off point of this index. Medline searches revealed no studies applying SOC to interventions to improve physical health.

Delbar and Benor (2001) examined the effect of a nursing intervention using coping resources on cancer patients' ability to cope with their diseases and treatment in relation to symptoms in a quasi experiment. The participants receiving the intervention (n=48) were visited at home ten times by nurses for approximately two hours consecutively over three months. During the meetings participants were asked about their complaint, relevant symptoms and were assessed by nurses. The main duty of nurses was to help patients create and choose appropriate and efficient alternative solutions to their problems by advising, guiding and supporting. It can be seen that this was a form of patient empowerment. Patient's perceptions of the intensity of symptoms, familial support, independence, knowledge were considered. The instruments used in this study were the 29 item SOC Scale, the multidimensional health locus of control (MHLC) scale and symptom control assessment scale (SCA). When compared to controls (n=46), the SOC score in the intervention group increased significantly and locus of control improved substantially. These results were related to decreases in intensity of symptoms and increases in independence and self knowledge. Interestingly, patients' SOC was correlated substantially with the intensity of all symptoms in the SCA. Moreover, it also was associated with patients' perceptions of familial help and knowledge needed to control non-physical symptoms. These findings support ideas that SOC may be related to coping.

Oxelmark and colleagues (2007) evaluated a group based intervention integrating medical and psychological approaches for inflammatory bowel diseases (IBD) patients. The programme consisted of nine sessions over consecutive weeks. Each session included lectures and group therapy for ninety minutes. The lectures focused on IBD in terms of causes, symptoms and treatment. The group therapy sessions were led by the medical workers and psychologists and considered consequence of disease, psychological reactions, obtaining information of diagnosis, stress and management, coping and self image. Subjects had opportunities to express their experiences, feelings, difficulties and capacity to coping. The IBD questionnaires (IBDQ) and the 29 item SOC Scale were used to evaluate health related quality of life and SOC. No significant differences were found in SOC or IBDQ between the

intervention and control groups after six and twelve months. In addition, there was no significant change in the SOC score between the two groups.

Table 3 summarises the four articles that have applied SOC or salutogenic principles to promote health in regard to study design, sample size, age of participants, duration of the intervention, programme characteristics and outcomes.

Table 3 Studies that have applied sense of coherence or salutogenic principles in health interventions

Authors	Intervention description	Research design	Sample size	Age	Duration	Programmes	Outcomes
Hillert <i>et al.</i> (2002)	Short- term group intervention using a salutogenic approach on environmental illness patients	Pre-post single group	22 subjects	29-52 yrs	10 months (8 week intervention)	<ul style="list-style-type: none"> • To improve self knowledge and awareness of personal relationship by using group meetings • To increase bodily consciousness, bodily control by using physiotherapy 	<ul style="list-style-type: none"> • No effect on body awareness or muscular tension • Most participants achieved better self-knowledge and alternative methods to cope with stress
Delbar and Benor (2001)	Nursing intervention using SOC on cancer patients, focusing on abilities to cope	Quasi-experimental study	IG = 48 CG = 46	20-70 yrs	3 months	<ul style="list-style-type: none"> • To help patients create and choose appropriate solutions to problems perceive intensity of symptoms, familial support, independence and knowledge during ten times visited patients at homes by nurses 	<ul style="list-style-type: none"> • Enhanced SOC, less intense symptoms and greater self knowledge and independence
Langeland <i>et al.</i> (2006)	Talk therapy group intervention applying a salutogenic principle on patients suffering from mental health behaviour problems	Randomised controlled trials	IG = 59 CG = 47	20-80 yrs	10 months (19 week intervention)	<ul style="list-style-type: none"> • Subjects exchanged experiences and coping strategies and discussed their homework associating four main aspects of human life: inner feeling, major activity, interpersonal relationship and existential issues 	<ul style="list-style-type: none"> • Enhanced SOC compared to controls
Oxelmark <i>et al.</i> (2007)	Group based intervention integrating medical and psychological approach for inflammatory bowel diseases (IBD) patients	Randomised controlled trials	IG = 24 CG = 20	37.3 yrs	12 months (9 week intervention)	<ul style="list-style-type: none"> • Lectures focusing on causes, symptoms and treatment of IBD by specialists • Group sessions about disease, psychological reactions, stress and management, coping and self image 	<ul style="list-style-type: none"> • No apparent effect on IBDQ or SOC

IG = Intervention group, CG = Control group, IBD = Inflammatory Bowel Disease

2.3.4.2 Interventions that have applied other psychological factors in health studies

This section critically reviews studies that have applied the psychological factors that overlap with SOC and the salutogenic idea. As discussed before (see section 2.3.4), to understand the characteristics of interventions that have applied these psychological factors, original articles needed to be identified. An electronic search was performed of the PsycINFO, MEDLINE and CINAHL databases between 1946 and May 2012 using and combining the search terms ‘health’, ‘self esteem or self efficacy or locus of control’, ‘intervention or program*’, ‘controlled trial’. Exclusion criteria included not being published in English. One thousand two hundred and nineteen (1,219) articles were found. Those that were not relevant, that is, did not use self-esteem, self-efficacy or locus of control to develop the intervention or did not clearly measure these psychological factors were excluded. Studies that did not clearly specify intervention strategies, that were carried out in special groups such as medically compromised patients (e.g. patients with HIV and cancer) or used particular methods such as computer and telephone-based approaches were also excluded. Most studies found above (1,219) were excluded as they did not use self-esteem, self-efficacy or locus of control to develop the intervention. Seven trials of interventions remained and were included.

Interventions adopting self-esteem

Most of systematic reviews in relation to interventions adopting self-esteem, as discussed before, relate to specific health conditions. For example, a systematic review conducted by Ekeland and colleagues (2005) to determine if exercise (such as aerobic classroom activity, jogging, swimming and dancing) alone or as part of a comprehensive intervention can improve self-esteem in children and young people. The results, based on 25 comparisons with participants aged 3-20 years, indicated that exercise might improve self-esteem in children and young people at least in the short term. However, as the authors note, the review was limited because of the low quality of the trials. To understand the characteristics of interventions that have applied self-esteem to promote health, original articles may have to be located.

Regarding the interventions in randomised controlled trials, for example, O’Dea and Abraham (2000) evaluated the effect of an interactive, school-based and self-esteem education program on the body image and eating attitudes and behaviours of

adolescents aged 11-14 year olds. The programme was based on the educational theories of cooperative, interactive, and student-centred learning. The methods included the use of group work, games, play, drama and a “content-free” curriculum in order to foster a positive sense of self, student involvement, vicarious learning, exchange of feedback and positive environments in which the students felt that they could not fail programmes. The intervention consisted of nine consecutive weekly lessons of 50–80-min duration with additional home-based activities. The intervention group participated in the program, whereas the control group students received their scheduled personal development and health class. The intervention group significantly improved the body satisfaction and increased aspects of self-esteem; social acceptance and physical appearance.

Interventions adopting self-efficacy

Lorig and colleagues (2001a) carried out a randomised controlled trial to evaluate an intervention based on self-efficacy to improve health status in patients with various diseases such as lung disease, heart disease, stroke and arthritis. Four-hundred and eighty-nine patients attended a 7 week self management programme called the Chronic Disease Self Management Program (CDSMP) taught by professional leaders, lay readers and peers. This program guided skill mastery through weekly action planning and feedback, modelling self management behaviours, solving problems and social support. At one year post intervention, participants improved significantly in health behaviours such as exercise, self-efficacy and health status such as fatigue, pain and depression. They had fewer visits to see the doctor than the comparison group.

Another study was carried out by Lorig and colleagues in 831 patients aged 40 years and older with heart disease, lung disease or arthritis who participated in the CDSMP. Subjective health ratings, including disability, social and role function, health care utilization and self-efficacy were assessed at 1 year and 2 years. Emergency visits and health distress decreased significantly and self-efficacy significantly improved at 1 year. There was no change in other variables (Lorig *et al.*, 2001b).

Fu and colleagues (2003) conducted a study in China by using CDSMP. Nine-hundred and fifty-four patients with diabetes, chronic lung disease, heart disease or hypertension were recruited. Four-hundred and thirty patients in the intervention

group received CDSMP and a copy of a help book. The programme ameliorated health behaviours, self-efficacy and health status in the intervention patients. These patients had more minutes of aero exercise, improvement of cognitive symptoms management and self-efficacy to own symptoms and diseases and fewer hospitalizations when compared to the control group who did not receive CDSMP.

Features of a successful self-efficacy intervention for patients with chronic diseases were suggested by Marks and Allegrante (2005) who recommended a variety of learning methods such as discussions, brainstorming, demonstrations, goal setting, fostering self management of physical activities, food selection and weight control, applying encouragement and social support and use small group intervention approaches with active participation strategies (Marks and Allegrante, 2005).

Using search strategies and terms described in the beginning of section 2.3.4.2, effective interventions that have applied self-esteem, self-efficacy or locus of control to promote health in randomised controlled trials are presented in Table 4. This table outlines the study design, sample size, age of participants, duration of the intervention, programmes' characteristics and outcomes of each study.

Table 4 Randomised controlled trials of health interventions that have applied psychological factors

Authors	Intervention description	Psychological factor	Sample size	Age	Duration	Programmes	Outcomes
O'Dea and Abraham (2000)	Self-esteem intervention to improve the body image, eating attitudes and behaviours in adolescents	Self-esteem	IG = 275 CG = 195	11-14 yrs	12 months (9 week intervention)	<ul style="list-style-type: none"> • Nine consecutive weekly lessons, additional home-based activities • Based on cooperative, interactive and student-centred learning • Group work, team work games, play and drama to foster positive sense of self, involvement, vicarious learning and exchange of feed back 	<ul style="list-style-type: none"> • Improved body satisfaction, physical appearance rating and current weight losing behaviours • Improved aspects of self-esteem
Chiang <i>et al.</i> (2008)	Effects of a life review programme on self-esteem and life satisfaction in elderly people	Self-esteem	IG = 36 CG = 39	78.13 (Mean age)	3 months (8 weeks intervention)	<ul style="list-style-type: none"> • Once a week 1-1.5 hrs lessons • A series of group discussion on topics regarding life reviews; childhood memories, subjects' family and friends and the greatest things achieved in life • A variety of techniques such as rounds and dyads and activities such as role-playing a life experience 	<ul style="list-style-type: none"> • Improved self-esteem and life satisfaction
Lorig <i>et al.</i> (2001a)	Self-efficacy to improve health using Chronic Disease Self Management Program (CDSMP)	Self-efficacy	IG = 489 CG = NA	≥ 40 yrs	14 months (7 week intervention)	<ul style="list-style-type: none"> • Based on self-efficacy • Guiding skill mastery through action planning, feedback, problem solving and social support (called CDSMP) 	<ul style="list-style-type: none"> • Improved health behaviours such as exercise and self-efficacy • Decreased symptoms such as fatigue, pain and depression
Fu <i>et al.</i> (2003)	Intervention to improve health in chronic diseases	Self-efficacy	IG = 430 CG = 524	≥ 20 yrs	7 week intervention	<ul style="list-style-type: none"> • Receiving CDSMP (see above) • Receiving a help book regarding CDSMP 	<ul style="list-style-type: none"> • Improved health behaviours • Increase in self-efficacy • Fewer hospitalizations

IG = Intervention group, CG = Control group, CDSMP = Chronic Disease Self Management Program

Table 4 Randomised controlled trials of health interventions that have applied psychological factors (continued)

Authors	Intervention description	Psychological factor	Sample size	Age	Duration	Programmes	Outcomes
Kakudate <i>et al.</i> (2009)	Oral hygiene instruction using 6-step methods to enhance self-efficacy	Self-efficacy	IG = 18 CG = 20	40-70 yrs	3 week intervention	<ul style="list-style-type: none"> • Once a week programme for 3 weeks • Assist lifestyle changes using 6-step method: 1) identifying problems 2) creating confidence and commitment 3) increasing awareness of behaviours 4) developing and implementing and action 5) evaluating the plan 6) maintaining behaviours 	<ul style="list-style-type: none"> • Higher self-efficacy and improved plaque index, tooth brushing duration and frequency of interdental cleansing in the intervention group
Clarkson <i>et al.</i> (2009)	Targeted oral hygiene self-efficacy and action plan to influence oral hygiene clinical outcomes	Self-efficacy	<u>Patient RCTs</u> IG = 149 CG = 151 <u>Cluster RCTs</u> IG = 244 CG = 234	<u>Patient RCTs</u> 37.5 <u>Cluster RCTs</u> 35.7	5 minute intervention	<ul style="list-style-type: none"> • Powered toothbrush and behavioural advice on timing, method, and duration of tooth brushing to target oral hygiene self-efficacy (Social Cognitive Theory) and action plans (Implementation Intention Theory) • Using a series of steps; tell, show, do and plan 	<ul style="list-style-type: none"> • Improved behavioural (time, duration and methods), cognitive (self-efficacy and planning) and clinical (plaque and gingival bleeding) outcomes • Clinical outcomes better only in Cluster RCTs
Bastani <i>et al.</i> (2010)	Impact of preconception health education on health locus of control and self efficacy in women	Self-efficacy Locus of control	IG = 109 CG = 101	18-35 yrs	2 hour intervention	<ul style="list-style-type: none"> • 1-hour meeting addressing participants' initial concerns and questions then identifying key issues at a workshop • A single 2-hour workshop with group education regarding healthy lifestyle training; benefits of healthy lifestyles, correlations of unhealthy and healthy lifestyles with morbidity and mortality and consequences of overweight and/or underweight on pregnancy and pregnancy outcomes. 	<ul style="list-style-type: none"> • Increased health locus of control and self-efficacy in experimental group

IG = Intervention group, CG = Control group, RCTs = Randomised controlled trials

In conclusion, there have been efforts to apply psychological constructs (i.e. self-esteem, self-efficacy, locus of control and salutogenic principles) in relation to health. The purpose of these interventions has included improving health, decreasing symptoms, motivating favourable behaviours, enhancing the capability of individuals for self-care and coping with their problems. Some interventions were apparently unsuccessful. Most interventions have targeted knowledge, attitudes, beliefs and behaviours but have ignored the development of social environments which have a greater impact on population health than individual behaviours (Blane, 1985). The successful interventions have included group sessions, using various means in programmes and intensive resources, helping individuals to gain experience from activities and considering the improvement of social environments. These characteristics will be applied to the oral health intervention in this thesis.

2.4 Health promoting schools

Schools can be considered key settings for health promotion to target children. The effectiveness of a settings approach was asserted by Dooris (2005) with the potential to encourage connections between stakeholders and promote interactions between disparate health issues. School is an effective and efficient structure for implementing health promotion initiatives (WHO, 2003). Schools can be healthy places; providing healthy environments and creating conditions through services, policies, physical and social circumstances that are conducive to better health. The experiences and skills children have at school are likely to be factors determining their health.

2.4.1 The background of health promoting schools

The idea of school health appeared in the early 1960s. A number of meetings and conferences between WHO and the United Nations Education, Scientific and Cultural Organisation (UNESCO) considered how to improve schools. Thereafter, an international document emphasised the school health programmes pragmatically in terms of planning and implementation (WHO, 1966). Nonetheless, most documents produced and reported by WHO from 1966 until the early 1970s contained specific planning and implementing methods in schools besides gathering epidemiological data on the health of children. In 1978, the Declaration of Alma Ata was a potent stimulus for health in schools. The focus of 'Health for All by the year 2000' made governments get closer to health promoting schools.

The direction of health promoting schools was shaped apparently by the Ottawa Charter involving five key planks of building healthy public policy, creating supportive environments, strengthening community action, developing personal skills and reorienting health services (WHO, 1986). It was claimed that the change of health behaviours and the maintenance are the main outcome for health education. In addition, the health behaviours may extend from individual's own practices to behaviours that implicate empowerment, advocacy and support. School health initiatives were founded and examined by the Health Education and Health Promotion Unit of the Division of Health Promoting, Education and Communication of the WHO in terms of status of school health programmes improving health. These have made recommendations on policy and actions that WHO, all governments and other organisations can use to improve the health of children, school staff and families through schools and communities (WHO, 1995). From approach to practices, the management, the collaboration and structures need to be considered.

2.4.2 Definition and guidelines of health promoting schools

Health Promoting Schools (HPS) is a model to help schools with health issues. It is developed at country level and is implemented in countries over the world in varying degree. Basically, it has derived from discussions under the patronage of the World Health Organisation (WHO) and defined as “a school constantly strengthening its capacity as a healthy setting for living, learning and working” (WHO, 1998).

A set of guidelines for health promoting schools captured the direction of the Ottawa Charter for Health Promotion in five areas: (WHO, 1996).

- healthy school policies
- the physical environment of the schools
- the social environment of the schools
- school/community relationships
- personal health skills and school health services

The concept of a health promoting school is a comprehensive approach to school health (Lee, 2009; St Leger, 2000). The approach extends beyond the formal health education curriculum and individual behavioural change to consider the physical and social environments of schools and their connections with parents and the

community (Lee, 2009). Subsequent guidelines have addressed the development of relationships within schools, enhancing self-esteem among children and the promotion of staff health (Parson *et al.*, 1996). School commitment and participatory approaches are considered to be key to success (Nutbeam, 1992) so that schools are encouraged to develop programmes or interventions combining or involving these guidelines (WHO, 1996).

2.4.3 Evaluation of health promoting schools

The multifaceted structures of the health promoting school require principles of evaluation to be established. Parson and colleagues (1996) proposed an evaluation framework in three areas: the context, the process and the product. The context is the planning and management structures of schools. The process includes the health education curriculum and the physical and social environments. Interventions involving health related knowledge, attitudes, skills and health behaviours can be seen as the products. Process evaluation highlights four main themes that contribute to the health promoting school: ownership, leadership, collaboration and integration (O'Hara and McNamara, 2001). The findings of evaluation studies are more likely to focus on the effect of health promoting schools in enhancing psychological features such as self-esteem and promoting health behaviours such as reducing the use of tobacco, alcohol and other substance use (Allensworth, 1994). Interventions to promote physical activity, mental health and healthy eating were likely to be the most effective (Stewart-Brown, 2006).

The changes resulting from health promoting schools occur at three levels: individuals, groups and organisation. However, the organisational level tends to be the most important level of change that needs the appropriate methods for assessment (Greenberg *et al.*, 2001). The assessment of health promoting schools in some regions such as England, Wales and Scotland are on the basis of quasi-experimental designs measuring health outcomes, including quantitative methods to appraise the organisation change and quality of intervention (Bowker and Tudor-Smith, 1996; Crosswaite *et al.*, 1996; Hickman and Hearly, 1996).

In relation to health promoting school approaches, Lister-Sharp and colleagues (1999) systematically reviewed health promotion in schools and the health promoting schools approach. One-hundred and forty-three of over 1,200 studies of health

promotion in schools and health promoting schools approaches met the inclusion criteria. The evidence supporting the health promotion schools approach was limited but promising. Some approaches improved health behaviours and health such as dietary intake and fitness respectively whereas others enhanced mental and social well-being such as self-esteem. Programmes based on social learning theory and social influences were more likely to be more effective than those which did not. Additionally, the interventions with changes to the school ethos, environment or encouragement of family and community participation tended to be more effective than those which did not. This evidence has been supported by a systematic review, a Health Evidence Network (HEN) synthesis report, aimed to determine the effectiveness of health promotion in schools with particular focus on the health promoting schools approach. The articles included in this study were published between 1997 and 2003 and covered mental health, healthy consumption, physical exercise, substance use and misuse, aggressive behaviours and peer approaches. The finding has showed variety in the effectiveness of the different types of the programmes (Stewart-Brown, 2006).

An electronic search of the PsycINFO (from 1987 to May 2012) and MEDLINE (from 1946 to May 2012) databases was performed using and combining the search terms 'health', 'promotion', 'schools', 'intervention or program*', 'controlled trial' and 'systematic review'. The combined searches found a number of systematic reviews of health promoting schools that evaluated health interventions targeting a variety of behaviours (e.g. physical activity, dietary intake and smoking) (508 studies). The reviews were hand-searched for those where the authors had made associations between the features of the intervention that had made it effective or ineffective. Those systematic reviews of health promoting schools that have provided details of the intervention are included and are presented in Table 5.

Table 5 Systematic reviews of health promoting schools

Target	References	Finding	Notes
Physical activity	van Sluijs <i>et al.</i> (2007) Kriemler <i>et al.</i> (2011) van Sluijs <i>et al.</i> (2011) de Bourdeaudhuij <i>et al.</i> (2011) Dobbins <i>et al.</i> (2011)	<ul style="list-style-type: none"> • Effects ranged from 3 mins more physical activity to a 50% increase in a number of participations being regularly active 	<ul style="list-style-type: none"> • Effective interventions included school, family or community involvement and multicomponent interventions • Limited quality, lacking randomisation, blinding of outcome assessment and inadequate adjustment for confounders
Obesity	Sharma (2006) Flodmark <i>et al.</i> (2006) Kropski <i>et al.</i> (2008) Brown and Summerbell (2009) Katz (2009) Gonzalez-Suarez <i>et al.</i> (2009) Stevens (2010)	<ul style="list-style-type: none"> • TV watching found to be modifiable followed by physical and nutritional behaviours • Physical education was helpful in reducing childhood obesity 	<ul style="list-style-type: none"> • Intervention targeted physical activity and nutrition behaviours • Supportive policies and environments change diets and exercise required to reduce obesity • Key outcomes (BMI, skinfold thickness and waist circumferences) not measured in all studies • Short term follow-up limits conclusions
Dietary intake (e.g. fruit and vegetables consumption)	Knai <i>et al.</i> (2006) Ells <i>et al.</i> (2008) van Cauwenberghe <i>et al.</i> (2010)	<ul style="list-style-type: none"> • Improvement of fruit and vegetable consumption ranging from +0.3 to +0.99 servings/day • Programmes that adapted school lunches or increased availability of healthy food and combined with a nutrition curriculum increased dietary intake • Limited effects if only focus on environmental change or nutrition education 	<ul style="list-style-type: none"> • Multicomponent interventions tended to be more effective, including increasing access to fruit and vegetables, teacher training, integrating within the curriculum, leadership and encouragement by peers and school food service staff and involvement of parents at school and at home • Follow-up periods were relative short
Smoking	Torre <i>et al.</i> (2005) Park (2006) Flay (2009)	<ul style="list-style-type: none"> • Small effect of school-based smoking prevention 	<ul style="list-style-type: none"> • Little evidence that information alone is effective • No evidence of significant long term effects • Culturally relevant programmes and training in refusal skills tended to be effective • Long-term effects from interactive social influences or social skill programmes, involved 15 or more sessions

Table 5 Systematic reviews of health promoting schools (continued)

Topic	References	Finding	Notes
Social, emotional and mental health	Wells <i>et al.</i> (2003) Green <i>et al.</i> (2005) Maxwell <i>et al.</i> (2008)	• Programmes to promote mental health were more effective than those to prevent mental illness	<ul style="list-style-type: none"> • Greater effectiveness when focused on self-esteem and coping outcomes • Successful interventions lasted more than a year • Programmes adopting a whole school approach more effective than class-based programmes • Short duration of most studies

In summary, the systematic reviews of health promoting school interventions are summarised in Table 5. The evidence suggests that effective school health promotion programmes are more likely to be complex and multidimensional, target school psychosocial environments, to include personal skill development and to include active involvement of the whole school, parents and/or community and to have longer periods of implementation.

2.4.4 Barriers and facilitators for health promoting schools

Factors that influence the effectiveness of school-based interventions in school can be seen as barriers or facilitators and include whole school approaches, supportive leadership, working with parents and communities, incentives, child participation and training and ongoing consultation

2.4.4.1 Whole school approach

The whole school approach involves activity in the curriculum, school environments and communities (St Leger *et al.*, 2007). Naylor and Mackay (2009) postulated that whole school approaches or multicomponent approaches promoting physical activities were associated with a number of attributes within schools such as physical education, classroom activities, families and playgrounds.

Stewart-Brown (2006) systematically reviewed the evidence of effectiveness of school-based health promotion interventions in improving health and preventing diseases. He concluded that interventions that were effective in changes in children's health and health behaviours tended to have a whole school approach impacting on the physical and psychosocial environment in terms of team development, school lunch arrangements, physical activities and social surroundings (van Sluijs *et al.*, 2007; Stewart-Brown, 2006). An intervention that has been integrated into the fundamental work of schools is more likely to be effective, sustainable and have a positive result than those without integration.

2.4.4.2 Supportive leadership

Strong leadership and key persons are needed for successful implementation to conduct and coordinate the programme. Supportive leadership can be described by involvement in discussions concerning the implementation of the intervention (Forman *et al.*, 2009; Thaker *et al.*, 2008). In a school setting, teachers can act as

facilitators or, in turn, barriers for health promotion programmes. The interest of staff in the intervention may contribute as facilitator whereas a lack of interest can be a barrier (Forman *et al.*, 2009). Teachers who have attended health promotion training are likely to be more involved in health promotion and other comprehensive approaches to health education (Jourdan, 2008).

2.4.4.3 Working with parents and the community

Parental and communal involvement can support and reinforce interventions in schools (Naylor and McKay, 2009), whereas lack of parental association and poor parental attitudes reduce the success of interventions (Mihalic and Irwin, 2003). Methods used to work with parents have included brochures or booklets and activities associating with parents, promoting a link between parents, teachers and the community.

2.4.4.4 Incentives

Incentives can facilitate school-based health promotion. On the other hand, lack of programme material can be a barrier (Thaker *et al.*, 2008). Incentives include prizes, praise, cash payment, material support and free access to resources and can be either peer or individual incentives. Kavanagh and colleagues (2006) conducted a systematic review of incentives to promote better health in children aged between 11-19 years. There was a significant improvement of behaviours in children who obtained incentives. Incentives can motivate children's participation in school, for example, returning signed forms in the vaccination programmes within five days after making a decision by their parents (Unti *et al.*, 1997).

2.4.4.5 Child participation

Participation of young people can facilitate school-based health interventions (Sinclair, 2004). Appropriate strategies are more likely when children's views are taken into account (Forman *et al.*, 2009). Neglecting child participation has inhibited the success interventions and conflicts with the principles of child empowerment, which is embedded in the definition of health promotion.

2.4.4.6 Training and ongoing consultation

Training and ongoing assistance after training are necessary for effective implementation and sustainability. Lack of teacher training and support has been

seen as a barrier to intervention implementation (Thaker *et al.*, 2008). The training should be repeated over time since there may be a high turnover of staff (Forman *et al.*, 2009).

2.4.5 Oral health promotion in school

WHO has advocated the use of health promoting schools to promote general and oral health. A study in Brazil evaluated the impact of health promoting schools on the oral health of 1,823 12-year-olds in 33 schools. Supportive schools adopting health promoting policies on food, smoking and physical environments reduced dental caries in school children significantly when compared to non supportive schools (Moysés *et al.*, 2003). The integration of oral health in health promoting schools derived from the common risk factors approach. For instance, high frequency and amount of sugar consumption are important factors that lead to tooth decay, obesity and diabetes (WHO, 2007). Thus action at this common risk factor will yield a multiplicity of benefits. Whilst studies have indicated the positive impact of the health promoting school on oral health, less well known is how interventions influencing oral health are integrated into healthy school programmes. Oral health has been viewed separately to general health and perceived to be promoted insufficiently (Gill *et al.*, 2009).

It is generally accepted that the ways of working within oral health promotion are focused on preventive approaches, behaviour changes, educational approaches, empowerment and social change (Daly *et al.*, 2002). Additionally, oral health promotion is not only directed simply at diminishing oral diseases and injury to the teeth but may also promote feelings of well-being and social acceptability. The imperative is that oral health is referred to much more than the possession of healthy teeth. The extent to which oral disorders affecting functions and psychosocial well-being is therefore an appropriate outcome (Locker *et al.*, 2000).

2.4.6 Oral health interventions in schools

Oral health interventions are usually targeted toward two common oral diseases; tooth decay and periodontal diseases. To prevent these oral diseases, the reduction of their risk factors is considered to be a major issue in oral health promotion. Moreover, the best time for delivering the intervention is said to be a key issue for

success (Petre *et al.*, 2007). Although it is suggested that the sooner oral health related behaviours are initiated, the higher probability for successful maintenance, there is a socially critical period, which may particularly influence health in the long term. It is believed that the period from primary to secondary school is the earliest critical period to modify and maintain patterns of oral health related behaviours (Kuusela *et al.*, 1997).

Over the past three decades, many oral health promotion interventions have been attempted. Kay and Locker's systematic review (1998) examined the quality and the effectiveness of these interventions from 96 journals, 192 papers. The settings of primary research were schools, clinic, community and others. The participants were children, adults, elderly people and disabled people. Research designs included were randomised controlled trials (RCTs), quasi-experimental studies and single group studies. Another systematic review, Sprod *et al.* (1996) identified oral health promotion practices from papers published for a period 1982 to January 1996. Articles whose purposes were to evaluate or describe policy and practice in oral health promotion were included.

Systematic reviews of oral health promotion interventions were identified in the Cochrane Database of Systematic reviews and MEDLINE through OvidSP (from 1946 to May 2012). Search terms included 'oral or dental', 'health', 'education or promotion', 'controlled trial' and 'review'. The combined electronic searches found 481 reviews. Exclusion criteria included not being published in English and oral health was not the primary outcome. Systematic reviews involving special groups (e.g. medically compromised and orthodontic patients), clinical treatments as the primary intervention, those using pharmacological interventions such as antiplaque agents or fluoride or fissure sealants were also excluded. Table 6 summarises the remaining eight systematic reviews of oral health promotion interventions.

Table 6 Systematic reviews of oral health promotion interventions (excluding those applying fluoride or fissure sealants)

References	Findings	Notes
Schou and Locker (1994)	<ul style="list-style-type: none"> • Dental education improved knowledge but no such changes in behaviours and clinical outcomes 	<ul style="list-style-type: none"> • Short term improvement in knowledge • Simple intervention could improve knowledge • Study design and evaluation quality generally poor
Brown (1994)	<ul style="list-style-type: none"> • Average improvement of knowledge 20%, plaque level 18% and gingival bleeding 13% • No effects of dental health education on caries reduction • Mass media was ineffective to improve knowledge and promote behaviour change • Little success in changing attitudes towards dental health 	<ul style="list-style-type: none"> • Short term improvement in knowledge but effects on behaviours and clinical outcomes limited • Evaluation quality generally poor • Short term follow-up • Most studies used small convenient samples
Kay and Locker (1996, 1998)	<ul style="list-style-type: none"> • Dental education programmes improved knowledge • Simple dental education about plaque control improved plaque levels and oral hygiene • Little effects of school tooth brushing programme on caries reduction • School-based educative programme did not affect oral hygiene 	<ul style="list-style-type: none"> • Short term improvement in knowledge but effects on behaviours and clinical outcomes limited • Temporary reduction in plaque levels • Simple approaches appeared as effective as elaborate interventions in reducing plaque • Short term follow-up
Sprod <i>et al.</i> (1996)	<ul style="list-style-type: none"> • Positive effects on reduction of plaque level and gingivitis 	<ul style="list-style-type: none"> • Temporary reduction in plaque levels • Short term follow-up • Most studies measured plaque and gingivitis
Watt and Marinho (2005)	<ul style="list-style-type: none"> • Reduction of plaque level and gingivitis in short term, up to 6 months post interventions • Limit of evidence supported long term improvement of gingival health 	<ul style="list-style-type: none"> • Wide range and diversity of outcome measures • Several shortcoming in methodological employed
Renz <i>et al.</i> (2007)	<ul style="list-style-type: none"> • Psychological interventions improved plaque scores and reduced gingival bleeding • No changes in pocket depth or attachment loss • Improved self-report brushing and flossing 	<ul style="list-style-type: none"> • Overall quality of trials was low • Design of the interventions was weak as ignored key aspects of theories
Satur <i>et al.</i> (2010)	<ul style="list-style-type: none"> • Clinically-based smoking cessation intervention showed promise in terms of both oral and general health benefits • Programmes used ‘informative giving’ alone were not effective • Community-based programmes incorporated participative approaches and flexible delivery were effective 	<ul style="list-style-type: none"> • Short term follow-up • Incorporation of oral health into health promoting schools and monitoring outcomes in oral health terms were supported

Most outcomes of oral health promotion studies were clinical or behavioural and focussed on outcomes such as caries status and oral hygiene. Non-clinical outcomes have included knowledge, attitudes and behaviours.

The reviews included in Table 6 considered oral health promotion in all settings. As the present study concerned oral health in schools, school-based controlled trials and quasi-experimental studies of the effectiveness of the interventions identified within the systematic reviews shown in Table 6, together with those that were published subsequent to the systematic reviews are reviewed in the sections that follow.

Caries status

Most interventions that used caries levels as an outcome measure were tooth brushing programmes with or without fluoridated tooth pastes. Some studies indicated that greater caries reductions could be reached in the long term. Axelsson and colleagues (1987) assessed a caries level using decayed, missed, filled tooth surface (DMFS) in 13 year old children. Students were randomised into three groups. Group 1 received prophylactic treatments such as professional mechanical tooth cleansing and chlorhexidine application along with oral hygiene instruction. These treatments were given four times in a period of two days and repeated every six months during the study period. Group 2 received the same treatment as group 1 but only oral hygiene instruction was repeated every six months. Group 3 received a prevention programme and the use of topical fluoride. After six months, there was no significant difference in caries levels among three groups. In comparison to DMFS in students in the experimental group, in research conducted by Horowitz and colleagues (1980) over four years, DMFS in the former group was lower in the experimental group than the control group. Other randomised controlled trials in clinical and community settings reported no significant effects on caries levels (Blinkhorn and Wight, 1987; Craig *et al.*, 1981).

A study of the effect of a six year oral health educational programme in primary school children was carried out. An intervention group of 3,291 children with a mean age of 7.1 years (SD=0.43) was compared with a control group of 672 12 year olds. The intervention group received a yearly one hour instruction for six years. The outcome variables included caries prevalence and incidence, dental care level and self-reported oral health behaviours. There was no significant change in decayed,

missing and filled teeth (DMFT) between the intervention and control group. There were significant differences in the use of fluoride and improving reported dietary habits (Vanobbergen *et al.*, 2004). It is noted that interventions aiming to reduce dental caries without fluoride tend not to work (Kay and Locker, 1998).

Oral Hygiene

Interventions promoting oral hygiene often involve oral hygiene instruction for plaque control via tooth brushing using plaque levels as an outcome measure in RCTs. Most studies with a short follow-up period reveal a decrease of plaque levels (Babb and Weinstein, 1983; Horowitz *et al.*, 1980; Worthington *et al.*, 2001). It can be seen that a simple instruction may reduce plaque levels. However, changes are not sustained (Horowitz, 1990; Kay and Locker, 1998).

Knowledge

The simple provision of information may increase knowledge Worthington and colleagues (2001) investigated the effect of an oral health education programme in 10 year old children. Interventions consisted of four one hour lessons at four week intervals. The children in the intervention and the control groups were examined for plaque scores and dental knowledge before the interventions and at 4 and 7 month follow-up. Children had better knowledge of tooth brushing in the intervention group than the control group.

Behaviours

A school-based oral health educational programme on children, mothers and school teachers in Wuhan city, China was evaluated by Petersen and colleagues (2004). Oral hygiene instruction by teachers for thirty minutes every month over three years was delivered to children and their mothers. There were significant changes in knowledge and oral health related behaviours such as tooth brushing twice daily, dental visits and the use of fluoride in the intervention group when compared with the controls.

Tolvanen and colleagues (2009) conducted a randomised controlled trial to investigate the effect of 3.4 year oral health promotion programme in 1,691 11-12 year old children in Pori, Finland. The intervention group received the intervention aimed to increase knowledge regarding oral health problems and prevention, change oral health behaviours and provide social support. Children in the intervention group

had significant improvement of knowledge, attitudes and behaviours when compared to the control group.

Eleven potential randomised controlled trials and quasi-experimental studies of school-based oral health promotion interventions identified within and published subsequent to the systematic reviews of oral health promotion in Table 6 are presented in Table 7.

Table 7 Randomised controlled trials and quasi-experimental studies of oral health promotion in schools

Authors	Intervention description	Research design	Sample size	Duration	Programme	Outcome
Nowjack-Raymer <i>et al.</i> (1995)	Improved periodontal status through self-assessment	Randomised controlled trial	IG 1=175 IG 2=161 No CG	2 yrs	<ul style="list-style-type: none"> • Instruction for bleeding assessment and plaque assessment • Classroom and individual training at the beginning and oral prophylaxis at 1 year 	<ul style="list-style-type: none"> • No differences between groups • Significantly fewer sites with gingival bleeding in both groups
Helderman <i>et al.</i> (1997)	Oral health education in primary schools in Tanzania	Cluster randomised controlled trial	IG=309 (8 schools) CG=122 (4 schools)	3 yrs	<ul style="list-style-type: none"> • 1 day workshop on oral diseases and prevention for 2 teachers of each school • 1 day seminar on radio and newspaper on the programme, teacher's role and oral health related knowledge discussion • Weekly tooth brushing session for children • Monthly lesson on the cause and prevention of caries and gingivitis 	<ul style="list-style-type: none"> • No differences in DMFS and DMFT between groups • Lower bleeding score in experimental children • Changes in behaviour such as tooth brushing twice a day, dental visit and fluoride use in the intervention groups • Increased knowledge, attitudes of teacher and mothers
Redmond <i>et al.</i> (1999)	Dental health education for adolescents	Cluster randomised trial (Rolling programmes of 6 months allowing comparison between participants at 6 and 12 month)	1063 children from 28 schools	1 yr	<ul style="list-style-type: none"> • 3 lessons lasting 20 mins in a 6-month period • Interactive lessons emphasised good oral health contributing to appearance and social acceptability and included tooth brushing • Toothbrushes, toothpastes and disclosing agent provided for home use 	<ul style="list-style-type: none"> • Reduced plaque levels in experimental group • Improved knowledge and increased duration of tooth brushing

IG = Intervention group, CG = Control group

Table 7 Randomised controlled trials and quasi-experimental studies of oral health promotion in schools (continued)

Authors	Intervention description	Research design	Sample size	Duration	Programme	Outcome
Worthington <i>et al.</i> (2001)	Dental educational programme for 10 -year old children	Cluster randomised controlled trial	CG = 17 schools IG = 15 schools	8 months	• Four lessons during the period of four weeks aiming to improve oral hygiene	• Increased knowledge related to tooth brushing
Frencken <i>et al.</i> (2001)	Oral health education in primary schools in Zimbabwe	Randomised controlled trial	IG=297 (4 schools) CG=309 (5 schools)	3.5 yrs	• 3 day workshop focusing on oral diseases and prevention, oral treatment, dental fluorosis for 2 representative teachers of each school	• No changes in DMFS • No changes in plaque level
Vanobbergen <i>et al.</i> (2004)	Oral health education in primary school	Quasi-experimental study	IG=3291 CG=672	6 yrs	• 6 yearly one hour instruction of oral health care	• No changes in DMFT in children between two groups • Changes in the use of fluoride and dietary habits
Petersen <i>et al.</i> (2004)	School-based oral health education on children, mothers and school teachers in Wuhan city , China	Quasi-experimental study	Children IG=335 CG=331 Teacher IG =32 CG=315	3 yrs	• 2 day workshop for teachers focusing on oral diseases, prevention and general health • Children and mothers received oral hygiene instruction supervised by teacher on average 30 mins every month consecutive 3 yrs	• No differences in DMFS and DMFT between groups • Lower bleeding score in experimental children • Better behaviour such as tooth brushing twice a day, dental visit and fluoride use in the intervention groups • Increased knowledge, attitudes of teacher and mothers

IG = Intervention group, CG = Control group

Table 7 Randomised controlled trials and quasi-experimental studies of oral health promotion in schools (continued)

Authors	Intervention description	Research design	Sample size	Duration	Programme	Outcome
Yazdani <i>et al.</i> (2009)	School-based education on oral cleanliness and gingival health in 15 yrs school children in Tehran, Iran	Cluster-randomised trial	CG = 130 Leaflet group = 148 Videotape group = 139	12 week intervention	<ul style="list-style-type: none"> • Oral health knowledge regarding oral health, plaque, dental attendance, diet, fluoride and favourable behaviours through a leaflet or videotape that used the same pictures, models and script 	<ul style="list-style-type: none"> • Improved oral hygiene and gingival health
Tai <i>et al.</i> (2009)	School-based oral health promotion to promote clinical status and oral habit in Chinese children aged 6-7 years.	Cluster-randomised controlled trial	CG = 7 schools (697) IG = 8 schools (661)	3 year intervention	<ul style="list-style-type: none"> • 30 mins OHE for children biweekly for 3 years • 30 mins OHE for mothers once a year • OHE booklet for children • Annual poster presentation • Contest on knowledge, painting oral health situation and tooth brushing • A tour of dental hospital once in 3 yrs • Oral examination by dentists in classrooms • Provisions of fluoride toothpaste • Free dental treatments such as filling, scaling, sealants, pulp treatments 	<ul style="list-style-type: none"> • No difference in DMFS and DMFT between groups • Lower plaque and gingivitis in the intervention group • Higher children in the intervention group who had favourable habit including brushing twice a day, previous year dental attendance and using fluoride toothpaste

IG = Intervention group, CG = Control group

Table 7 Randomised controlled trials and quasi-experimental studies of oral health promotion in schools (continued)

Authors	Intervention description	Research design	Sample size	Duration	Programme	Outcome
Saied-Moallemi <i>et al.</i> (2009)	School-based programme to promote gingival health in preadolescents	Quasi-experimental study	CG = 117 IG 1 = 115 IG 2 = 114 IG 3 = 111	3 month intervention	<ul style="list-style-type: none"> • Class work , solving problems containing oral health messages (IG1) • Oral health education leaflet and brushing diary(IG2) • Combination of interventions in IG1 and IG2 (IG3) 	<ul style="list-style-type: none"> • Improved plaque in IG2 and IG3 • No changes between three intervention groups
Tolvanen <i>et al.</i> (2009)	School-based oral health promotion programme in Finnish children	Randomised controlled trial	CG = 247 IG = 250	3.4 yrs	<ul style="list-style-type: none"> • Oral health knowledge regarding oral problems and prevention • Use of xylitol products after meals • Pupils run the oral health promotion projects under supervision of oral health professionals • Creating healthy school environments by providing drinking water instead of soft drink, avoiding vending machine and encouraging children to have free healthy lunch 	<ul style="list-style-type: none"> • Improved knowledge, oral hygiene and behaviours

IG = Intervention group, CG = Control group

The evidence base for oral health promotion interventions summarised by Watt (2005) and findings from systematic reviewed studies (Brown, 1994; Schou and Locker, 1994; Kay and Locker, 1996; Sprod *et al.*, 1996; Kay and Locker, 1998; Watt and Marinho, 2005; Satur, 2006; Satur *et al.*, 2010) have drawn attention to several common findings.

Firstly, even though the interventions were termed health promotion, in fact, most were dental health education interventions. The methods were relatively didactic and focused on prevention of dental caries and periodontal diseases. Interventions that are purely educational are not sufficient to promote oral health.

Secondly, changes in knowledge, attitudes and beliefs are short term and do not lead to sustained changes in oral health related behaviours (Schou and Locker, 1994; Kay and Locker, 1998; Sprod *et al.*, 1996; Watt, 2005). Knowledge can be increased using simple interventions. Interventions focusing on cognition are likely to changing attitudes and beliefs but there are questions about behaviours as oral health behaviours appear to be more difficult to change. Simple interventions may alter behaviours but these changes are likely to be limited. Additionally, oral health related behaviours are difficult to relate to critical outcomes. In medical studies, there are fewer difficulties because mortality and morbidity are used as end points and are relatively clear compared to the end points used in oral health. Furthermore, the threshold of behaviour change needed to change health requires defining.

Thirdly, plaque levels and gingival bleeding tend to be reduced after delivering interventions. Simple oral health promotion interventions are as effective as more complex approaches in reducing the level of plaque, but the differences are difficult to sustain (Watt and Marinho, 2005). Schou (1985) evaluated the long term effect of an intervention using active involvement in the design and implementation of the programme and found a 52.6% improvement in plaque and 44.5% reduction in gingival bleeding at 3.5 year follow-up. Active participation may have had an important effect on the improvement.

Fourthly, simple interventions tend to evoke behaviour changes. Greater or longer changes appear to require intensive and robust approaches (Sprod *et al.*, 1996). Oral health promotion interventions that consider economic, social and environmental

conditions, psychological factors, active participation and culture are more likely to achieve their goals.

In conclusion, previous oral health interventions have limited success in improving oral health due to their narrow focuses on knowledge, attitudes and beliefs. Behaviour changes are needed but they are extremely complex. It is difficult for people to adopt healthier lifestyles by modifying only themselves. For this reason, interventions that focus simply on changing oral health behaviours cannot achieve sustained improvements in oral health. Environments and health resources that contribute opportunities for behaviour change are necessary. Factors influencing and supporting oral health include psychological, individual, social and environmental factors. Attempts to improve oral health must tackle these determinants together in comprehensive and complementary interventions.

2.5 Rationale for the study

Oral health related quality of life (OHRQoL) is a multidimensional construct that refers to the extent to which oral disorders or oral diseases disturb individuals' daily functioning and well-being. It is therefore a natural outcome for health promotion interventions. It is clear that factors influencing oral health, including oral health related quality of life are not only oral diseases but also psychological and social factors. These factors have been tested to explore relationships among variables using the Wilson and Cleary model (Baker *et al.*, 2007; Baker *et al.*, 2008; Baker *et al.*, 2010; Gururatana, 2011b). It is apparent that a range of individual and environmental factors influence oral health; one of which is SOC (Baker *et al.*, 2010; Gururatana, 2011b).

SOC interventions have been shown to be effective in relation to general health and well-being (Langeland *et al.*, 2006), but no study has applied SOC to promote oral health. Such interventions may prove effective because as this review shows, health promotion may be more effective if it is multidimensional in its approach and if it considers psychological and environmental factors. As evidenced in this review, salutogenic principles could act as a framework for oral health promotion. Therefore, the purpose of this study was to examine whether an intervention to enhance SOC would influence OHRQoL of children.

2.6 Aim and objectives

2.6.1 Aim

The aim of this study was to investigate the effect of an intervention to enhance SOC and OHRQoL and to explore determinants of OHRQoL in children.

2.6.2 Objectives

- To establish an intervention to enhance SOC
- To assess the effectiveness of the intervention
- To explore determinants of OHRQoL

2.7 Hypotheses

The research in this thesis will test the following hypotheses:

Primary hypotheses:

- The school-based intervention increases SOC
- The intervention to enhance SOC improves OHRQoL

Secondary hypotheses:

- Greater SOC predicts better OHRQoL
- Higher SES (parental income, education and occupation) predicts better OHRQoL
- Clinical status is not related to OHRQoL

Chapter Three

Methods

3.1 Overview

This cluster randomised study was to

- To establish an intervention to enhance SOC.
- To assess the effectiveness of the intervention
- To explore determinants of OHRQoL

3.2 Participants

3.2.1 Target population

Primary school children aged 10-12 years in Thailand

3.2.2 Intended sample

The intended sample was Grade 5 (Pratom 5) students aged 10-12 years from twelve eligible primary schools in Khonkaen. This age group was chosen for pragmatic reasons to fit in with school year and curriculum in Thai schools. Children from six primary schools formed a study group and those from six primary schools formed a comparison group.

3.2.3 Exclusion criteria for participants

- Children whose parents did not provide consent to participate in the study
- Children who did not have the ability to complete the questionnaires
- Children who had medical and cognitive problems
- Children who declined to take part

3.3 Recruitment and randomisation

The eligibility criteria for schools included the school's size, location and the projects related to health, including oral health. Each school was located in a suburban area in Khonkaen and had 200-300 students in total, including 20-30 children in Grade 5. The unit of randomisation was the school and only children in Grade 5 took part. Randomisation used block permutation to balance the number of schools/participants in each group. The schools were listed. Then a random sequence of blocks of 4 was created and the first point in the sequence was selected by a person not involved in the project. Schools were allocated to the two groups

according to the sequence. Six schools were randomly assigned to the intervention and the comparison groups respectively. There were a total of 261 participants at baseline from the twelve schools.

Children in Grade 5 (aged 10-12) in these schools who met the inclusion criteria were identified when they attended school. The researcher described the study in detail to potential participants, gave them information sheets, consent forms, assent forms (Appendix A) and invited them to take part. The children took the forms home to show their parents/guardians before deciding whether to take part. Children who agreed were given the questionnaires to complete. After that students had a clinical examination. All students were assured that participation was not necessary and they could withdraw at any time.

3.4 Sample size

This pilot study was carried out to assess the possible effect size for power calculations for a subsequent trial. It was possible that completion of the questionnaires at baseline influenced children's responses at follow up. Therefore, to distinguish between this effect and the effect of the intervention, a comparison group did not receive the intervention.

3.5 Permission and Liaison

- Ethical approval was obtained from the University of Sheffield and the Ethical Review Committee for Research in Human Subjects: Ministry of Public Health, Thailand. A letter of permission was issued by the Ethical Review Committee for Research in Human Subjects: Ministry of Public Health, Thailand (Appendix B).

- The Sirindhorn College of Public Health and Provincial health office, Khonkaen province, Thailand were informed the date and duration of data collection.

- Administrative arrangements with local school administrators and head teachers were performed.

- All participants, including the parents/guardians and children were informed about the study. Parents provided consent and children provided assent.

- Teachers delivering the intervention attended the meeting and received a training programme regarding intervention delivery from the primary researcher.

3.6 Variables

Variables considered in this study were used to populate to the Wilson and Cleary model (1995) (Figure 4).

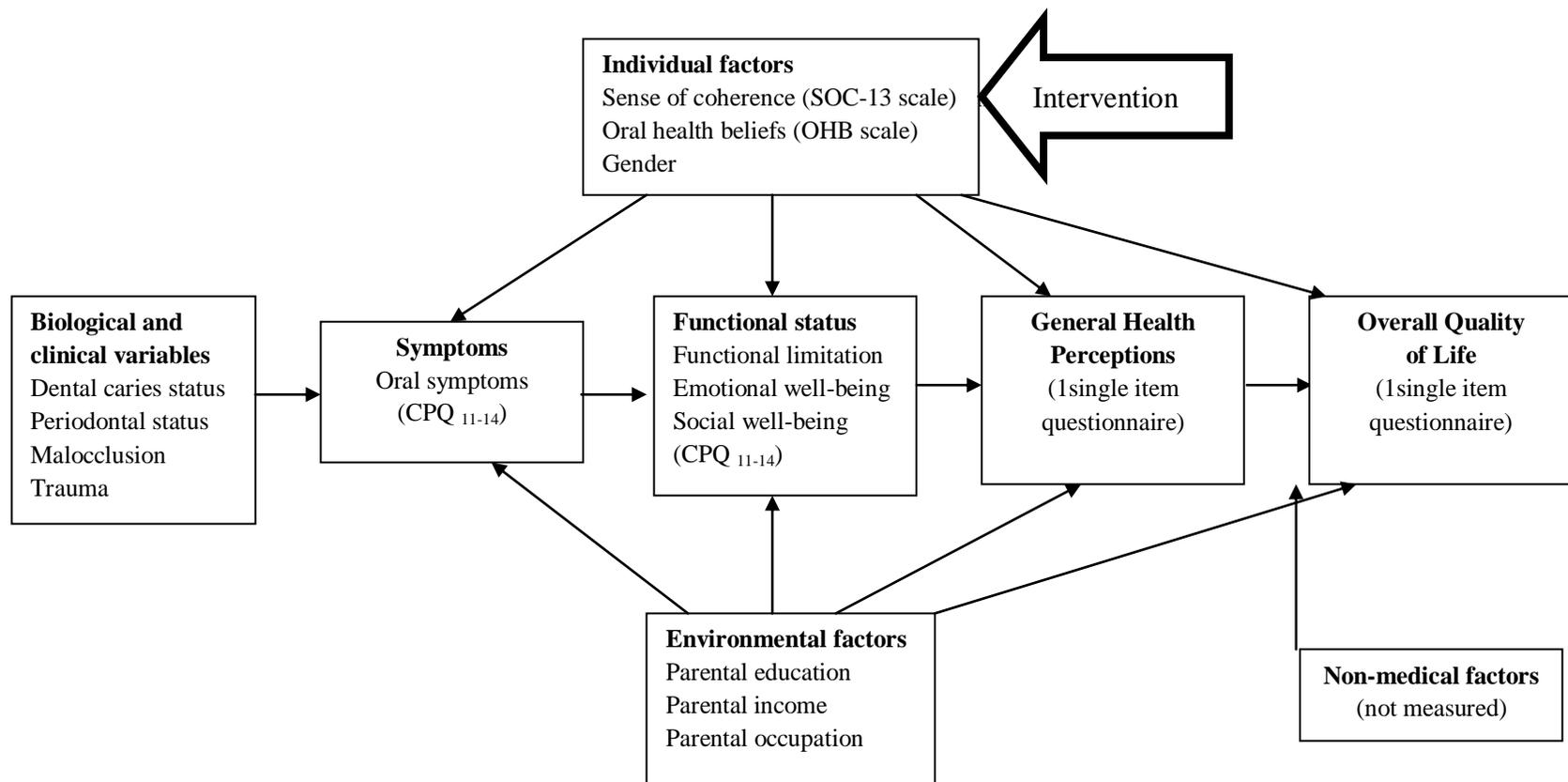


Figure 4 Selecting variables and analytic strategy within the Wilson and Cleary model (1995)

3.6.1 Demographic variables

Data on children's age, gender and ethnicity and parents' education, income, number of children were collected using questionnaires.

Ethnicity was categorised into four groups; Thai, Thai-Chinese, Thai-Malaysian and others.

Parental educational attainment was recorded separately for paternal and maternal education as 'Primary school', 'Matthayom 1-3 or equally', 'Matthayom 4-6 or equally', 'Undergraduate' and 'Postgraduate'. These data were subsequently grouped into three categories; primary school, matthayom or secondary school and university levels of education.

Parental income was recorded as ' $\leq 5,000$ baht', '5,001-10,000 baht', '10,001-15,000 baht', '15,001-20,000 baht' and '>20,000 baht'.

Parental occupation was recorded as 'Officials', Government enterprise, Personal business, Employee, Unemployed and others.

Demographic questionnaires were adapted from one used in the sixth Thai National Oral health survey (Ministry of Public Health, 2007).

3.6.2 Clinical variables

Clinical variables consisted of caries, dental trauma, malocclusion, periodontal status and dental defects or anomalies, all measured during clinical examination using the normative indices for trauma, dental caries and periodontal disease of the WHO (1997).

Dental caries was recorded as '0' = 'No caries' (Code 0) and '1' = 'Yes caries' (Code 1 and 2). Missing teeth were recorded as '0' = 'No missing teeth due to caries' (No code 4 at all) and '1' = 'Yes missing teeth due to caries' (Code 4). Filled teeth were recorded as '0' = 'No filled teeth (No code 3 at all) and '1' = 'Yes filled teeth' (Code 3). Decayed, missing and filled teeth were pooled and calculated using DMFT index.

Periodontal status was dichotomised as ‘No periodontal diseases’ (CPI=0) or ‘Yes periodontal diseases’ (CPI > 0).

Dental or enamel defects were categorised as ‘No enamel defect’ or ‘Yes enamel defect’.

Dental trauma was grouped as ‘No trauma present’ or ‘Yes trauma present’.

Malocclusion was recorded using the Index of Orthodontic Treatment Need (IOTN) (Brook and Shaw, 1989). Using the aesthetic component (AC), Codes 1, 2, 3, 4, 5, 6 and 7 were categorised as ‘No need/slightly need treatment’. The other codes were categorised as ‘Great need treatment’.

Clinical examination forms and clinical codes used in this study are detailed in Appendix C.

3.6.3 Individual factors

3.6.3.1 Sense of Coherence (SOC) (Intermediate outcome)

Sense of coherence was measured using the 13- item sense of coherence scale (SOC-13) (Antonovsky, 1987) answered on a seven-point Likert type scale ranging from 1 to 7. Each item required semantic responses, for example, from ‘Never happened’ (1) to ‘Always happened’ (7) for the item ‘Has it happened that people whom you counted on disappointed you?’. Some questions related to specific issues such as ‘You overestimate or underestimated its importance’ (1) to ‘You saw thing in the right proportion’ (7) for the item ‘When something has happened, have you generally found that?’ After reverse scoring some items, higher scores represented higher SOC. The range of scores is from 13 to 91. SOC-13 has shown acceptable validity and reliability. The internal reliability represented by Cronbach’s alpha of the short form of 13 items ranged from 0.74 to 0.91 in earlier studies (Antonovsky, 1987; Larsson and Kallenberg, 1999).

3.6.3.2 Oral health beliefs (OHB)

The OHB scale was included because oral health beliefs are related strongly to oral health behaviours. They may affect symptoms, oral health perception and therefore overall well-being (Broadbent *et al.*, 2006).

The OHB questionnaire comprises six items regarding diet, oral hygiene practices (keep dental clean and use dental floss), fluoride use (fluoridated toothpaste and fluoridated water) and dental attendance (Broadbent *et al.*, 2006). The children answered each item on a four-point Likert scale ranging from ‘Extremely important’ (4) to ‘Not at all important’(1). The range of scores is from 6 to 24.

3.6.4 Symptoms and functional status (Primary outcome)

The Child Perception Questionnaire (CPQ₁₁₋₁₄) (Jokovic *et al.*, 2002) was used to assess oral health related quality of life (OHRQoL). The 37-item questionnaire comprises four domains: oral symptoms, functional limitations, emotional well-being, and social well-being. Children were asked whether in the past three months they had experienced the problem described by each item. Participants responded on a five-point Likert scale ranging from 0 (Never) to 4 (Everyday or almost every day). Higher scores represented worse OHRQoL. CPQ₁₁₋₁₄ has showed acceptable reliability, criterion validity and construct validity in relation to global oral health rating and life overall in Australia (Do and Spencer, 2008), the UK (Marshman *et al.*, 2005) and Thailand (Gururatana *et al.*, 2011a). The reliability represented by Cronbach’s alpha was 0.91 with an Intra-class Correlation Coefficient at 0.90 (Jokovic *et al.*, 2002). The full version Thai CPQ was validated by Gururatana and colleagues (2011a) showed acceptable reliability represented by Cronbach’s alpha at 0.86 and good construct validity in relation to global oral health ratings.

3.6.5 General health perceptions (GHP)

General health perceptions (GHP) or global ratings of oral health were obtained by the use of a question ‘Would you say that the health of your teeth, lips jaws or mouth is...?’. This global rating had a five-point response phrase ranging from ‘Excellent’ (0) to ‘Poor’ (4). Higher scores represented worse general health perceptions.

3.6.6 Overall quality of life (Overall QoL)

The extent to which the condition affected each child’s overall well-being was obtained by the use of a question worded as follows: ‘How much does the condition of your teeth, lips jaws or mouth affect your life overall?’. This question had a five-point response format ranging from ‘Not at all’ (0) to ‘Very much’ (4). Higher scores represented worse overall well-being.

All scales used in this study can be seen in the Appendix C.

Data were managed as summarised in Table 8.

Table 8 Summary of data management

Variables	Description of measure	Summary measure
OHRQoL	Comprises 4 subscales on 5-point scale; Symptoms (6 items) Functional limitation (9 items) Emotional well-being (9 items) Social well-being (13 items)	Sum of the item scores for the four subscales that generate scores of CPQ ₁₁₋₁₄
GHP	One single item on a 5-point scale	GHP
Overall QoL	One single item on a 5-point scale	QoL
SOC	13 items on a 7-point scale (Item 1,2,3,7 and 10 were reversed score)	Sum of the item scores
OHB	6 items on a 4-point scale	Sum of the item scores

These variables were grouped in a simplification of the Wilson and Cleary model (Figure 5).

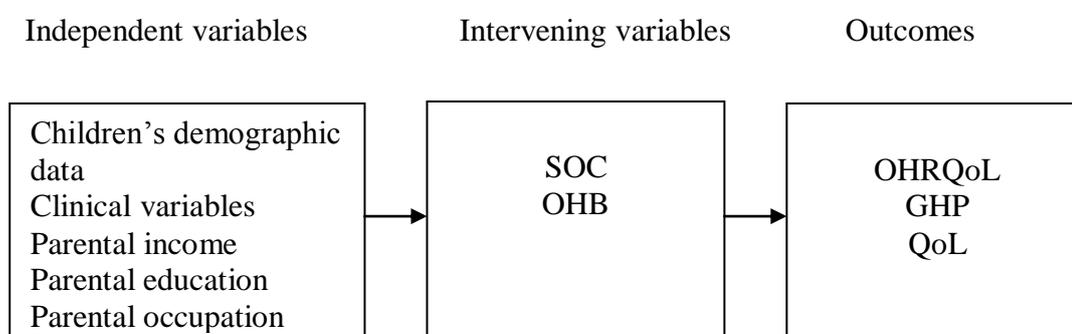


Figure 5 All variables grouped following the process of the study

3.7 Intervention

The intervention was targeted at schools and individuals. Six schools with a total of 133 Grade 5 students received the intervention, delivered by trained teachers whilst in the comparison group, 6 schools with 128 children did not receive it. The intervention was developed based on literature searches, advice from educationalists and findings from previous work on SOC and OHQoL in 10-14 year old

schoolchildren (Baker *et al.*, 2010; Gururatana, 2011b). The intervention comprised seven 40-60 minute sessions over two months and focused on child participation and empowerment. The contents of each session are summarised in Table 9.

Table 9 Outline of sessions in the intervention

Session	Title	Aim	SOC components	Content/activities
1	Healthy mouth	Increase understanding, awareness of oral health and self-efficacy	Comprehensibility	<ul style="list-style-type: none"> • Defining a healthy mouth and its importance • Learning to understand the mouth via variety of resources and brushing teeth effectively
2	Face games	Increase self-esteem and self-efficacy	Comprehensibility & manageability	<ul style="list-style-type: none"> • Taking photos and writing nice things about people
3	Name calling	Increase self confidence	Comprehensibility	<ul style="list-style-type: none"> • Making masks & role playing
4	Changing my life	Increase ability & belief to control lives	Manageability & meaningfulness	<ul style="list-style-type: none"> • Assessing oral health and life overall and planning to improve
5	Healthy school part I (Brain storming)	<ul style="list-style-type: none"> • Increase self-esteem, self-efficacy, self confidence, ability and beliefs to control lives by experiences gained from doing healthy school project 	Comprehensibility, manageability & meaningfulness	<ul style="list-style-type: none"> • Working in groups and undertaking healthy school projects
6	Healthy school part II (Plan & implement)	<ul style="list-style-type: none"> • Creating healthy environments 		
7	Healthy school part III (Evaluation)			

Sessions 1-4 were classroom activities whereas sessions 5-7 involved working on healthy school projects. In session 1 (healthy mouth), children learned to think positively about their health (e.g. normal clinical status, good body image, smiling with confidence and talking without embarrassment) and recognised how to improve

and maintain their health. They were approached by being asked the questions ‘What does a healthy mouth mean to you?’ ‘What do you think interferes with having a healthy mouth’ and ‘How do we get rid of these things’. Additionally, they learned to improve their oral health by brushing their teeth effectively under supervision of the researcher and teachers. This session aimed to increase children’s knowledge, awareness of oral health, self-efficacy as well as the comprehensibility component of SOC.

In session 2 (Face games), children learned to think positively about themselves and others and increase their belief and confidence in their own ability and value. The activities in this session were divided into two parts. In Activity 1, the teachers took a photo of every child and gave children their photos and asked them to affix and decorate their photos as they wanted. In activity 2, teachers asked children to write nice things for others around the photos such as specific abilities, skills, personality etc. After children finished their work, teachers read out the nice comments and children guessed who the person was. The teacher then gave the children their photos and asked them to write down how the compliment made them feel. Children also marked themselves on the activities that they had done. This session aimed to increase children’s self-esteem, self-efficacy and comprehensibility and manageability components of SOC.

In session 3 (Name calling), children learned to think about how we use names as a way of showing familiarity with other people. The session comprised two activities; making masks and role playing. In the first activity, children were supposed to be elephants, rabbits and other animals in the forest and needed to make their own mask to represent their character. In Activity 2, children were asked to work in small groups to play act using the following background:

Background: There are many kinds of animals that live in the forest. An elephant and rabbit meet for the first time. They immediately know that they will be best friends.

Scene: 1. Elephants and rabbits meet and introduce themselves by using their own name.

2. They start to get to know each other.
3. After one year they play with each other.
4. During playing they call each other silly names.

After role playing, teachers asked children, for example, ‘What names did they choose for the first time when they meet each other?’, ‘What names did they use later?’ ‘Do they have silly names for their best friends?’, ‘Do they have silly names for strangers?’, ‘Why the difference?’ and ‘Is this teasing?’, following which, the teacher facilitated a class discussion. The session aimed at helping children increase self confidence and comprehensibility component of SOC. Children saw that calling names are names used by people to show familiarity when they know someone well. These names are not meant to make the person feel bad or hurt them. Thus, they should not necessarily feel upset, embarrassed or nervous when others call them informal names or nicknames.

In session 4 (Changing life), children considered shaping their life by goal setting and planning to improve their life. Children were requested to think about their life that may be related to family, friends and schools and then rated their life using the scale from 0 (very dissatisfied) to 10 (very satisfied) and give a reason for the score. Children wrote on their personal poster about ‘things I like about me’ and ‘three things I am good at’. Then, teachers introduced the idea of health as a continuum (not just sick/well) and gave examples:

‘People can be happy even though they have disease such as heart diseases or oral diseases (e.g. decayed teeth). It depends on the ability of people to cope with their problems such as asking others for information to be able to take good care of themselves and behaving in a certain way to prevent any further problems or to reduce symptoms. People who pay attention to themselves and believe that they can do things are more likely to feel control over their life than those who believe only others can help or in fate or luck’.

Following this, on their personal poster, children were asked to rate themselves from 0 (very dissatisfied) to 10 (very satisfied) in relation to their oral health, write down what they could do in order to have scores towards 10 (have a better life and oral health) and then presented their poster to other students in the class.

The session was aimed at increasing the meaningfulness and manageability components of SOC. The session also helped children to learn how to improve their personal skills through behavior rehearsal which aimed to diminish their anxiety or less effective social responses by practicing more ‘appropriate’ forms of behavior.

The last three (Sessions 5-7) involved working on healthy school projects. The children brainstormed, planned, implemented and evaluated their project under the supervision of the teachers. These sessions aimed to help children think positively about their health, increase their knowledge and awareness of health, self-esteem, self confidence and self-efficacy, develop positive attitudes, personal skill, coping strategies and all components of SOC.

The strategy used for the intervention was a mixture of didactic teaching, discussion and games. **The important methods used in this intervention are focused on a participatory approach so that children take part in all activities or events.** Accordingly, children were enabled to sit and play with freedom and talk and learn amongst themselves. Teachers played a role praising, supporting and encouraging them to complete each piece of their work. The sessions were more like play than usual school work in Thailand. Details of the intervention are described in Appendix D.

Six teachers, one from each intervention school, were trained together at a one-day course provided by the researcher (ON) in order to ensure uniformity across schools. They were provide details of the intervention and discussed all relevant issues in terms of time, materials, style of teaching and any feedback to facilitate the intervention. For instance, the teachers recommended warm up activities before some of the sessions and this was agreed upon during the training.

In the first part of the training, teachers were introduced to basic information on health, including oral health and oral health related quality of life, learning the basic concepts and about determinants of health. Exercises provided in this section helped teachers understand general and oral health. Teachers were also introduced to SOC as an individual factor influencing health. After this session, teachers drew conclusions about SOC, embracing the importance of SOC and the need to enhance SOC in children in order to improve their oral health.

The second part of the training was dedicated to the intervention. Teachers were given details on each session, its aims, objectives, activities and relevant resources. They were instructed explicitly about the methods used in this part focusing on child participation in activities or events to empower students to give them confidence or

power to do things. All relevant materials were disseminated to teachers. Gantt charts listed the dates for each session to help them deliver the intervention in the appropriate time. Any query that emerged during training was answered by the researcher.

Handbook for teachers delivering the intervention (Appendix D).

A handbook was developed for teachers. It comprised two main parts

- Basic information about health, oral health and oral health related quality of life, including the definitions. A section on determinants of health focused on an individual characteristics including sense of coherence.
- A guide to the intervention described its aims, objectives, explanatory terms, activities and provided resources for each of the lessons

To facilitate the success of the intervention the main barriers and facilitators to school-based health promotion programmes were considered, including training, supportive leaderships, visible impacts, student participations, working with parents and whole school approaches (Figure 6) (details in section 2.4.4).

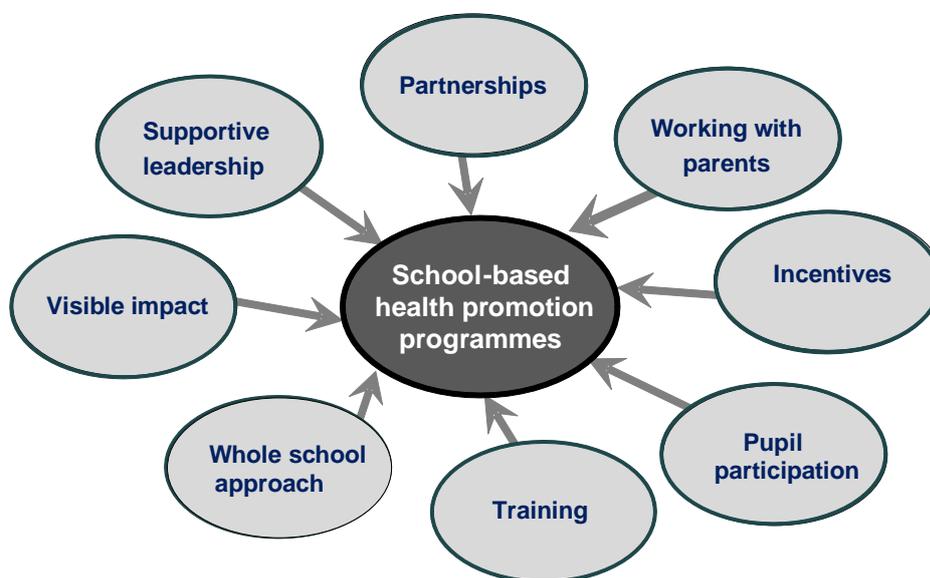


Figure 6 Summary of the main barriers and facilitators to school-based health promotion programmes

The healthy school projects created by children were introduced to school administrators and head teachers. According to the literature, successful implementation needs strong

leadership and key personnel. Forman and colleagues (2009) noted that teachers acted as facilitators for health promotion interventions through leadership behaviours by being open to learn about the intervention.

Teachers delivering the intervention received an intensive one-day training course led by the researcher (ON) on how to deliver the intervention. They were provided details of the intervention and gave any feedback to facilitate the intervention. During the intervention delivery, the researcher visited each school to check on progress. At this time, the researcher also looked at every piece of work completed by the children such as the reflection sheets and personal posters. Teachers were informed that if they needed help or had any problems or questions to contact the researcher and telephone details were distributed. For this purpose the researcher helped all teachers in each of the intervention to conduct Session 1 (healthy mouth).

Although the parents/guardians did not take part in the activities of the intervention they were informed about the activities within schools. They received information about the intervention such as copies of their children's dental records and participation sheets in regard to the intervention.

The healthy school project created by the children involved whole schools because effective school health promotion interventions encompass activities in the curriculum, school environment and community. Whole school approaches integrate programmes into school organisations extend and sustain positive outcomes (St. Leger *et al.*, 2007).

Child participation was embraced as fundamental in the SOC-based health promoting school intervention. The appropriate strategies for promoting the health of children only occur when the views of the young people are taken into account. Actively involving children in programmes facilitates implementation (Forman *et al.*, 2009).

Intensive resources including all relevant materials support and praise were employed within the intervention. These resources can be seen as 'incentives' that used to motivate students to active participate in the health promotion programme.

3.8 Conduct of the study

3.8.1 Training and Calibration

Two dentists working at the Sirindhorn College of Public Health, Khonkaen were calibrated to the WHO diagnostic criteria (WHO, 1997) and trained in the use of CPQ₁₁₋₁₄ and other questionnaires.

3.8.2 Equipment

Mouth mirrors, explorers, cotton pliers, hand instruments, cotton wool, gloves, recording sheets, pencils, computer, software, lesson plan and relevant resources were provided by the Sirindhorn College of Public Health, Khonkaen.

3.8.3 Translation

All questionnaires were translated into Thai by the researcher, and then translated back into English by a Thai linguist conversant in both languages, who had not seen the original English version of the questionnaires. The translated English version was compared with the original version. Amendments and repeat procedures were made until there was only minimal discrepancy between the two versions.

3.8.4 Allocation of the intervention

The allocation of the intervention was based on schools. After recruiting the 12 schools, the intervention was block randomly assigned to six schools which were the intervention groups and the other six schools were in the comparison groups. All participants in Grade 5 in each school were included.

3.8.5 Personnel

- Two dentists and two dental therapists conducted the clinical examinations.
- Six teachers delivered the SOC intervention to students in the study group.

3.8.6 Pilot study

A pilot study was performed with children whose characteristics were similar to the study group. Thai versions of the questionnaires were pre-tested in seventeen children. The suitability of the items in Thai, time to answer the questionnaires, the language simplicity and understanding were appraised. All suggestions were noted. The reliability and validity of the questionnaires were tested.

Ten of seventeen children were female. The mean age was 10.94 (SD=0.24). Scores of CPQ₁₁₋₁₄ and SOC-13 for males and females were similar. The reliability of CPQ₁₁₋₁₄ and SOC-13 represented by Cronbach's alpha were 0.85 and 0.75 respectively.

The validity in terms of face validity, content validity was evaluated. For CPQ₁₁₋₁₄, information from discussion with children disclosed a significant point with the questionnaires. Some students forgot that responses should concern their teeth, lips, jaws or mouth. Periodic reminding was necessary. At first answering, the SOC scale was difficult on the seven-point Likert scale. Therefore, children were shown an example and an explanation helped them to cope with this problem.

The handbook was given to teachers so that they could give feedback on delivering the intervention. Any suggestions on the duration of each activity and the appropriateness of the material were obtained so that the intervention could be amended.

3.8.7 Data collection

Data at baseline included clinical data from examinations conducted at the schools by the use of portable equipment. The children were asked to complete all questionnaires at school. Two weeks and then three months after the intervention, the researcher contacted the school authorities and arranged for follow-up data collection. Within two weeks after the intervention delivery, all variables except for demographic factors and clinical variables were again measured. Three months later, all variables measured at baseline were collected again, including clinical data. At the end of the study, each participant was thanked for his or her involvement in the trial (Figure 7).

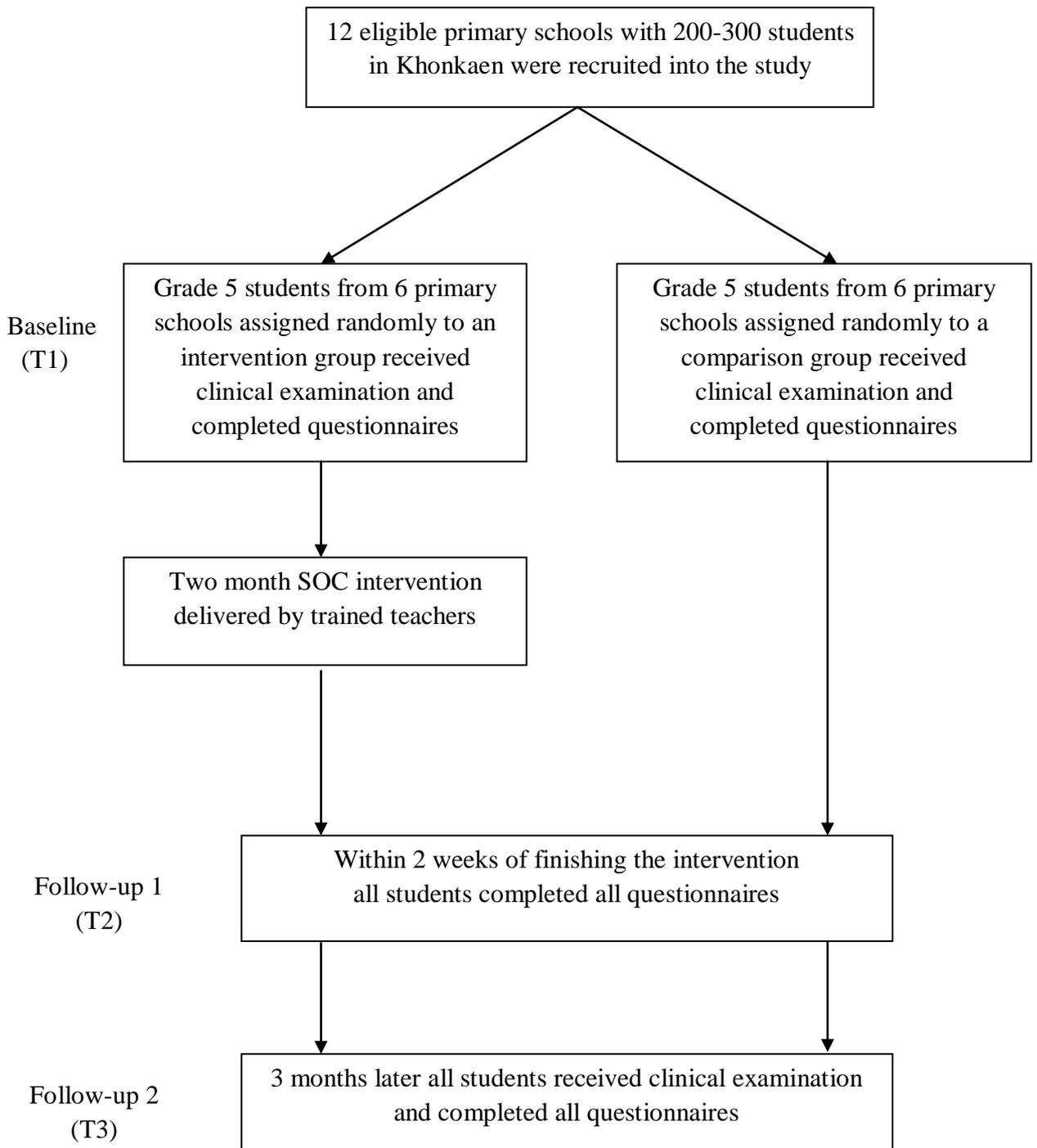


Figure 7 Trial profile

3.8.8 Data transfer

Clinical and questionnaire data at baseline, immediately after finishing the SOC intervention and three months after finishing the intervention were transferred from hard copies to an SPSS database by the researcher. All data were rechecked for accuracy against the original hard copies by assistant researchers.

3.8.9 Data analysis

In the absence of preliminary data there could be no power calculations. This sample size was based on estimation. Therefore, the preliminary analysis for the study provided the descriptions of the central tendency and distribution for the independent and outcome variables at baseline and follow-up.

- Students who failed to answer more than one seventh of the questions were excluded from the analysis. Other missing data were replaced by the sample mean /median/baseline scores.
- Scores for each health domain (symptoms, functional limitations, emotional well-being and social-well-being) of the CPQ₁₁₋₁₄ for each student were computed as total scores.
- The total CPQ₁₁₋₁₄, SOC and OHB scores at baseline (T1), within two weeks (T2) and at 3 month (T3) after the intervention were computed as total scores.
- The reliability and validity of all scales were assessed including test-retest reliability.

Data were analysed in three phases.

Phase 1 described the distribution of all variables using appropriate measures of central tendency and spread and proportions.

Phase 2 evaluated the effect of the intervention on OHB, SOC and OHRQoL. To take clustering into account, mixed effects models with restricted maximum likelihood (REML) were employed, comparing scores of SOC and CPQ₁₁₋₁₄ between the two groups. The group was used as a fixed effect and schools were considered as random effects. Baseline data of the relevant outcome were used as covariates.

Phase 3 explored the determinants of OHRQoL using appropriate bivariate analyses including Pearson and Spearman's rank correlations. Finally, structural equation modelling (SEM) was used to test complex relationships and identified predictors in the Wilson and Cleary model in lagged analysis (Figure 8).

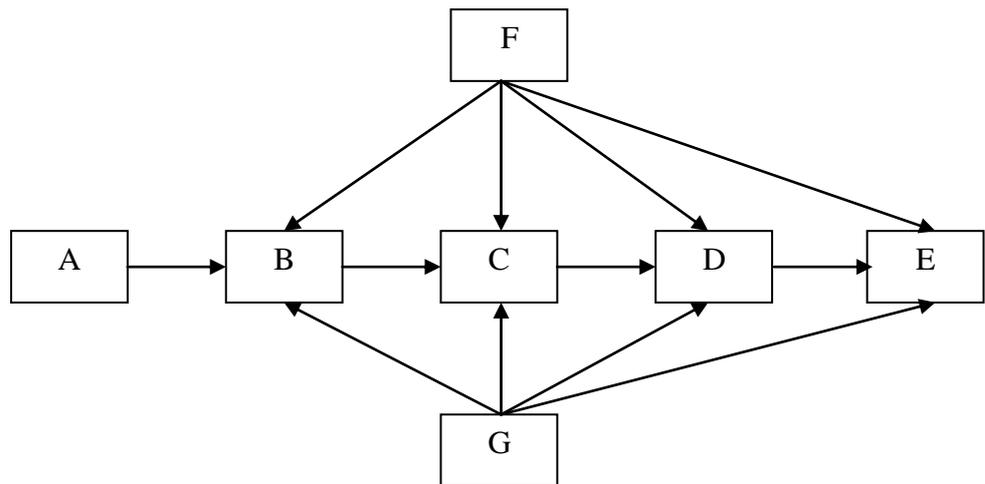


Figure 8 Data analysis within the model

The model hypothesised that B was predicted by A, F and G. Relationships among A, B, F and G at baseline and B at T3 were tested. Subsequently, the relationships between A, B, C, F and G at baseline and C at T3 were tested.

Chapter Four

Results

4.1 Introduction

Twelve primary schools in Khonkaen with 261 grade 5 students were recruited into the study over two weeks. All 261 students completed the first copies of all questionnaires at T1. This reduced to 260 (99.61 %) at T2 and 257 (98.47 %) at T3 respectively. Four missing students moved to another city and could not be contacted. For this reason, 132 students remained in the intervention and 125 in the comparison groups. The period and process of data collection can be seen in Figure 9. The results are presented in three sections.

Section 4.2 relates to phase 1, which describes the samples with respect to gender, ethnicity, age, parental socio-economic and clinical status and other variables including SOC, OHB, OHRQoL, GHP and overall QoL. The reliability of the questionnaires is also described in this section.

Section 4.3 reports phase 2, which assesses the effectiveness of the intervention by reporting data on intermediate and outcome variables. Mixed effect models are used to compare scores between the two groups.

Section 4.4 reports phase 3 of the analysis regarding associations between independent and dependent variables at baseline (T1) and 3 month follow-up (T3). The Wilson and Cleary model guided the analyses testing the hypothesised relationships, first using bivariate Pearson and Spearman's rank correlations and then using structural equation modelling (SEM) to test complex interrelationships.

4.2 Descriptive analysis (Phase 1)

4.2.1 Demographic data

The two groups were broadly similar in demographic terms (Table 10). The mean age was 10.91 (SD=0.44) and 10.86 years (SD=0.44) in the intervention and control groups respectively. Most students identified themselves as Thai. The highest education level of the majority of parents was primary school level and the mean income was lower than 5,000 baht (£100) per month for both groups.

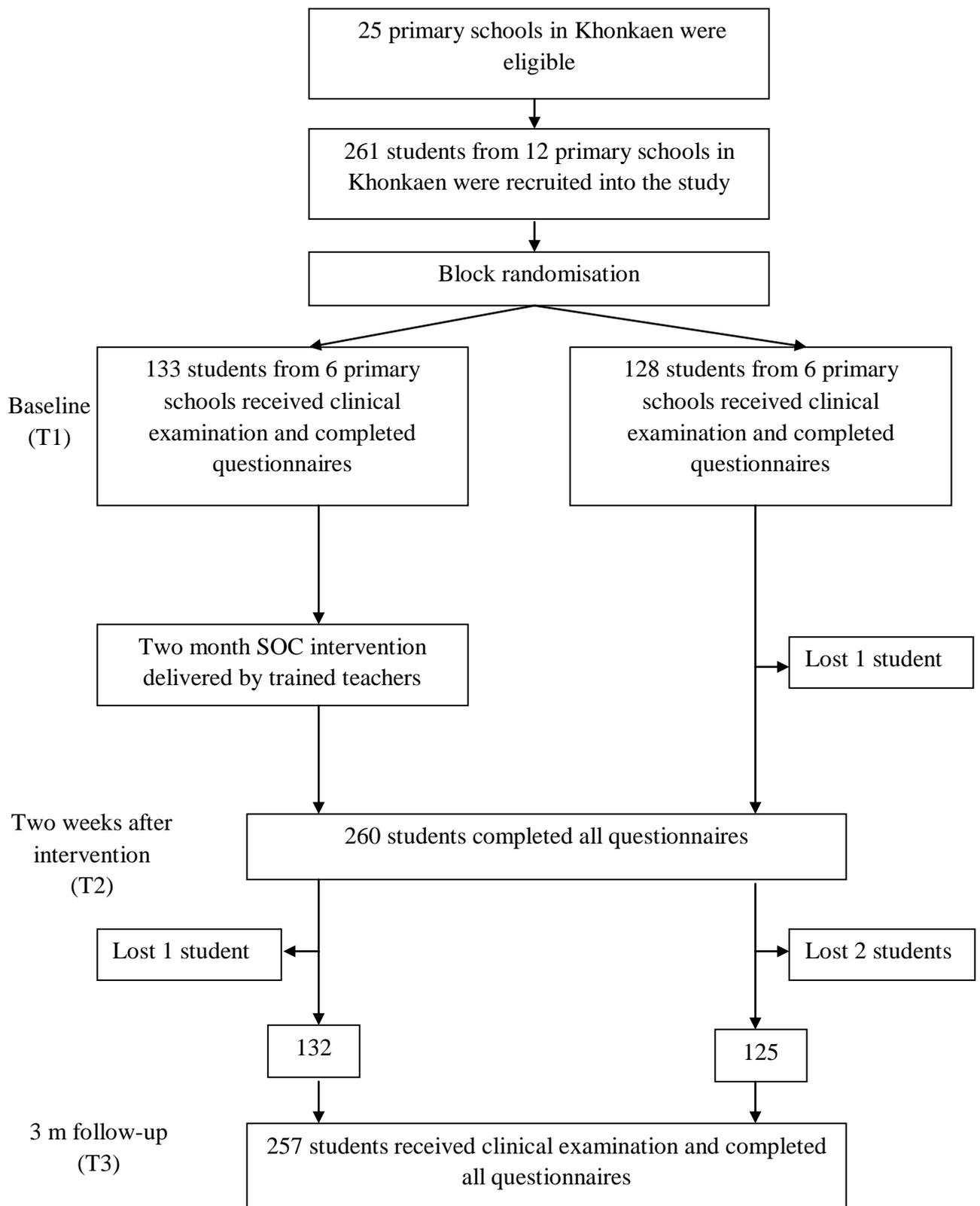


Figure 9 Study profile

Table 10 Demographic data for 257 participants

	Intervention group n = 132 (%)	Control group n = 125 (%)
Gender		
Male	45.5	51.2
Ethnicity		
Thai	90.9	97.6
Thai-Chinese	7.5	1.6
Thai-Malaysian	0.8	0
Other	0.8	0.8
Father's education level		
Primary school	64.4	69.6
Matthayom 1-3 or equally	15.9	14.4
Matthayom 4-6 or equally	14.4	12.8
Undergraduate	3.8	2.4
Postgraduate	1.5	0.8
Mother's education level		
Primary school	66.7	69.6
Matthayom 1-3 or equally	20.5	23.2
Matthayom 4-6 or equally	8.3	7.2
Undergraduate	3.0	0
Postgraduate	1.5	0
Career		
Officials	4.5	0.8
Government enterprise	0	4.8
Personal business	31.1	24.8
Employee	50	45.6
Unemployed	11.4	12.8
other	3.0	11.2
Income per month		
≤ 5,000 baht (£100)	59.1	50.4
5,001- 10,000 baht (£100- £200)	27.3	39.2
10,001- 15,000 baht (£200- £300)	7.5	5.6
15,001- 20,000 baht (£300- £400)	2.3	1.6
> 20,000 (£400)	3.8	3.2

4.2.2 Clinical data

Clinical data described decayed, missing and filled teeth, periodontal disease, malocclusion and dental trauma collected using the WHO Oral Health Survey Basic methods 4th edition and the Index of Orthodontic Treatment Need (IOTN). Mean DMFT was similar in both groups (Table 11, Figure 10). Likewise, eighty percent of the intervention group and seventy-six percent of the control group had gingivitis (Figure 11).

Table 11 Caries and treatment experience of the sample

	Mean (SD)	
	Intervention group (n=132)	Comparison group (n=125)
Decayed teeth	0.87 (1.09)	0.94 (1.19)
Missing teeth	0.08 (0.32)	0.07 (0.31)
Filled teeth	0.18 (0.40)	0.16 (0.50)
DMFT	1.13 (1.21)	1.18 (1.37)

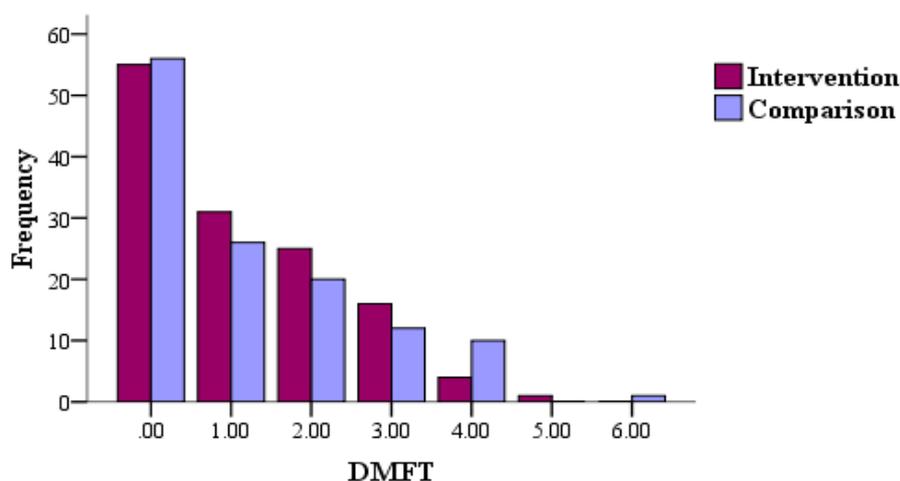


Figure 10 Caries and treatment experience between groups

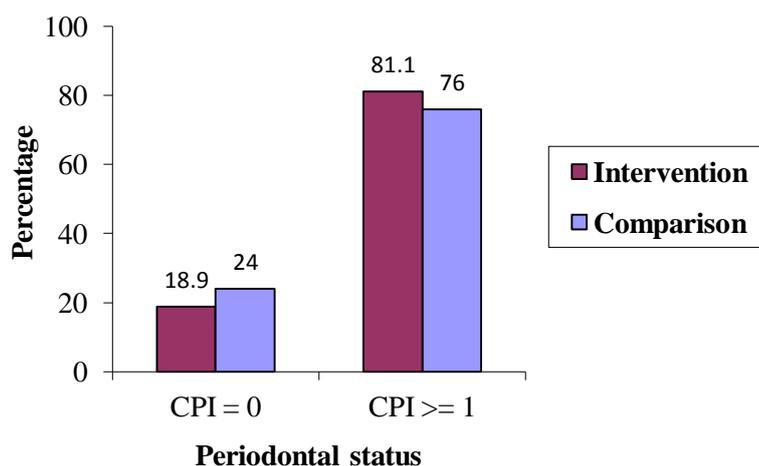


Figure 11 Periodontal status between groups

Levels of trauma and malocclusion were also similar in both groups. The criteria for dental traumatic injury were adapted from WHO (1997). Injuries were recorded as ‘Less than one third’, ‘Between one and two thirds’ and ‘More than two-thirds’ of the crown. One student had trauma on their anterior teeth of less than 1/3 of the crown. Most participants were in IOTN grades 1, 2, 3, 4, 5, 6 and 7 so did not need treatment or needed only minor orthodontic treatment (Table 12).

Table 12 Orthodontic status between groups

Index of Orthodontic Treatment Need	Intervention group (%)	Control group (%)
No/slightly need treatment (Grades 1,2,3,4,5,6 & 7)	96.97	98.40
Great need treatment (Grades 8,9 & 10)	3.03	1.60

4.2.3 Individual factors

4.2.3.1 Sense of coherence (SOC)

SOC scores were assessed via Antonovsky’s SOC-13 (1987) with 3 subscales; comprehensibility, manageability and meaningfulness. Students responded to each item on a seven-point scale (Possible scores ranged from 13 to 91) at all three time points.

At T1 mean scores of SOC and its scales were similar in the intervention and comparison groups. At T2 and T3 SOC scores and its subscales were higher in the intervention group (Table 13, Figure 12).

Table 13 Sense of coherence scores between groups at three time points

Time point	SOC measure	Intervention Mean (SD)	Comparison Mean (SD)
T1	Comprehensibility	20.67 (5.23)	20.98 (4.95)
	Manageability	17.60 (4.43)	18.56 (5.13)
	Meaningfulness	20.43 (3.99)	19.52 (3.94)
	Total SOC	58.71 (10.44)	59.07 (10.23)
T2	Comprehensibility	22.64 (5.07)	20.81 (5.32)
	Manageability	20.14 (4.57)	18.21 (4.24)
	Meaningfulness	21.71 (4.21)	19.17 (3.72)
	Total SOC	64.50 (11.58)	58.21 (10.11)
T3	Comprehensibility	22.76 (4.75)	20.86 (4.53)
	Manageability	18.84 (4.50)	17.96 (4.34)
	Meaningfulness	21.07(3.73)	19.90 (3.49)
	Total SOC	62.68 (10.04)	58.79 (9.49)

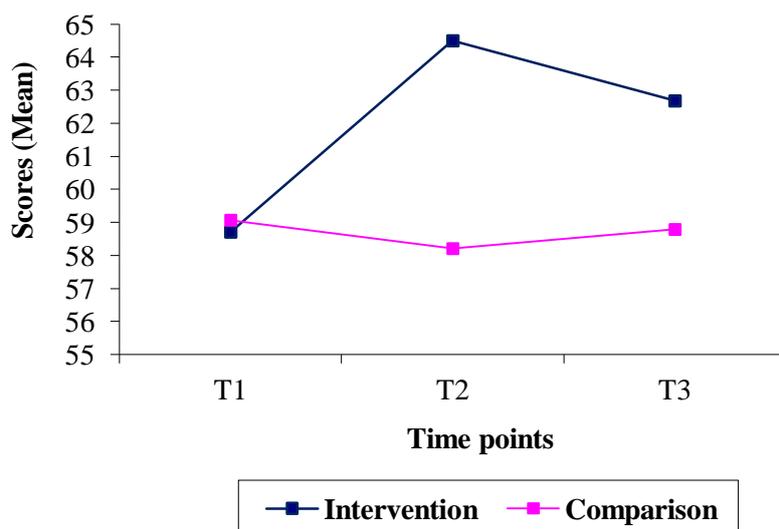


Figure 12 Sense of coherence scores between groups at three time points

4.2.3.2 Oral health beliefs (OHB)

OHB scores were measured with the oral health beliefs questionnaire of 6 items regarding diet, oral hygiene practices, fluoride use and dental attendance (Broadbent *et al.*, 2006) on four-point Likert scales from ‘Extremely important (4)’ to ‘Not at all important’ (1) (Possible scores ranged from 6 to 24).

Table 14 shows the mean scores of OHB at all three time points. At T1 the mean scores of OHB were similar in the intervention and control groups. The changes of OHB scores at three time points can be seen in **Figure 13**.

Table 14 Oral health beliefs scores between groups at three time points

Time points	Intervention group Mean (SD)	Comparison group Mean (SD)
T1	20.01 (2.73)	20.36 (2.83)
T2	21.62 (2.51)	20.49 (2.60)
T3	21.63 (2.31)	19.79 (3.55)

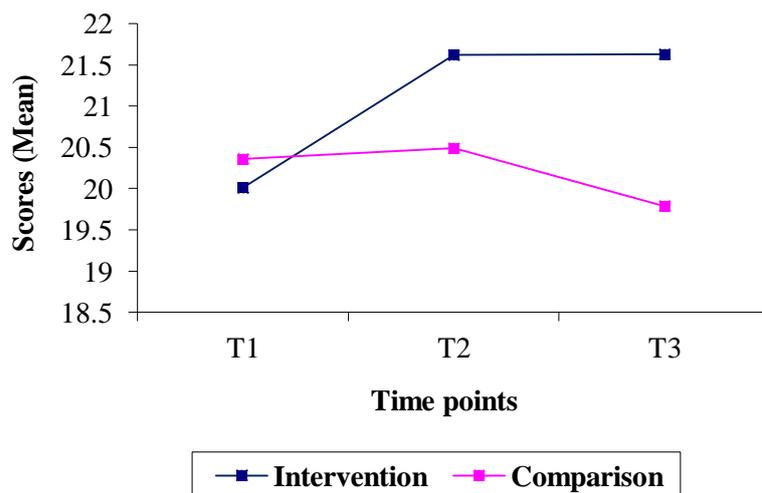


Figure 13 Oral health beliefs scores between groups at three time points

4.2.4 Symptoms and functional status (OHRQoL)

Symptoms and functional status (OHRQoL) were measured by using CPQ₁₁₋₁₄ (Jokovic *et al.*, 2002). The scale comprises four domains: oral symptoms, functional limitations, emotional well-being, and social well-being. Students responded to 37 items on a five-point Likert scale ranging from 0 (Never) to 4 (Everyday or almost every day) (Possible scores of symptoms ranged from 0 to 24 whereas functional status ranged from 0 to 124). The scores were collected at all three time points at T1, T2 and T3.

Table 15 and Figure 14 present the mean scores of total CPQ₁₁₋₁₄ and its subscales between the groups at all three time points. At T1 CPQ₁₁₋₁₄ scores of the intervention and control groups were similar.

Table 15 CPQ₁₁₋₁₄ scores between groups at three time points

Time point	CPQ ₁₁₋₁₄ measure	Intervention group Mean (SD)	Comparison group Mean (SD)
T1	Symptoms		
	Oral symptoms	8.32 (3.97)	8.26 (3.06)
	Functional status	24.45 (16.12)	22.70 (13.93)
	Functional limitation	6.30 (4.93)	6.65 (4.41)
	Emotional well-being	9.54 (6.35)	8.88 (5.89)
	Social well-being	8.26 (7.00)	7.17 (5.86)
	Total CPQ₁₁₋₁₄ (OHRQoL)	32.77 (18.74)	30.97 (15.78)
T2	Symptoms		
	Oral symptoms	6.22 (3.81)	7.25 (3.33)
	Functional status	15.76 (12.85)	19.78 (15.76)
	Functional limitation	4.20 (4.11)	5.46 (4.70)
	Emotional well-being	5.86 (4.93)	7.61 (6.35)
	Social well-being	5.69 (5.52)	6.70 (6.59)
	Total CPQ₁₁₋₁₄ (OHRQoL)	21.98 (15.45)	27.03 (17.95)
T3	Symptoms		
	Oral symptoms	5.73 (3.40)	6.92 (3.37)
	Functional status	12.80 (11.64)	17.40 (14.30)
	Functional limitation	3.46 (3.76)	5.00 (4.54)
	Emotional well-being	5.13 (5.05)	6.71 (5.92)
	Social well-being	4.20 (4.64)	5.68 (5.80)
	Total CPQ₁₁₋₁₄ (OHRQoL)	18.53 (13.95)	24.32 (16.72)

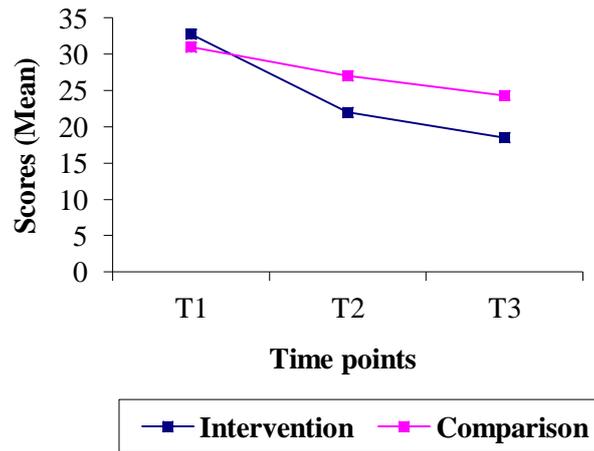


Figure 14 Oral health related quality of life scores between groups at three time points

4.2.5 General health perceptions (GHP)

General health perceptions were similar between the groups at baseline. Fifty-one percent of the intervention group and fifty-three percent of the control group rated their global oral health as ‘fair’ (Figure 15).

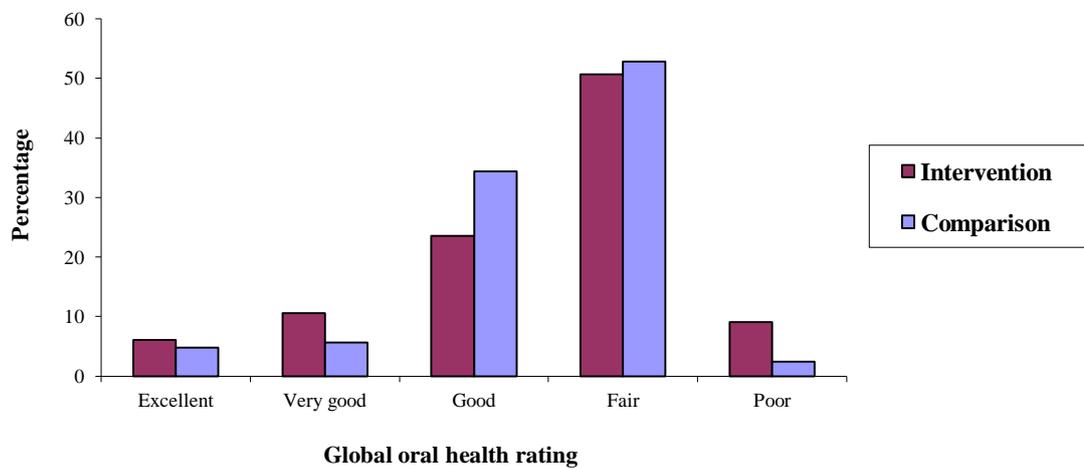


Figure 15 Global oral health rating

4.2.6 Overall quality of life (Overall QoL)

Overall quality of life was also similar across groups. Forty-one percent of the intervention group and forty-two percent of the control group said that the condition of teeth lips, jaw or mouth affected their life ‘very little’ (Figure 16).

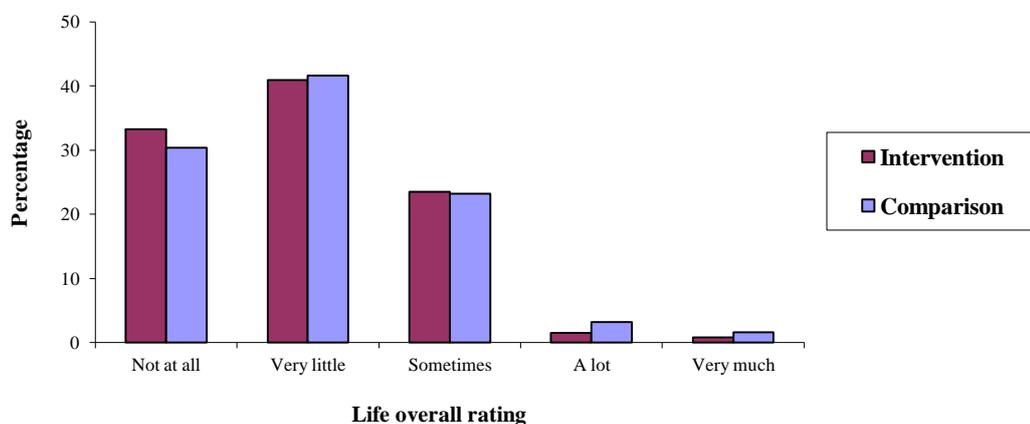


Figure 16 Life overall rating

4.2.7 Reliability of all questionnaires

Cronbach’s reliability coefficients of all scales were assessed at the three time points. In this study the Cronbach’s alpha coefficients of SOC, CPQ₁₁₋₁₄ and OHB scales were from 0.63 to 0.75, 0.90 to 0.92 and 0.55 to 0.72 respectively and were deemed acceptable (Table 16).

Table 16 Internal reliability of all questionnaires used in this study

Variable	Measure	Cronbach's reliability coefficient	Cronbach's reliability coefficient	Cronbach's reliability coefficient
		T1	T2	T3
SOC	SOC-13	0.63	0.75	0.69
OHRQoL	CPQ ₁₁₋₁₄	0.90	0.93	0.92
OHB	OHB-6	0.55	0.62	0.72

Cronbach’s reliability coefficients of the subscales of SOC and CPQ₁₁₋₁₄ are presented in Tables 17-18 and were considered acceptable.

Table 17 Internal reliability of sense of coherence subscales

Subscales	T1	T2	T3
Comprehensibility	0.40	0.59	0.50
Manageability	0.39	0.48	0.47
Meaningfulness	0.39	0.46	0.32

Table 18 Internal reliability of CPQ₁₁₋₁₄ subscales

Subscales	T1	T2	T3
Symptom	0.58	0.67	0.62
Functional limitation	0.68	0.78	0.79
Emotional well-being	0.83	0.86	0.86
Social well being	0.79	0.83	0.82

Table 19 presents test-retest reliability represented by intra-class correlation coefficients for all questionnaires at all three time points.

Table 19 Test-retest reliability of all questionnaires

Variable	Measures	Intra-class	Intra-class	Intra-class
		correlation	correlation	correlation
		coefficients	coefficients	coefficients
		T1 toT2	T1 to T3	T2 to T3
SOC	SOC-13	0.35**	0.30**	0.38**
OHRQoL	CPQ ₁₁₋₁₄	0.65**	0.53**	0.67**
OHB	OHB-6	0.30*	0.34**	0.14

** Correlation coefficient is significant at the 0.01 level (2-tailed)

* Correlation coefficient is significant at the 0.05 level (2-tailed)

4.3 Assessing the effectiveness of the intervention (Phase 2)

- Hypotheses tested
- 1) The school-based intervention enhances SOC
 - 2) The intervention improves OHRQoL

To evaluate the effectiveness of the intervention to enhance SOC and OHRQoL and take clustering into account, the mixed effects models with restricted maximum likelihood (REML) were employed to analyse data, comparing scores of SOC and CPQ₁₁₋₁₄ between the two groups. Group allocation was considered as the fixed effect and schools were entered as random effects. Baseline data were used as covariates.

4.3.1 Sense of coherence between the two groups after the intervention at T2 and T3

Table 20 contains the results of the fixed effects test and indicates that group allocation predicted SOC both at T2 and T3. The parameter estimates for T2 and T3 (Tables 21-22) indicate that children in the intervention group had significantly higher SOC than those in the comparison group, accounting for 6.39 and 4.05 SOC points respectively.

Table 20 Type III tests of fixed effects for sense of coherence between groups at T2 and T3

Time points	Source	Denominator df	F	p-value
T2	Baseline	254	43.96	< 0.01
	Group	9	12.48	< 0.01
T3	Baseline	254	28.27	< 0.01
	Group	9	12.20	< 0.01

Table 21 Estimates of fixed effects for sense of coherence at T2

Parameter	Estimate	SE	df	t	p-value	95 % CI	
						Lower bound	Upper bound
Group	6.39	1.81	9	3.55	< 0.01	2.30	10.48
Baseline	0.4	0.06	254	6.63	< 0.01	0.28	0.53

Table 22 Estimates of fixed effects for sense of coherence at T3

Parameter	Estimate	SE	df	t	p-value	95 % CI	
						Lower bound	Upper bound
Group	4.05	1.16	9	3.49	< 0.01	1.76	6.34
Baseline	0.30	0.05	254	5.32	< 0.01	0.19	0.41

The residual (within groups) variances and the variance due to the sampling procedure (schools variances) at T2 and T3 are presented in Table 23 where the residual is larger than the random variance estimates, the random effects may be eliminated from the model. The Wald test confirmed there was no evidence that the schools were different and affected the responses to the intervention ($p = 0.27$). The variance of school effects accounted for 0.043 [(4.99/ (4.99+97.59)] or 4% of the total variances at T2. At T3, the parameter was set to zero because it was redundant. Therefore the intra-cluster correlation coefficient for SOC was 0.043.

Table 23 Estimates of covariance parameters for sense of coherence at T2 and T3

Time points	Parameter	Estimate	SE	Wald Z	p-value	95 % CI	
						Lower bound	Upper bound
T2	Residual	97.59	8.84	11.04	< 0.01	81.71	116.55
	Schools	4.99	4.52	1.10	0.27	0.85	29.46
T3	Residual	86.41	7.67	11.27	< 0.01	72.61	102.82
	Schools	0 ^a	0

a. This parameter is set to zero because it is redundant

4.3.2 CPQ₁₁₋₁₄ scores between the two groups after the intervention (Primary outcome)

Table 24 contains the results of the fixed effects test and indicates that group allocation predicted OHRQoL both at T2 and T3. The parameter estimates for T2 and T3 (Tables 25-26) indicate that children in the intervention group had significantly lower CPQ₁₁₋₁₄ scores representing better OHRQoL than those in the comparison group, accounting for 6.07 and 6.50 CPQ₁₁₋₁₄ points respectively.

Table 24 Type III tests of fixed effects for CPQ₁₁₋₁₄ between groups at T2 and T3

Time points	Source	Denominator df	F	p-value
T2	Baseline	164	146.74	< 0.01
	Group	9	10.56	< 0.05
T3	Baseline	182	72.22	< 0.01
	Group	9	10.98	< 0.01

Table 25 Estimates of fixed effects for CPQ₁₁₋₁₄ at T2

Parameter	Estimate	SE	df	t	p-value	95 % CI	
						Lower bound	Upper bound
Group	-6.07	1.87	9	-3.25	< 0.05	-10.40	-1.73
Baseline	0.58	0.05	164	12.11	< 0.01	0.49	0.68

Table 26 Estimates of fixed effects for CPQ₁₁₋₁₄ at T3

Parameter	Estimate	SE	df	t	p-value	95 % CI	
						Lower bound	Upper bound
Group	-6.50	1.96	9	-3.31	< 0.01	-10.91	-2.11
Baseline	0.42	0.05	182	8.50	< 0.01	0.32	0.52

The residual (within groups) variances and the variance due to the sampling procedure (schools variances) at T2 and T3 are presented in Table 27 where the residual is larger than the random variance estimates, the random effects may be eliminated from the model. The Wald test confirmed there was no evidence that the schools were different and affected the responses to the intervention ($p = 0.66$).

The variance of school effects accounted for 0.013 [2.25/ (171.23+2.25)] or 1% of the total variances at T2. As OHRQoL was the primary outcome in this study, an intra-cluster correlation coefficient (ICC) was 0.013. At T3, the parameter was set to zero because it was redundant.

Table 27 Estimates of covariance parameters for CPQ₁₁₋₁₄ at T2 and T3

Time points	Parameter	Estimate	SE	Wald Z	p-value	95 % CI	
						Lower bound	Upper bound
T2	Residual	171.23	15.53	11.03	< 0.01	143.34	204.54
	Schools	2.25	5.08	0.44	0.66	0.03	187.54
T3	Residual	178.96	16.16	11.07	< 0.01	149.93	213.62
	Schools	0 ^a	0

a. This parameter is set to zero because it is redundant

4.3.3 Oral health beliefs between two groups after the intervention

Table 28 contains the results of the fixed effects test and indicates that group allocation predicted OHB both at T2 and T3. The parameter estimates for T2 and T3 (Tables 29-30) indicate that children in the intervention group had significantly higher OHB than those in the comparison group, accounting for 1.10 and 1.84 OHB points respectively.

Table 28 Type III tests of fixed effects for oral health beliefs between groups at T2 and T3

Time points	Source	Denominator df	F	p-value
T2	Baseline	254	13.66	< 0.01
	Group	9	6.57	< 0.05
T3	Baseline	254	30.97	< 0.01
	Group	9	16.73	< 0.01

Table 29 Estimates of fixed effects for oral health beliefs at T2

Parameter	Estimate	SE	df	t	p-value	95 % CI	
						Lower bound	Upper bound
Group	1.10	0.43	9	2.56	< 0.05	0.13	2.05
Baseline	0.21	0.06	254	3.70	< 0.01	0.10	0.32

Table 30 Estimates of fixed effects for oral health beliefs at T3

Parameter	Estimate	SE	df	t	p-value	95 % CI	
						Lower bound	Upper bound
Group	1.84	0.45	9	4.09	< 0.01	0.85	2.83
Baseline	0.35	0.64	254	5.65	< 0.01	0.23	0.48

The residual (within groups) variances and the variance due to the sampling procedure (schools variances) at T2 and T3 are presented in Table 31 where the residual is larger than the random variance estimates, the random effects may be eliminated from the model. The Wald test confirmed there was no evidence that the schools were different and affected the responses to the intervention ($p = 0.32$).

The variance of school effects accounted for 0.040 [0.25/(6.06+0.25)] or 4% of the total variances at T2 and for 0.028 [0.23/(7.80+0.23)] or 2.8% of the total variances at T3. The intra-cluster correlation coefficients for OHB were 0.040 and 0.028 at T2 and T3 respectively.

Table 31 Estimates of covariance parameters for oral health beliefs at T2 and T3

Time points	Parameter	Estimate	SE	Wald Z	p-value	95 % CI	
						Lower bound	Upper bound
T2	Residual	6.06	0.55	11.04	< 0.01	5.07	7.23
	Schools	0.25	0.25	0.99	0.32	0.34	1.82
T3	Residual	7.80	0.70	11.08	< 0.01	6.54	9.31
	Schools	0.23	0.25	0.91	0.36	0.03	1.95

4.3.4 Clinical status between two groups after the intervention

DMFT and gingival health were compared between the two groups.

DMFT

Tables 32 shows that group allocation was not related to DMFT at T3 as the scores were similar in the intervention and comparison groups ($p = 0.11$) (Table 33).

Table 32 Type III tests of fixed effects for DMFT between groups at T3

Time points	Source	Denominator df	F	p-value
T3	Baseline	254	1047.50	< 0.01
	Group	9	3.12	0.11

Table 33 Estimates of fixed effects for DMFT at T3

Parameter	Estimate	SE	df	t	p-value	95 % CI	
						Lower bound	Upper bound
Group	-0.15	0.08	9	-1.77	0.11	-0.35	0.04
Baseline	1.00	0.03	254	32.36	< 0.01	0.94	1.06

The residual (within groups) variances and the variance due to the sampling procedure (schools variances) at T2 and T3 are presented in Table 34 where the residual is larger than the random variance estimates, the random effects may be eliminated from the model. The Wald test confirmed there was no evidence that the schools were different and affected the responses to the intervention ($p = 0.74$). The variance of school effects accounted for 0% of the total variances at T3.

Table 34 Estimates of covariance parameters for DMFT at T3

Time points	Parameter	Estimate	SE	Wald Z	p-value	95 % CI	
						Lower bound	Upper bound
T3	Residual	0.40	0.04	11.03	< 0.01	0.34	0.48
	Schools	0	0.01	0.34	0.74	0	1.10

Gingival health

At T3, more children in the intervention group had normal gingival health (31.81%) than the comparison group (19.51%) [Chi-square test, $\chi^2(1) = 4.41$, $p = 0.04$].

4.3.5 Differences between schools as random effects

To consider random effects that may affect of the effect of the intervention, the variance of the random effects (Schools) derived from the sampling procedure was estimated using the Wald Z test. From Tables 23, 27, 31 and 34, the random effects due to schools were not significant indicating there was no significant effect of

schools on the intervention. Therefore, school effects were not needed to be taken into account in the mixed effect models. Mean SOC and CPQ₁₁₋₁₄ scores in each school were presented (Tables 35-36, Figures 17-18).

Table 35 Sense of coherence scores between schools at three time points

Group	Schools	Mean SOC scores(SD)		
		at T1	at T2	at T3
Intervention	Bannongkham	58.68 (11.30)	61.77 (8.76)	61.41 (9.01)
	Banped	58.48 (7.06)	60.64 (10.85)	62.56 (10.32)
	Banlengpuei	60.26 (9.26)	68.89 (9.43)	63.47 (6.73)
	Banprakue	54.17 (8.26)	64.00 (10.16)	59.04 (7.91)
	Bangotha	66.00 (13.43)	66.70 (15.71)	68.25 (13.95)
	Bansongpuei	55.91 (9.94)	66.26 (12.58)	62.17 (9.74)
	Total		58.71 (10.44)	64.50 (11.58)
Comparison	Banpue	60.35 (8.65)	61.75 (9.99)	60.35 (9.57)
	Bannonghin	59.52 (11.65)	54.06 (9.32)	54.41 (8.55)
	Bandonbom	55.25 (10.26)	55.17 (10.05)	58.00 (9.32)
	Bangudgwang	60.97 (9.59)	58.45 (9.64)	58.90 (9.05)
	Bansuanmorn	59.86 (11.87)	63.60 (11.66)	62.40 (9.69)
	Bannonetun	55.78 (9.75)	56.22 (6.01)	58.44 (12.11)
	Total		59.07 (10.23)	58.21 (10.11)

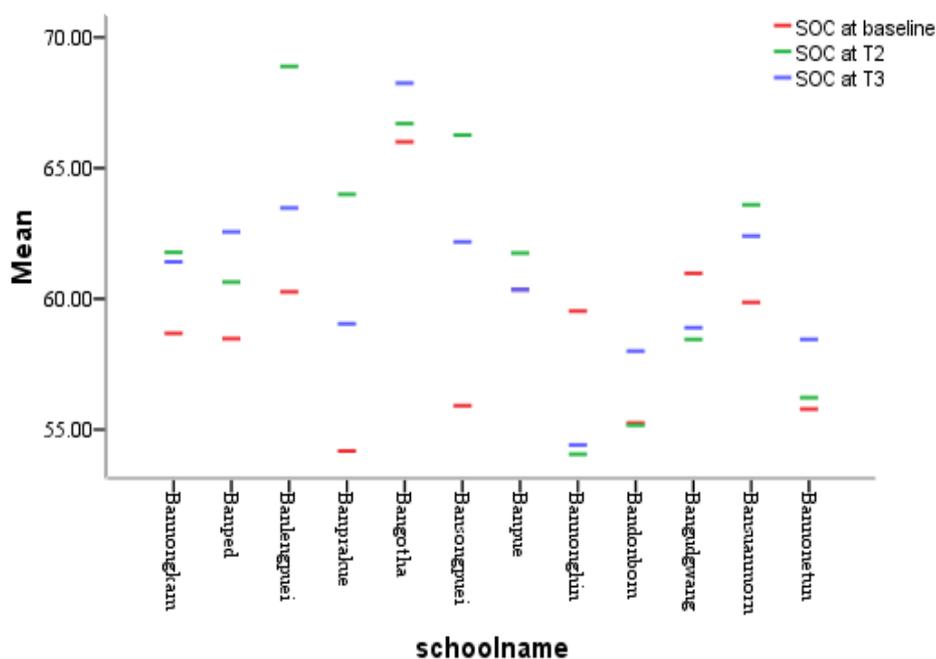


Figure 17 Mean sense of coherence scores between schools at three time points

Table 36 CPQ₁₁₋₁₄ scores between schools at three time points

Group	Schools	Mean CPQ ₁₁₋₁₄ scores(SD)		
		at T1	at T2	at T3
Intervention	Bannongkham	24.59 (12.38)	13.63 (10.52)	10.50 (9.06)
	Banped	30.04 (13.22)	22.44 (13.65)	22.76 (13.67)
	Banlengpuei	26.78 (15.33)	16.89 (9.24)	12.11 (8.73)
	Banprakue	47.82 (19.47)	30.69 (16.53)	26.57 (15.42)
	Bangotha	20.45 (18.58)	12.10 (9.37)	14.20 (10.87)
	Bansongpuei	44.17 (16.40)	33.56 (17.10)	22.65 (15.87)
	Total		32.77 (18.74)	21.98 (15.45)
Comparison	Banpue	22.20 (16.43)	19.15 (16.77)	15.50 (15.23)
	Bannonghin	31.58 (12.56)	27.29 (13.68)	24.18 (14.17)
	Bandonbom	35.75 (15.50)	34.83 (17.75)	26.83 (13.76)
	Bangudgwang	31.45 (14.88)	26.93 (18.51)	26.27 (18.71)
	Bansuanmorn	32.93 (20.64)	28.13 (18.91)	26.13 (19.33)
	Bannonetun	31.11 (10.94)	21.89 (19.53)	25.78 (15.43)
	Total		30.98 (15.74)	27.03 (17.95)

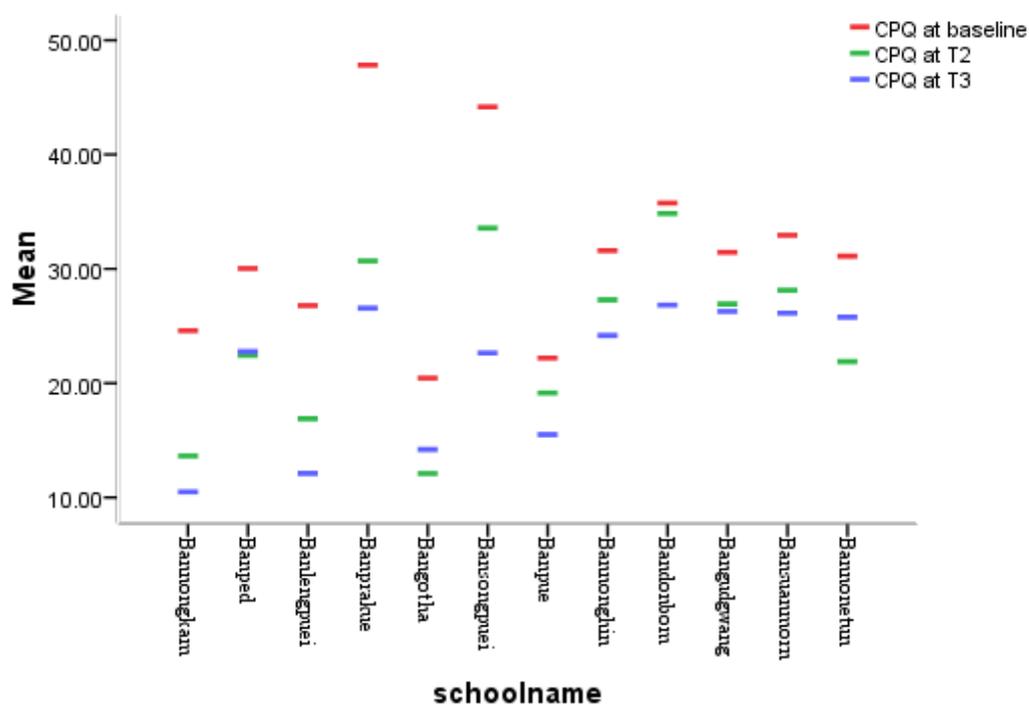


Figure 18 Mean CPQ₁₁₋₁₄ scores between schools at three time points

4.3.6 The improvement of sense of coherence and oral health related quality of life among students in the intervention group

It may be interesting to note which schools in the intervention group had the most improvement of SOC and OHRQoL. Mean differences of SOC and CPQ₁₁₋₁₄ scores by schools are presented in Figure 19 and Figure 20.

Figure 19 depicts mean differences of SOC scores in each school in the intervention group. The greater mean differences represent higher improvement of SOC. Bansongpruei had the most improvement of SOC whereas Bangotha had the last at both T2 and T3.

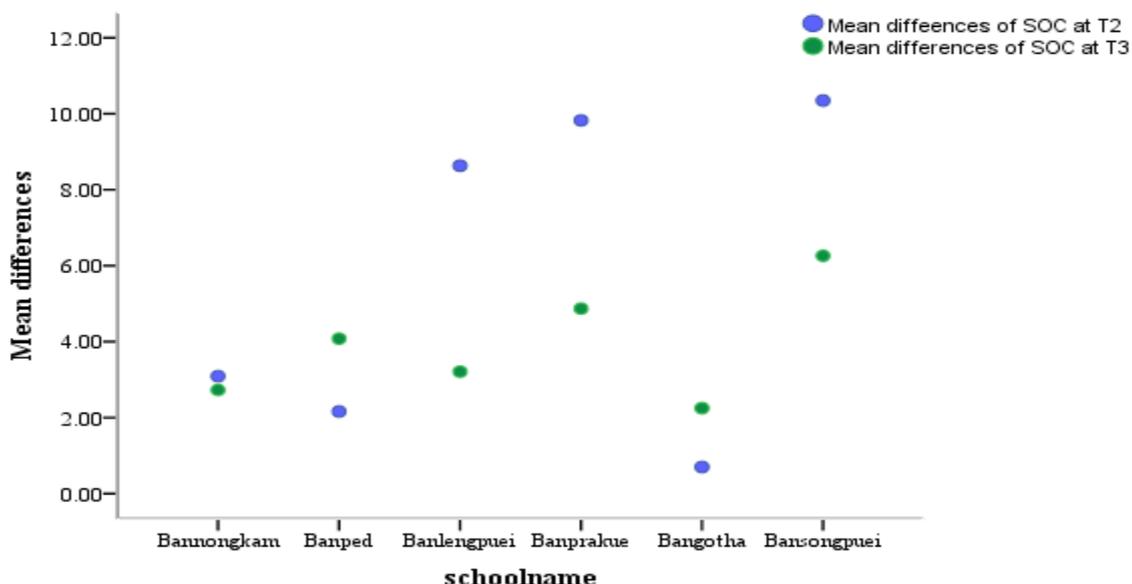


Figure 19 Mean differences of sense of coherence scores between schools in the intervention group at T2 and T3

Banprakue had the most decrease in CPQ scores representing the highest improvement of OHRQoL at T2 whilst Bansongpuei had the highest improvement of OHRQoL at T3 (Figure 20).

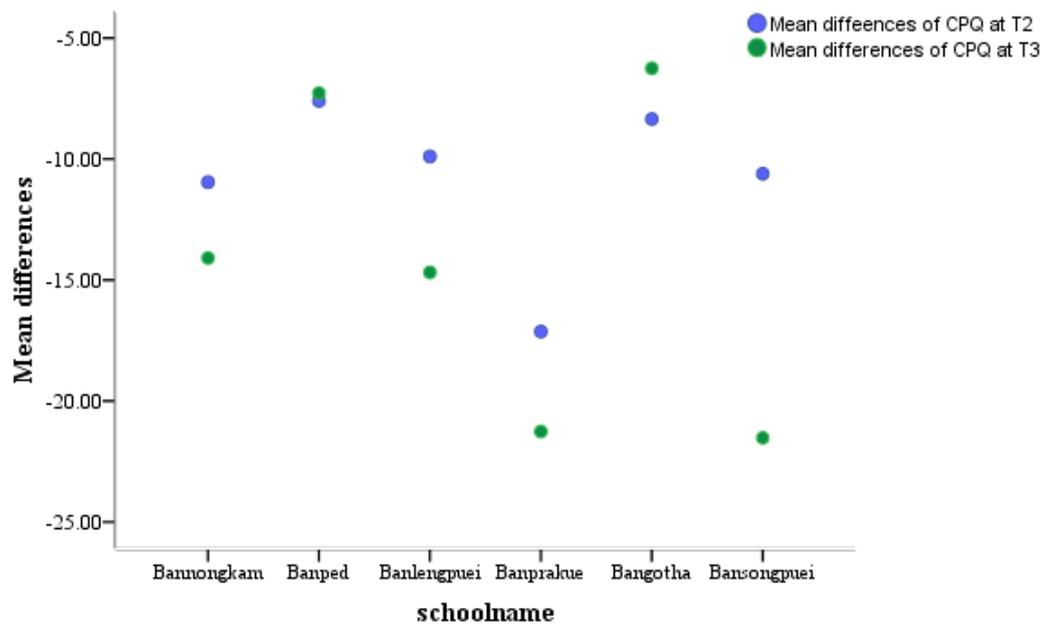


Figure 20 Mean differences of CPQ₁₁₋₁₄ scores between schools in the intervention group at T2 and T3

The improvements of SOC and OHRQoL varied between schools. It may be that teachers who delivered the interventions had different styles of teaching.

4.4. Associations among variables within the Wilson and Cleary model (Phase 3)

- Hypotheses tested
- 1) Greater SOC predicts better OHRQoL
 - 2) Higher SES (parental income, education and occupation) predicts better OHRQoL
 - 3) Clinical status is not related to OHRQoL

The relationships among variables within the Wilson and Cleary model were first explored using bivariate correlations including Pearson and Spearman's rank correlations. Thereafter, structural equation modelling (SEM) was used to test the complex relationships using the Wilson and Cleary model to guide the analyses.

4.4.1 Bivariate analyses

The lagged association between variables within the Wilson and Cleary model at baseline (T1) and 3 month follow-up (T3) was assessed using appropriate bivariate analyses; Pearson correlations or Spearman's rank correlations.

4.4.1.1 Relationships between clinical status, individual factors, environmental factors and symptoms at baseline and symptoms at T3

Tables 37-38 present the lagged analyses between clinical status, individual factors, environmental factors and symptoms at baseline and symptoms at T3. There were significant associations between individual factors and symptoms. Children who reported higher symptoms at T3 were those who had more symptoms and lower SOC at baseline. However, there were no significant relationships with clinical status.

Table 37 Relationships between independent variables and symptoms at baseline and symptoms at T3

Independent variables (Baseline)	r
<u>Individual factors</u>	
Gender	-0.04
SOC	-0.14*
OHB	-0.05
Group allocation	0.17**
<u>Environmental factors</u>	
Maternal education	0.01
Paternal education	0.01
Parent income	0.04
Parent occupation	0.09
Symptoms at baseline	0.40**

**Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)
Spearman's rank correlation between environmental factors and symptoms
Pearson correlation between individual factors and symptoms

Table 38 Relationships between clinical variables at baseline and symptoms at T3

Clinical status	Mean (SD) symptoms scores	r
Caries status		0.08
DT = 0	6.04 (3.47)	
DT > 0	6.59 (3.39)	
Filled teeth		-0.05
FT = 0	6.39 (3.59)	
FT > 0	5.87 (2.33)	
Periodontal diseases		0.09
CPI = 0	5.69 (3.54)	
CPI > 0	6.48 (3.39)	
Malocclusion		-0.02
IOTN = 0	6.32 (3.42)	
IOTN > 0	5.83 (4.22)	
Trauma		-0.08
No	6.33 (3.43)	
Yes	2.00 (0)	

**Pearson correlation is significant at the 0.01 level (2-tailed),

* Pearson correlation is significant at the 0.05 level (2-tailed)

4.4.1.2 Relationships between clinical status, individual factors, environmental factors, symptoms and functional status at baseline and T3

Tables 39-40 present the lagged analyses between clinical status, individual factors, environmental factors, symptoms and functional status at baseline and functional status at T3. There were significant correlations between functional status, symptoms and individual factors. Children who had higher functional impacts at T3 were those who experienced more symptoms and functional impacts and lower SOC at baseline. There were no significant relationships with clinical status (Table 40).

Table 39 Relationships between independent variables, symptoms and functional status at baseline and functional status at T3

Independent variables (Baseline)	r
<u>Individual factors</u>	
Gender	0.09
SOC	-0.14*
OHB	-0.11
Group allocation	0.18*
<u>Environmental factors</u>	
Maternal education	0.04
Paternal education	-0.05
Parent income	0.02
Parent occupation	-0.02
Symptoms	0.34**
Functional status	0.45**

**Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)
 Spearman's rank correlation between environmental factors and functional status
 Pearson correlation between individual factors, symptoms and functional status

Table 40 Relationships between clinical variables at baseline and functional status at T3

Clinical status	Mean (SD)	r
Functional status scores		
Caries status		0.09
DT = 0	13.83 (12.08)	
DT > 0	16.27 (14.15)	
Filled teeth		0.03
FT = 0	14.88 (13.41)	
FT > 0	15.92 (11.87)	
Periodontal diseases		0.06
CPI = 0	13.44 (12.13)	
CPI > 0	15.47 (13.44)	
Malocclusion		-0.10
IOTN = 0	15.24 (13.25)	
IOTN > 0	6.50 (5.36)	
Trauma		-0.07
No	15.09 (13.17)	
Yes	0.00 (0)	

**Pearson correlation is significant at the 0.01 level (2-tailed),
 * Pearson correlation is significant at the 0.05 level (2-tailed)

4.4.1.3 Relationships between clinical status, individual factors, environmental factors, symptoms, functional status and general health perceptions at baseline and general health perceptions at T3

Tables 41-42 show the lagged analyses between clinical status, individual factors, environmental factors, symptoms, functional status and GHP at baseline and GHP at T3. There were significant correlations between GHP, functional status, symptoms and individual factors. Children who had worse GHP at T3 were those who had more symptoms and functional impacts, worse GHP and lower SOC at baseline. Moreover, children who had worse GHP at T3 were also experienced more caries and had worse gingival health at baseline (Table 42).

Table 41 Relationships between independent variables, symptoms and functional status and general health perceptions at baseline and general health perceptions at T3

Independent variables (Baseline)	r
<u>Individual factors</u>	
Gender	-0.07
SOC	-0.13*
OHB	0.00
Group allocation	-0.06
<u>Environmental factors</u>	
Maternal education	-0.05
Paternal education	-0.02
Parent income	0.03
Parent occupation	0.00
Symptoms	0.24**
Functional status	0.16*
GHP	0.26**

**Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)
Spearman's rank correlation between environmental factors and GHP
Pearson correlation between individual factors, symptoms, functional status and GHP

Table 42 Relationships between clinical variables at baseline and general health perceptions at T3

Clinical status	Mean (SD) GHP scores	r
Caries status		0.15*
DT = 0	1.97 (1.03)	
DT > 0	2.26 (0.86)	
Filled teeth		-0.07
FT = 0	2.14 (0.93)	
FT > 0	1.95 (1.11)	
Periodontal diseases		0.18**
CPI = 0	1.78 (0.98)	
CPI > 0	2.20 (0.94)	
Malocclusion		-0.10
IOTN = 0	2.13 (0.96)	
IOTN > 0	1.50 (1.05)	
Trauma		0.06
No	2.11 (0.96)	
Yes	3.00 (0)	

**Pearson correlation is significant at the 0.01 level (2-tailed),

* Pearson correlation is significant at the 0.05 level (2-tailed)

4.4.1.4 Relationships between clinical status, individual factors, environmental factors, symptoms, functional status, general health perceptions and overall quality of life at baseline and T3

Tables 43-44 present the lagged analyses between clinical status, individual factors, environmental factors, symptoms, functional status, GHP and overall QoL at baseline and overall QoL at T3. There were significant relationships between overall QoL, GHP, functional status, symptoms, individual factors and environmental factors. Children who had better QoL at T3 were those who reported better GHP and functional status, fewer symptoms and higher SOC at baseline. However, there were no significant relationships with clinical status (Table 44).

Table 43 Relationships between independent variables, symptoms, functional status, general health perceptions and quality of life at baseline and quality of life at T3

Independent variables (Baseline)	r
<u>Individual factors</u>	
Gender	-0.10
SOC	-0.22 ^{**}
OHB	-0.09
Group allocation	0.05
<u>Environmental factors</u>	
Maternal education	0.01
Paternal education	-0.00
Parent income	0.01
Parent occupation	0.02
Symptoms	0.24 ^{**}
Functional status	0.29 ^{**}
GHP	0.14 [*]
Overall QoL	0.10

***Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)*

Spearman's rank correlation between environmental factors and overall QoL

Pearson correlation between individual factors, symptoms, functional status, GHP and overall QoL

Table 44 Relationships between clinical variables at baseline and quality of life at T3

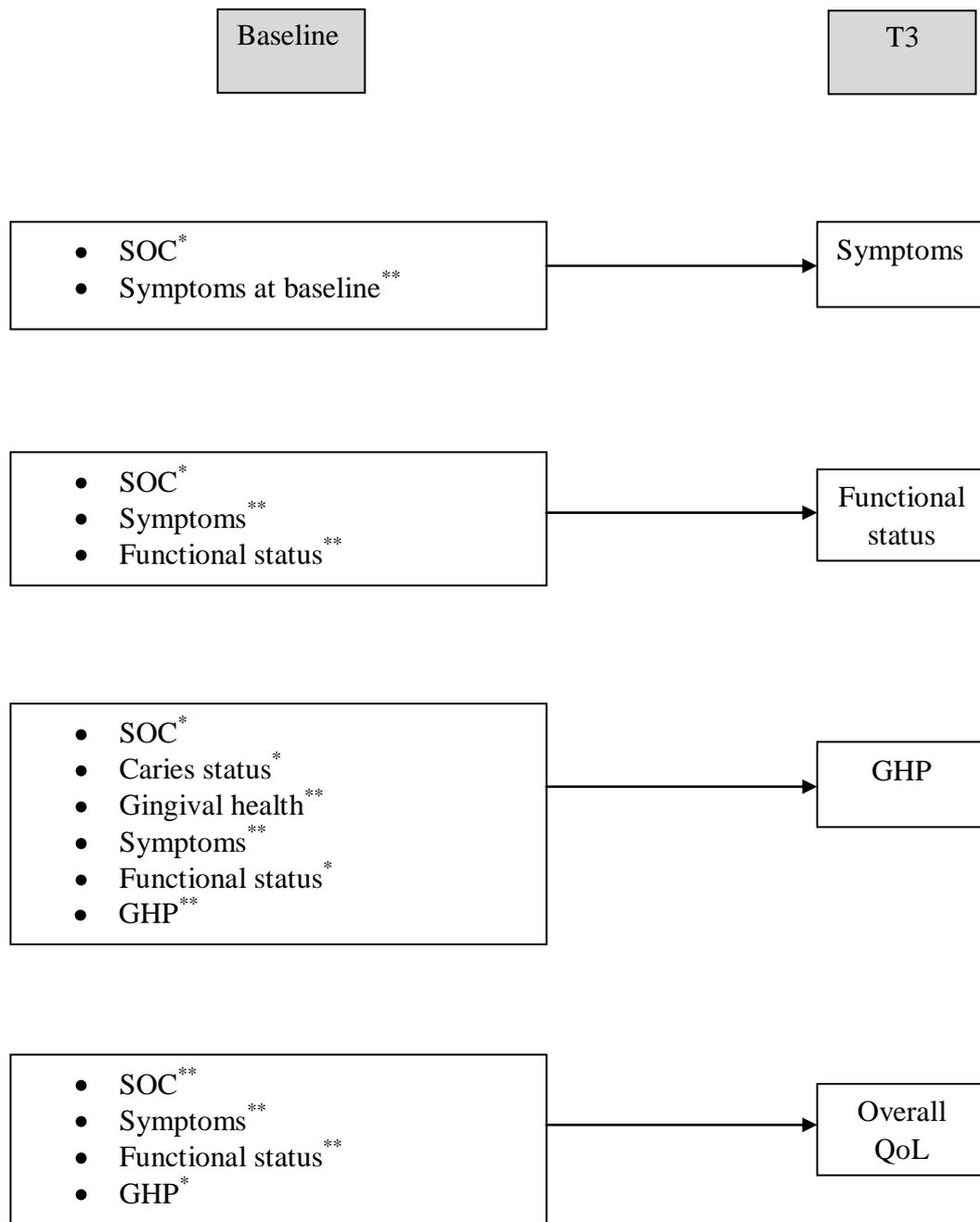
Clinical status	Mean (SD)	r
Overall QoL scores		
Caries status		0.01
DT = 0	0.90 (0.91)	
DT > 0	0.92 (0.91)	
Filled teeth		-0.07
FT = 0	0.94 (0.92)	
FT > 0	0.76 (0.85)	
Periodontal diseases		0.07
CPI = 0	0.78 (0.85)	
CPI > 0	0.95 (0.93)	
Malocclusion		-0.07
IOTN = 0	0.92 (0.92)	
IOTN > 0	0.50 (0.55)	
Trauma		-0.06
No	0.91 (0.91)	
Yes	0.00 (0)	

**Pearson correlation is significant at the 0.01 level (2-tailed),

* Pearson correlation is significant at the 0.05 level (2-tailed)

4.4.1.5 Summary of key relationships between clinical status, symptoms, functional status, general health perceptions and overall quality of life at baseline and at T3

Figure 21 summarises the significant relationships found in the bivariate analyses. Symptoms at T3 were related to SOC and symptom status at baseline. Functional status at T3 was associated with SOC, symptoms and functional status at baseline. GHP at T3 was associated with SOC, caries status, gingival health, symptom status, functional status and GHP at baseline. Overall QoL at follow up was related to SOC, symptoms, functional status and GHP at baseline.



**Pearson correlation is significant at the 0.01 level (2-tailed)

* Pearson correlation is significant at the 0.05 level (2-tailed)

Figure 21 Summary of key relationships of symptoms, functional status, general health perceptions and quality of life at baseline and T3

The preceding bivariate analyses were unlikely to capture the complex relationships in the data. In order to test further these complex interrelationships within the Wilson and Cleary model, structural equation modelling (SEM) was carried out to examine the direct and indirect pathways between key individual and environmental factors and oral health outcomes.

4.4.2 Structural equation modelling (SEM)

The parameters of the models were estimated with maximum likelihood (ML) estimation and boot strapping using AMOS 16. Boot strapping is currently advocated as the best method to test direct and indirect effects in mediation models (Kline, 2011). SEM explains systematically how each variable predicts others by assessing whether the model was an acceptable fit to the data. Specifically, SEM was used to test the relationships hypothesised within the Wilson and Cleary model in lagged analyses using baseline data (T1) to predict scores at 3 month follow-up (T3).

4.4.2.1 Confirmatory factor analysis

Confirmatory factor analysis (CFA) is the first of the two stages of SEM. It is used to identify whether indicators used to measure latent construct variables are acceptable (Brown, 2006). It is used to test the measurement model and the instruments (CPQ₁₁₋₁₄ and SOC-13 scales). For CPQ₁₁₋₁₄ scale, symptoms and functional status subscales were used separately as observed variables hypothesised within the Wilson and Cleary model. In relation to SOC, item loadings for each subscale were not the same as original subscales (Antonovsky, 1979). This, together with the low internal reliability (Table 17) meant that the overall SOC score was used as a single observed variable in the SEM analysis (Appendix E).

Another application of CFA was to assess the two latent variables; clinical and environmental factors. Firstly, CFA was used to test a latent environmental construct. Indicators representing the construct included maternal and paternal education, parent occupation and parent income (Figure 22). Most indicators were categorised before the analysis (detailed in section 3.6). Secondly, the latent clinical construct was tested. The indicators included caries, gingival health, IOTN and trauma (Figure 23).

The bootstrapped standardised estimates for the measurement models are summarised in Figure 22 and Figure 23. Factors (latent variables) are in ellipses, items (indicator variables) are in rectangles and residual terms in circles. As shown in Figure 23, all items loading for environmental factors were significant and maternal education had the highest factor loading (-0.68). There were no significant factors loadings on clinical variables thus clinical factors could not be used as a latent variable (Figure 23). Instead, each aspect of clinical status was used separately as an observed variable in a separate analysis.

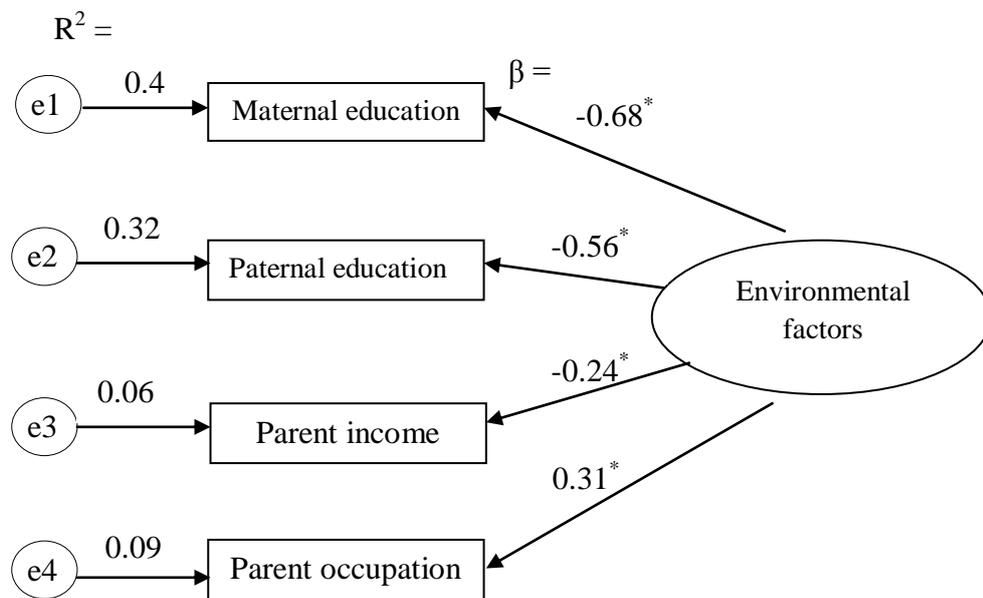


Figure 22 Bootstrapped standardised estimates for the confirmatory factor analysis of environmental factors. Note: * $p < 0.05$, β = bootstrapped standardised estimate; R^2 = the proportion of variability.

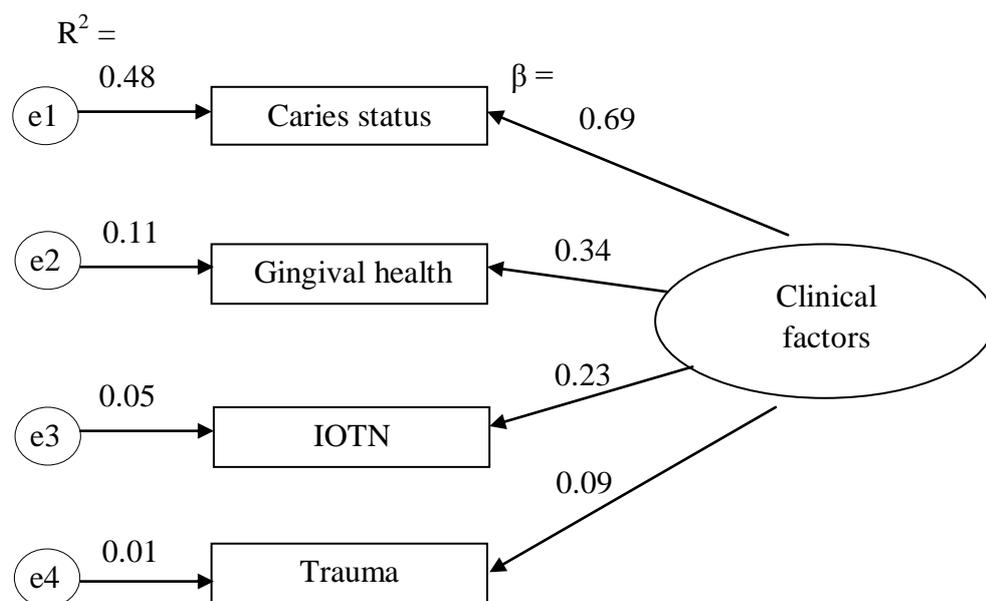


Figure 23 Bootstrapped standardised estimates for the confirmatory factor analysis of clinical factors. Note: * $p < 0.05$, β = bootstrapped standardised estimate; R^2 = the proportion of variability.

4.4.2.2 The Wilson and Cleary model as a structural model

After specifying the measurement model, the next step was to test a structural model, which examined the direct and indirect relationships between the constructs as hypothesised by the Wilson and Cleary model. Decayed teeth were included as the observed clinical factor. Environmental factors were included as a latent variable. GHP and overall QoL were not included in this analysis because single item measures were not stable enough within the model causing low reliability. Individual factors, SOC and OHB were included. Group allocation was also included to further assess the intervention effect.

Thus, the model comprised 6 observed and 1 latent variable; SOC, OHB, symptoms, functional status, groups, caries and environmental factors.

Model fit was evaluated by using absolute fit (χ^2/df ratio and standardised root mean square residual (SRMR)), root mean square error of approximation (RMSEA) with 90% confidence intervals (90% CI) and the comparative fit index (CFI).

A χ^2/df ratio < 3.0 , SRMR and RMSEA values < 0.08 and CFI > 0.90 were taken to indicate an acceptable model fit (Hu and Bentler, 1999).

The model was an excellent fit to the data ($\chi^2/df = 0.99$, $p = 0.49$, RMSEA (90% CI) = 0.00 (0.00-0.04), CFI = 1.00 and SRMR = 0.037).

Direct and indirect effects

Direct effects and mediations were assessed. Following Shrout and Bolger's (2002) techniques, 900 bootstrap samples were created (re-sampled from the original dataset) in order to derive less biased standard errors and 90% confidence interval (CI) bootstrap percentiles. The bias-corrected 95 % CI (BC 95% CI) was reported. Suppression effects represented by 'a', which occurs when either the absolute value of a predictor's beta weight is greater than its bivariate correlations with the criterion or the two have different signs were also recorded.

Bootstrapped standardised estimates for the model with caries as a clinical factor and summarised direct and indirect effects are summarised in Table 45 and Table 46.

Direct effects

Two of the main paths hypothesised within the Wilson and Cleary model were significant. Greater symptoms predicted more functional impacts when tested cross-sectionally. Among the psychological factors, higher SOC predicted fewer symptoms prospectively ($\beta = - 0.14$, $p < 0.05$) and less functional impacts ($\beta = - 0.23$, $p < 0.01$) when tested cross-sectionally. Greater OHB also predicted better functioning when tested cross-sectionally. There were no direct effects of environmental and clinical factors on other oral health outcomes. Group allocation predicted symptoms at T3 (Table 45).

Table 45 Direct effects with caries as a clinical factor at T1 and T3

Effect	β	Bootstrap SE	Bias-corrected 95% CI	% of total effect
Cross-sectional				
SOC - OHB	0.04	0.06	-0.07/0.16	100
OHB - Symptoms (T1)	-0.09	0.07	-0.23/0.05	100
OHB - Functioning (T1)	-0.14 [*]	0.05	-0.23/-0.04	77.00
SES - SOC (T1)	-0.07	0.08	-0.23/0.09	100
SES - Symptoms (T1)	0.06	0.07	-0.08/0.20	77.38
SES - Functioning (T1)	-0.09	0.08	-0.23/0.06	a
SOC (T1) - Symptoms (T1)	-0.28 ^{**}	0.05	-0.37/-0.17	100
SOC (T1) - Functioning (T1)	-0.23 ^{**}	0.05	-0.31/-0.13	61.62
Caries (T1) – Symptoms (T1)	0.12	0.06	-0.00/0.23	100
Caries (T1) - Functioning (T1)	0.01	0.05	-0.09/0.10	18.31
Symptoms (T1) - Functioning (T1)	0.50 ^{**}	0.05	0.40/0.60	100
Symptoms (T3) - Functioning (T3)	0.56 ^{**}	0.05	0.46/0.64	100
Group - Symptoms (T3)	0.18 ^{**}	0.06	0.07/0.29	100
Group - Functioning (T3)	0.10	0.05	-0.01/0.19	49.50
Prospective (T1-T3)				
OHB - Symptoms (T3)	-0.06	0.06	-0.18/0.05	100
OHB - Functioning (T3)	-0.08	0.05	-0.19/0.02	64.10
Symptoms (T1) - Functioning (T3)	0.10	0.05	-0.02/0.20	100
SES - Symptoms (T3)	-0.05	0.08	-0.22/0.11	a
SES - Functioning (T3)	-0.03	0.07	-0.16/0.11	77.42
Caries (T1) - Symptoms (T3)	0.08	0.06	-0.04/0.20	100
Caries (T1) - Functioning (T3)	0.04	0.05	-0.05/0.13	40.81
SOC (T1) - Symptoms (T3)	-0.14 [*]	0.06	-0.26/-0.02	99.31
SOC (T1) - Functioning (T3)	-0.04	0.05	-0.15/0.06	25.68

Note: ^{*} $p < 0.05$, ^{**} $p < 0.01$, β = bootstrapped standardised estimate, SE = standard error, CI = confidence interval, T1 = baseline, T3 = 3 month follow-up, SES = socio-economic status, a = suppression effect

Indirect effects

Significant prospective indirect effects included a pathway from SOC via symptom status to functional impacts. Greater SOC predicted less functional limitation ($\beta = -0.11$, $p < 0.01$) via better symptoms. More caries predicted more functional impacts when tested cross-sectionally. Group allocation predicted functional status at T3 (Table 46).

Table 46 Indirect effects with caries as a clinical factor at T1 and T3

Effect	β	Bootstrap SE	Bias-corrected 95% CI	% of total effect
Cross-sectional				
OHB - Functioning (T1)	-0.04	0.04	-0.12/0.02	23.00
SES - OHB	0.00	0.01	-0.03/0.00	100
SES - Symptoms (T1)	0.02	0.02	-0.03/0.06	22.62
SES - Functioning (T1)	0.05	0.05	-0.03/0.15	a
SOC (T1) - Functioning (T1)	-0.15**	0.03	-0.21/-0.09	38.38
Caries (T1) - Functioning (T1)	0.06*	0.03	0.00/0.12	81.69
Group - Functioning (T3)	0.10**	0.03	0.04/0.17	50.50
Prospective (T1-T3)				
OHB - Functioning (T3)	-0.04	0.03	-0.11/0.03	35.90
SES - Symptoms (T3)	0.01	0.01	-0.01/0.04	a
SES - Functioning (T3)	-0.01	0.05	-0.12/0.08	22.58
Caries (T1) - Functioning (T3)	0.06	0.04	-0.01/0.13	59.19
SOC (T1) - Symptoms (T3)	0.00	0.00	-0.02/0.00	0.69
SOC (T1) - Functioning (T3)	-0.11**	0.04	-0.19/-0.03	74.32

Note: * $p < 0.05$, ** $p < 0.01$, β = bootstrapped standardised estimate, SE = standard error, CI = confidence interval, T1 = baseline, T3 = 3 month follow-up, SES = socio-economic status, a = suppression effect

Figure 24 depicts the significant direct and indirect effects for the statistically parsimonious model. Baseline SOC had a direct effect on symptoms ($\beta = -0.14$, $p < 0.05$) and an indirect effect on functional status (via symptoms) at follow-up ($\beta = -0.11$, $p < 0.01$). Children with greater SOC had fewer symptoms, less functional limitation and better emotional and social well being, in other words better OHRQoL than those with weaker SOC. Caries status and family socio-economic status did not significantly influence OHRQoL. Group allocation was not related to baseline variables but predicted symptoms directly and functional status indirectly at T3. The model was also run for the other clinical factors and the results were slightly varied (see Appendix F).

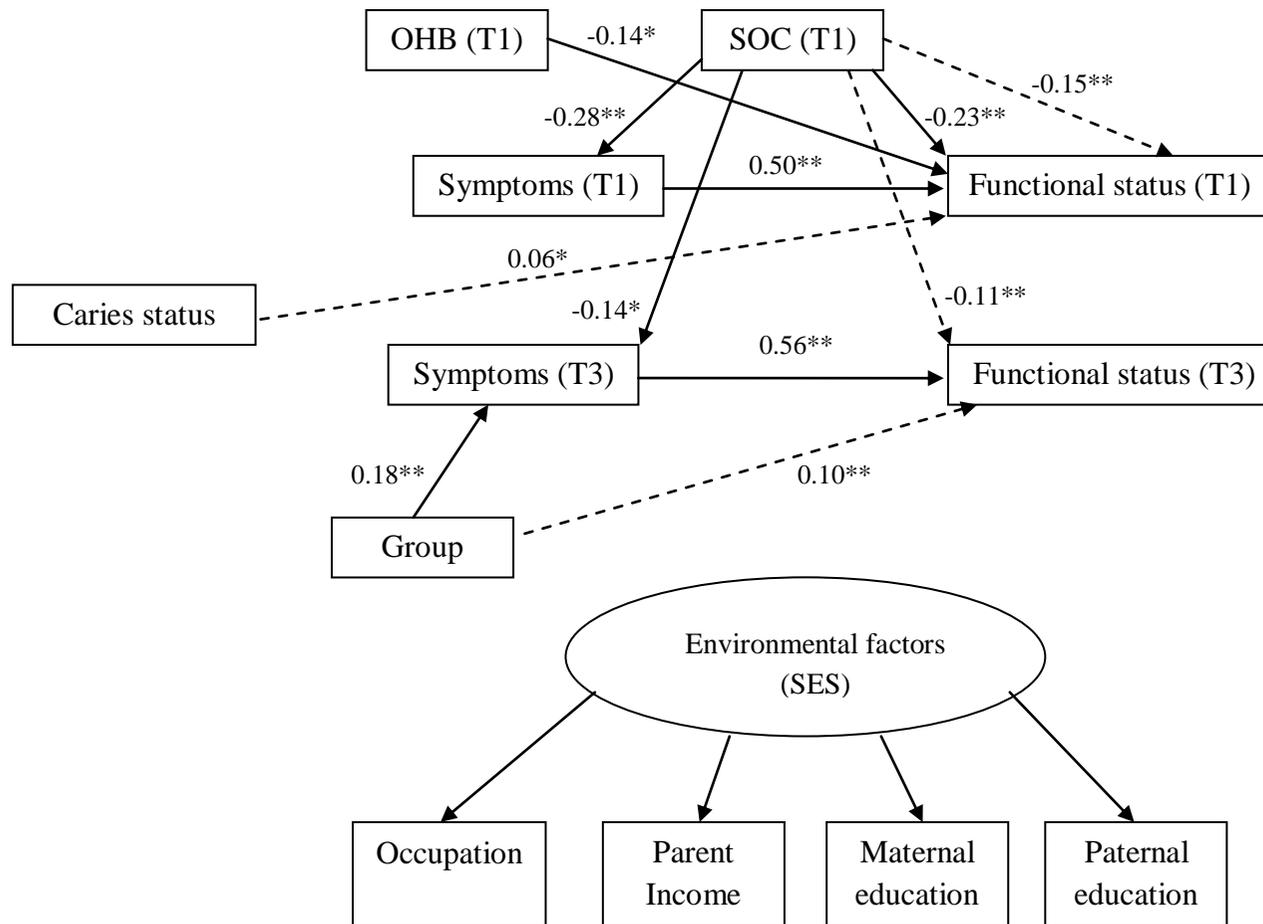


Figure 24 Significant direct and indirect effects for the statistically parsimonious Wilson and Cleary model at T1 and T3 with caries as a clinical factor. Note: * $p < 0.05$, ** $p < 0.01$, β = bootstrapped standardised estimate. Solid lines = direct effect; dashed lines = indirect effect; T1= baseline; T3= at 3 month follow-up, the error terms are omitted for the ease of interpretation

Summary

The intervention and comparison groups were similar at baseline in terms of demographic and clinical data. To test the effectiveness of the intervention to enhance SOC and improve OHRQoL, mixed effect models were used to compare SOC (intermediate outcome) and OHRQoL (primary outcome) between the intervention and comparison groups. The intervention group had significantly higher SOC accounting for 6.39 SOC points at T2 (Table 21) and 4.05 SOC points at T3 (Table 22) and better OHRQoL accounting for 6.07 CPQ₁₁₋₁₄ points at T2 (Table 25) and 6.50 CPQ₁₁₋₁₄ points at T3 (Table 26) than the comparison group. Intra-cluster correlation coefficients indicate that the effect of the intervention was explained by clustering effects to only a small degree (0.013).

However, caries status (as measured by DMFT) was similar in the two groups at T3 and was unaffected by the intervention (Tables 32-34). More children in the intervention group (31.81%) had normal gingival health than those in the comparison group (19.51%).

Structural equation modelling identified that SOC determined OHRQoL at 3 month follow-up. Children with greater SOC had fewer symptoms and less functional impacts. Socioeconomic and clinical status did not predict OHRQoL in this study.

Chapter Five

Discussion

5.1 Introduction

This cluster randomised trial in Thai primary school children aged 10-12 years tested the effect of an intervention to enhance SOC on oral health related quality of life. Predictors of OHRQoL were examined as a secondary aim. The school-based intervention enhanced SOC and improved OHRQoL. Lagged analysis with SEM showed that SOC measured at baseline had a direct effect on symptoms and an indirect effect on functional status by reducing symptoms at the follow-up.

The discussion of these results is divided into three parts. Section 5.2 discusses the primary aim of the research with regard to the improvement of SOC and OHRQoL after the intervention. Section 5.3 considers the predictors of variables within the Wilson and Cleary model. Section 5.4 addresses methodological issues and possible limitations of the research.

5.2 The intervention improved sense of coherence and oral health related quality of life

The primary aim of this study was to test the effect of the intervention to enhance SOC on OHRQoL in 10-12 year old children. The primary outcome was OHRQoL focusing on symptoms and psychosocial functions from the children's perspective. The intervention was school-based, delivered by teachers and comprising seven, 40-60 minute sessions over two months. The intervention significantly enhanced SOC and improved OHRQoL. That is, children in the intervention group reported greater SOC and lower impacts of oral health on their daily lives compared to children in the control group.

5.2.1 The improvement of sense of coherence and oral health related quality of life after the intervention

There are a number of explanations why the intervention enhanced SOC and improved OHRQoL.

5.2.1.1 Characteristics of the intervention

5.2.1.1.1 Used of theory to guide the intervention

The intervention established in this study was developed following the salutogenic theory and the related construct of SOC (Antonovsky, 1979). The theory explains why people stay well despite difficulties and stressful situations. In salutogenesis, health is seen as a continuous movement on an axis between health (ease) and illness (dis-ease). Therefore, salutogenesis focuses on resources, maintaining and improving movement towards health. SOC has been hypothesised as a significant facilitator of the movement toward health by identifying health resources and modifying the psychosocial environment that influences health (Antonovsky, 1996). It is a general orientation to view life in coherent, manageable and meaningful ways. Individuals with high SOC comprehend and assess the situations or stimuli they confront as non-stressors (comprehensibility). They perceive resources to be available and can use them to cope with stressful situations (manageability). They view situations such as life events and ill-health/disease as challenges and worthy of engagement (meaningfulness).

SOC considers the factors responsible for creating and maintaining health rather than focuses on understanding aetiology of disease, pathological process and risk behaviours. Individuals and communities with higher SOC are more likely to deal with stressors existing in human life and therefore maintain health and well-being than those with weaker SOC. The creation of health following the salutogenic idea required improvements in the ability to identify resources and ability to use them. SOC may be seen as an intermediate outcome of health.

Many previous oral health promotion interventions have been devised without any theoretical underpinning (Brown, 1994; Kay and Locker, 1998; Renz *et al.*, 2007; Schou and Locker, 1994; Sprod *et al.*, 1996). This may lead to 1) choosing the wrong factors on which to intervene 2) choosing the wrong place/time to intervene 3) choosing the wrong way (process) in which to intervene. Such an approach also lacks logic for further action. Oral health programmes developed using theory tend to be based on biomedical models focusing on disease rather health, whereas not all disease contributes to ill health. Some programmes have been established using psychological theories and models at the individual level that consider cognitive and affective processes (Brown, 1994). Although these may determine behaviours and

lifestyle, they may not sustain health due to the lack of attention to the determinants of health.

5.2.1.1.2 Comprehensive range of strategies

The intervention in this study was robust. It included a variety of methods, for example, oral health education, child participation and empowerment and health promoting schools. NICE (2007) suggested that individuals may require different approaches to change their health.

Positive oral health education

The present intervention is more than a health educational programme as it applied psychological factors and considered children's economic, social and environmental conditions. Clinical approaches and simple interventions applying only educational programmes may improve knowledge and clinical status such as gingival health. However, these are only short term effects that are limited to behavioural changes which are not sufficient to deliver sustained improvements in oral health (Brown, 1994; Kay and Locker, 1998; Sprod *et al.*, 1996; Watt, 2005).

The current intervention incorporated an oral health education session. However, even within this, a diverse approach was used including didactic teaching, discussion, activities and games. A variety of methods were emphasised as each person had different learning styles.

Most oral health education has concentrated on illness, regarding the causes and signs of diseases rather than people's view of their own health. In the 'healthy mouth' session in the present study, children learned to think positively about their health (e.g. normal clinical status, good body image, smiling with confidence and talking without embarrassment) and recognised how to improve and maintain their health. They were approached by being asked the questions 'What does the healthy mouth mean to you?', 'What do you think interferes with having a healthy mouth' and 'How do we get rid of it'. Additionally, they learned to improve their oral health by brushing their teeth effectively. The lesson made children aware of why they have healthy mouth, got them to think about the fact that it is not normal to have oral diseases and they can do something about it themselves. However, the objective of

this oral education session was more than knowledge and attitude, but rather the ability to understand, manage and maintain their health.

Knowledge may be a necessary factor that influences attitudes towards behaviours. It is considered an important part of oral health promotion (Daly *et al.*, 2005) as it aims to promote oral health by providing useful information leading to adoption of healthier life styles, positive attitudes and favourable behaviours (Sheiham and Watt, 2003). Knowledge is an internal process that determines an individual's view of and way of dealing with reality. An individual's learning process is dynamic and is based on previous knowledge and experiences. Moreover, learning is social activity that takes place between persons as interaction rather than something that is constructed solely in the individual mind (Lave, 1993). Constructing a school lesson that gave children opportunities to communicate their thoughts, questions and experiences was essential. However, it is clear that knowledge alone cannot improve health.

The oral health education session may have increased SOC in children by enhancing comprehensibility and manageability. Children with knowledge and who understand their health may perceive what they experience as structured, explainable and predictable. Self care management, for example, brushing teeth after staining plaque made children feel that they could control over their oral health by themselves.

Focusing on child participation and empowerment

This intervention focused on children's active participation and empowerment in all activities. Students could express their understanding, thoughts, ideas and feelings by discussing, writing and drawing. The intervention was child-centred as it was flexible regarding the child's voice and competency. The involvement of children in research has shifted from research *on* children involving 'what adults think children think' (Alderson and Morrow, 2004) towards research *with* children regarding children 'as competent and reflexive of their own experiences' (Marshman and Hall, 2008; Mayall, 1996).

Child participation and empowerment were clearly demonstrated in most sessions but especially in sessions 5-7, which promoted these principles via healthy school projects. Children applied what they had learned from previous sessions for other students by conducting projects towards healthy school environments. They were

encouraged and empowered to do the projects from their own experiences. They actively participated throughout by planning, implementation and evaluation, by discussing and deciding mutually what they planned to do. Thereafter, they conducted their projects for their whole schools. After two weeks, they evaluated their projects and discussed any problems and solutions. The activities in the projects included suggesting to other students to choose healthy food, teaching others to brush their teeth effectively, cooperating with teachers to run a tuck shop to provide healthy food. The children determined that confectionery would not be sold in the schools. Toothbrushes and fluoridated toothpastes were provided by schools and were available for students to use. These created healthy environments where students could adopt desirable behaviours and enhanced the components of SOC (i.e. comprehensibility, manageability and meaningfulness) that might promote their health in other ways (see section 5.2.3).

From these sessions children might see that they can take control of their health by creating healthy environments, increasing skills to take care of their health and coping with the difficulties. This ‘manageability’ may have enhanced their SOC. Antonovsky (1996) claimed that SOC can be shaped by participation in socially-valued decision making.

In session 2 (Face games), children learned to think positively about themselves and others and increase their beliefs and confidence in their own ability and value. In session 3 (Name calling), children perceived names can be used by people as part of familiarity. They should not necessarily feel upset, embarrassed or nervous when others call them informal or nicknames. These activities may help children increase comprehensibility.

In session 4 (changing life), children considered shaping their life by goal setting and planning to improve their life. This behavior rehearsal helped children diminish their anxiety or deficient social responses by practicing the desired forms of behaviour (Lazarus, 1966). This session may have increased the meaningfulness and manageability components of SOC. Individuals who feel that they can manage, plan and control their life rather than feeling at the mercy of others tend to experience increase in meaningfulness when anticipating and shaping the future (Wolff and Ratner, 1999). Photos of each session can be seen in Appendix G.

From the principle of children's rights, it is necessary to involve children so that they can take decisions for themselves in education and social and health care (James *et al.*, 1998). Denying children opportunities for taking responsibility may diminish the opportunities to develop their capacity to perform tasks. Most oral health research (87%) has been carried out in children as 'objects' rather than active participants (Marshman and Hall, 2008). In relation to research *with* children, children are involved in the development of child-centred questionnaires (Gherunpong *et al.*, 2004; Jokovic *et al.*, 2002) and the redesign of a paediatric dentistry service using children's perspective (Fitzgerald *et al.*, 2004). For the present study, children were actively involved in the design of the oral health promotion intervention. All activities that children participated and experienced may increase the components of SOC.

Applied health promoting schools

Health promoting schools were a key part of the intervention. They were included as a natural venue for children where they could strengthen the health resources available for SOC. The more resources an individual possesses, the better are the chances for strong SOC (Antonovsky, 1996). Antonovsky (1987) claimed that SOC acts as a resource in the successful management of stressful life events and is based on the judgement of the amount of resources that are available. These resources encompass a wide range of factors, for example, social support and environmental resources.

School-related resources and SOC

School-related resources such as a supportive school environment, appropriate and adequate learning conditions and schoolwork help strengthen SOC in children. The perception of social support and appropriate work experiences are life experiences that can improve a strong SOC (Antonovsky, 1987). Three major sources of social support are parents, peers and teachers (Cauce *et al.*, 1982). Parents and peers may provide informal relations and support whereas teachers represent formal sources. During the intervention teachers were the persons who encouraged students in their work. High level support from teachers and peers during working on healthy projects (Sessions 5-7) helped them their interest and mastery and then deal better and cope well in their life events. This influences SOC. High level of social support may be seen as a backup system for children to face challenges in difficult situations.

Natvig and colleagues (2006) conducted a cross-sectional study using the data from the Norwegian portion of the World Health Organisation Cross-National Survey 'Health Behaviours in School-Aged Children 1997/98 (HBSC) to explore to what degree school-related resources (supportive school climate, adequate learning conditions) and school-related stress (pressure of schoolwork, bored of school) were related to the SOC of the children. Four thousand one hundred and sixteen (4116) students aged 11-15 years completed questionnaires. A supportive school climate included social support from peers, parents and teachers and school climate. Support from peers and parents was ascertained using descriptive statements for which typical items were 'The students in my class enjoy being together' and 'If I have problems at school, my parents are ready to help'. Support from teachers was based on four descriptive statements such as 'Our teachers treat us fairly'. To measure school climate, students responded to a 3-item scale for which a typical item was 'I feel I belong at this school'. Adequate learning conditions included expectations from parents and teachers and academic performance measured by one single item 'In your opinion: what do your class teachers think about your school performance compared to your classmates?' School-related stress consisted of experiences of schoolwork as stressful and boring that were measured by one single item respectively. SOC was measured by the 13-item scale.

The experiences of being pressured by schoolwork were negatively related whereas a supportive school climate was positively related to SOC. Once SOC is based on a judgement of the adequacy of the resources (social support and environmental resources) the experience of life events may help strengthen SOC. The results also indicated that realistic expectations that are close to students' judgements of their own achievements are important for the experience of school situations as comprehensible and meaningful. They concluded that support from students, parents and teachers, adequate demands and expectations from teachers and parents that match students' capacity are all important for strengthening SOC.

In the present study school-related resources such as social support were from teachers and peers. The appropriate demand of schoolwork and the matching of teacher expectations and children's capacity are evident in the participation of decision making throughout the projects. When children experienced schoolwork as predictable, confidence boosting and continuous, then comprehensibility may be

strengthened. An optimal level of demands may enhance manageability, encouraging a feeling of being in control of allowing the children to use their skills and knowledge to run healthy school projects. Participation in decision making may be a source of meaningfulness which increases motivation and fosters pride in schoolwork. It can be concluded that SOC is improved by school conditions, in turn it influences the perception of, and the way in which children deal with their working conditions. Antonovsky claimed that the life experiences that individuals may internalise SOC are characterised by consistency, participation in shaping outcome and underload-overload balance (Antonovsky, 1987).

Public health approaches

Schools are considered a key setting for promoting children's health. They can be healthy places for providing a healthy environment and creating conditions through services, policies, physical and social circumstances that are conducive to better health (WHO, 2003). The experiences and skills help children strengthen their SOC and then contribute to health. Rather than relying solely on preventive and educational programmes, a mix of complementary public health approaches that focus on assisting individuals and communities to avoid disease and on the creation of supportive environments conducive to sustain good health is required (Watt, 2005).

Teachers are key persons who can reinforce children's SOC and facilitate successful health promoting schools. It was essential to train teachers not only in the details of the intervention and basic understanding of health but also adjusting the view they have of children. In some countries, teachers are more likely to view children as passive recipients and worry that involving children in decision-making may reduce their control and diminish the respect they receive from students. The views of teachers may have influenced the strength of SOC in children by contributing to their experiences as part of the overall school climate. Although, not powered for this purpose the exploratory analyses indicated variations in the effect between schools. When children are involved in decisions affecting school life, the relationships among students, teachers and other staff are improved leading to less conflict and greater educational outcomes (Lansdown, 2005). The interest, clear role and responsibility and support from teachers together with the child participation acted as the facilitators of successful intervention (Forman *et al.*, 2009).

Furthermore, the intervention supported active participation of local communities. It involved all members of the communities such as students, teachers and staff. This whole school approach facilitated the successful intervention (St Leger *et al.*, 2007). Moreover, the active participation of all members of schools may stimulate the sense of belonging and community spirit and increase social capital within the community (Watt, 2002).

In conclusion, the intervention in this study aimed to promote oral health by facilitating components of SOC, self-esteem, self-efficacy and coping strategies, and empowering children to create healthy environments where they could adopt favorable behaviours. It was more comprehensive and tailored than previous oral health promotion interventions as it embraced a wide range of strategies, including positive oral health education, child participation and empowerment via classroom activities and working on healthy school projects. Healthy environments were developed by the cooperation between students, teachers and staff via healthy school projects in order to promote oral health. Facilitating successful interventions such as using a whole school approach, working with children and teachers who are key persons in the school and the use of incentives to encourage participation of children were considered and incorporated. This contrasts with other oral health promotion interventions, which have focused primarily on oral health education. That is, the causes and prevention of oral disease in which children were given little opportunity to express their thoughts, feelings and ideas or suggest solutions or undertake actions to promote their health. In relation to health promotion interventions and other SOC interventions, the present intervention shared previously successful features such as group discussion, sharing of experiences, finding solutions and creating healthy environments. Most previous SOC interventions in health research have been related to adult patients with mental health problems. The intervention in this study was the first to actively employ principles of salutogenesis in relation to oral health and also the first SOC intervention with children rather than adults.

5.2.1.2 The effectiveness of the intervention

It is not easy to compare the effectiveness of the intervention in this study with others because of differences in study outcomes, methods, design and samples. Such evidence, limitations of those interventions as well as the studies carried out to test the effects of oral health interventions are detailed below.

5.2.1.2.1 Evidence from previous research

Most oral health interventions in previous studies can be termed ‘dental health education’. Those interventions improved knowledge but the improvement is likely to be short term. It was also found that knowledge alone leads to limited behaviour changes as oral health behaviours are difficult to change. It is evident that changes in behaviours are short term and may not lead to sustained changes in oral health (Brown, 1994; Schou and Locker, 1994; Kay and Locker, 1998; Kay and Locker, 1996; Sprod *et al.*, 1996; Watt, 2005).

Apart from attempts to improve knowledge, attitudes and behaviours, most oral health interventions have adopted clinical outcomes such as reducing caries and gingivitis. Successful interventions that have reduced tooth decay have tended to use fluorides and the interventions only decreased plaque and gingivitis in the short term (Brown, 1994; Brukiene and Alexsejuniene, 2009; Kay and Locker, 1998; Sprod *et al.*, 1996; Watt, 2005; Watt and Marinho, 2005).

5.2.1.2.2 Limitations of previous oral health promotion research

Most interventions were not theoretically driven and the evaluations were established without theoretical support, which may limit their effectiveness and explanatory power.

Other studies have used evaluation methods that may not be suitable to determine the effect of the intervention as they used pre-post study methods, small sample sizes and/or no control groups. Likewise, clinical outcomes tend to not be appropriate for oral health promotion intervention as they assess clinical status rather than health.

Most evaluations of oral health promotion in schools have involved dental education interventions and clinical outcomes. For example, cluster randomised controlled trials have tested the effect of educational programmes in primary schools (Helderman *et al.*, 1997; Worthington *et al.*, 2001). These programme included, for example, a workshop for teachers and lessons for children in relation to the causes and the prevention of oral disease such as dental caries and gingivitis. Children’s knowledge and behaviours improved (Helderman *et al.*, 1997; Worthington *et al.*, 2001) such as tooth brushing twice daily, dental visit and fluoride use (Helderman *et al.*, 1997) and had lower plaque and gingivitis (Helderman *et al.*, 1997; Tai *et al.*,

2009; Yazdani *et al.*, 2009). There were no significant changes in DMFS (Helderman *et al.*, 1997; Tai *et al.*, 2009). Frencken and colleagues (2001) conducted a randomised controlled trial to test an educational programme in primary school children in Zimbabwe. They found no significant changes in DMFS and plaque level between the intervention and control groups.

Medline searches indicate that this is the first randomised controlled trial of a school-based intervention that used OHRQoL as an oral health outcome. There were no significant changes in DMFT between the intervention and comparison groups but significant improvement of gingival health in the intervention group (section 4.3.4).

Some longitudinal studies have investigated the effect of preventive programmes and clinical treatments on OHRQoL. For example, fissure sealants and fluoride vanish programmes did not improve OHRQoL after 5.5 year follow-up (Iglesia *et al.*, 2007). Gururatana and colleagues (2011b) conducted a nine month longitudinal study to evaluate dental screening in Thai 10-14 year olds in which the children who needed dental fillings received them. The dental screening programme reduced the prevalence of untreated caries but did not enhance OHRQoL. Malocclusion and orthodontic treatment did not affect OHRQoL in 10-14 years old who needed orthodontic treatment (Taylor and colleagues (2009). Mashoto and colleagues (2010) investigated the changes of OHRQoL following atraumatic restorative treatment (ART), tooth extraction and oral health education in 1306 Tanzanian children at 6 month follow up. OHRQoL changed most following the ART filling and tooth extraction than ART filling or oral health education alone. The aforementioned studies may have limitations, as they were not randomised controlled trials.

Clinical indicators may be appropriate for clinical interventions whereas OHRQoL might be best for assessing oral health promotion strategies. OHRQoL appears to be the most appropriate outcome measure to evaluate oral health promotion in evaluation studies because it reflects health in terms of the individual's perception of their symptoms and psychosocial functioning. OHRQoL has also been suggested as an outcome measure for health promotion evaluation (Watt *et al.*, 2006). OHRQoL can be changed and measured during the period of this study. The outcome measures used in the evaluation of oral health promotion need to be appropriate to the intervention and the timescales involved in the programmes (Watt *et al.*, 2006).

The oral health promotion intervention in this study used OHRQoL as an outcome measure. The cluster-randomised trial was considered to be appropriate to reflect the school-based intervention and to prevent contamination. Thus, the design was appropriate. Yet, one particular feature may have offered special advantages.

5.2.2 Sense of coherence as a predictor of OHRQoL

Secondary analysis of the present study using structural equation modelling confirmed that children with higher SOC had fewer symptoms, less functional impacts and better OHRQoL. As already discussed, enhancing SOC improved OHRQoL up to 3 months following the intervention. Relationships between SOC and health outcomes have been investigated in a number of previous studies both in children and adults. Most findings show strong and consistent associations between SOC and these outcomes.

Sense of coherence and general health

The systematic review regarding relationships between SOC and health concluded that higher SOC is associated with better health (Eriksson and Lindstrom, 2006). Since then low SOC has been related to type 2 diabetes in Swedish women (Agardh *et al.*, 2003). A cohort study in cardiovascular and cancer patients 41-80 years old showed that SOC was associated with the thirty percent reduction of mortality rate (Surtee *et al.*, 2003). Low SOC was linked to life dissatisfaction, depression and poor psychosomatic health (Myrin and Lagerstrom, 2008). In addition, SOC appears to be an important factor for better health related quality of life (Drageset *et al.*, 2009).

Sense of coherence and oral clinical status

Individuals with higher SOC reported less gingivitis (Ayo-Yusuf *et al.*, 2008) and low SOC was associated with poor oral hygiene in Finnish adults (Savolainen *et al.*, 2005b). Strong SOC was related to less dental caries, fewer periodontal pockets and more teeth in 5401 dentate Finnish adults after adjustment for confounders (Bernabe *et al.*, 2010).

Sense of coherence and oral health related behaviours

Subjects with higher SOC were more likely to brush their teeth more frequently in 3 studies (Ayo-Yusuf *et al.*, 2009; Dorri *et al.*, 2010; Savolainen *et al.*, 2005b) and visit the dentist for regular check-ups in 4 studies (Bernabe *et al.*, 2009b; Freire *et*

al., 2002; Savolainen *et al.*, 2004; Savolainen *et al.*, 2005b). In this study, the intervention might have increased tooth brushing.

Sense of coherence and oral health

Strong SOC was connected to better OHRQoL in Finish adults (Savolainen *et al.*, 2005a) and children with higher SOC reported better OHRQoL in 2 longitudinal studies (Baker *et al.*, 2010; Gururatana *et al.*, 2011b).

Although numerous studies have examined the relationships between SOC and different health outcomes these studies are predominantly cross-sectional and cannot determine causality. Only the studies in Malaysia by Baker and colleagues (2010) and in Thailand by Gururatana and colleagues (2011b) were longitudinal and found that SOC predicted OHRQoL in children.

Baker and colleagues (2010) tested the determinants of children's oral health in a lagged cohort study of 439 Malaysian aged 12-13 years. Gururatana and colleagues' (2011b) cohort recruited 10-14 year old Thai children. Both studies used structural equation modelling and SOC was found to be the most important psychosocial predictor of OHRQoL in children. Higher SOC significantly predicted fewer symptoms and functional impacts and better OHRQoL.

In this study, SOC predicted OHRQoL (Figure 24). The results indicated that SOC reduced symptoms and functional limitation and therefore improved OHRQoL. This study supports the aforementioned cause-effect studies by Baker and colleagues (2010) and Gururatana and colleagues (2011b). However, data from this study go one stage further and provide the experimental evidence that SOC determines OHRQoL. This causal relationship is in accordance with Bradford Hill's tests of causation (Hill, 1965).

Cumulatively, enhancing oral health via SOC could be possible and the intervention based on SOC in this study enhanced SOC and improved oral health.

5.2.3 Sense of coherence pathways in promoting health

Antonovsky (1996) hypothesised that SOC may promote health via three different pathways. Firstly, by directly affecting physiological consequences through the

central pathways of the neuro-immune and endocrine systems. Secondly, by helping people to select health promoting behaviours. Finally, by regulating emotional tension when individuals confront stressors (Antonovsky, 1996).

5.2.3.1 Sense of coherence and physiological pathways

Antonovsky (1987) stated that “*My hypothesis, then, is that the strength of the SOC has direct physiological consequences and, through such pathways, affects health status*”. SOC may affect individual’s physiological and psychological responses to buffer adverse influences on life situations (Suominen *et al.*, 2005) at different stages of the process. For example, individuals with higher SOC tend to define stimuli as nonstressors and they will not experience so much tension and stress. This leads to differences in the physiological states. Individuals with stronger SOC had lower blood pressure, lower heart rate at rest, higher oxygen uptake capacity, lower cholesterol and triglycerides and had fewer health problems than those with lower SOC (Lindfors *et al.*, 2005; Lundberg and Nystrom-Peck, 1994). Low SOC has related to high serum cortisol level (Kuroki *et al.*, 2011). Therefore, strong SOC may constitute a biological buffer against ill health and disease (Lindfors *et al.*, 2005). A physiological effect might be likely to influence clinical status.

In the current study, the SOC intervention did influence gingival health but not the remaining clinical indices. Nevertheless, gingival health is the clinical indicator most likely to change in the shorter-term; notably 3-months in the present study. Thus, there was some evidence in the current study for a physiological effect of SOC.

5.2.3.2 Sense of coherence and behaviours

SOC may improve health via selecting favourable behaviours that contribute to oral health. SOC has been linked to regular attendance (Savolainen *et al.*, 2004) and the frequency of tooth brushing (Dorri *et al.*, 2010; Savolainen *et al.*, 2005b). Adolescents with higher SOC were likely to brush their teeth twice daily. It is conceivable that individuals with greater SOC may perceive themselves to have more control and confidence in their ability to achieve goal. They tend to comprehend the benefit of desirable behaviours such as regular brushing twice daily and are likely to see that it is worth pursuing favourable oral health behaviours. Moreover, people with stronger SOC were more likely to prevent damage and have preventive direction. They tend to seek for treatments and do highly compliance.

In this study, oral health behaviours were not examined directly, although oral health beliefs were assessed. Here, the SOC-intervention did influence OHB indicating some support for a behavioural pathway. However, it may be argued that the effect of oral health behaviours may be mediated by clinical status. Since clinical status was not consistently related to OHRQoL (Figure 24, Appendix F) and the improvement of gingival health in the intervention group was not marked, the effect of SOC on OHRQoL via oral health behaviours (which would be mediated by clinical status) appears to be modest.

5.2.3.3 Sense of coherence and coping strategies (emotional tension)

SOC may promote health by increasing in the ability to utilise resources more efficiently to cope with stress. Antonovsky (1987) posited that those with greater SOC tend to have more ability to manage a holding action and overcome stressors. If tension is managed successfully, this leads to positive health (Antonovsky, 1987)

Individuals with low SOC exposed to stress reported recent illness more than twice as often than unstressed girls (Nielsen and Hansson, 2007). People with higher SOC have lower stress, distress (Hood *et al.*, 1996) and depression (Myrin and Lagerstrom, 2008). SOC has also been associated with better psychosomatic health (Flensburg-Madsen *et al.*, 2005; Myrin and Lagerstrom, 2008). A randomised trial confirmed that SOC is a coping strategy utilising resources to find the solution to problems (Langeland *et al.*, 2006). SOC plays a key role for psychological adaptation (Tanga and Li, 2008; Wiesmann and Hannich, 2008; Wiesmann *et al.*, 2009) and is a buffer against stress (Pallant and Lae, 2002).

In the present study, the effect of SOC on OHRQoL may have been via emotional tension. Children with greater SOC may have had more ability to cope with stress and felt their lives were more manageable. The overlapping psychological factors such as self-esteem and self-efficacy are also likely to be linked with behaviours. The effects of SOC on OHRQoL through behavioural and emotional pathway are not distinct but overlap.

The intervention established in this study was developed to enhance SOC in children by providing an opportunity for them to increase their skills and life experiences through classroom activities and working on healthy projects. The skills and life

experiences were characterised by consistency, participating in shaping their life and the overload-underload balance of their schoolwork. Therefore, children with higher SOC may have been more able to comprehend their life as non-stressful. Moreover, they may have perceived that they had the resources available and felt more able to organise resources to improve and maintain their oral health. In addition, the children received advice/education on oral hygiene, oral health and tooth brushing and there was an impact on both gingival health and oral health beliefs. Taken together these findings suggest that the SOC intervention may have impacted on OHRQoL via the physiological, behavioural and/or emotional pathways. Whilst it is not possible to be more conclusive on the processes underlying the intervention's mechanisms of action, it does seem likely that the physiological, behavioural and emotional explanations are not distinct but overlap.

5.2.4 Sense of coherence as a framework for oral health promotion

The intervention based on SOC promoted oral health in an integrated school setting by modifying and making supportive environments, enabling people to clarify and mobilise resources in order to improve and maintain their health. This process is health promotion.

“the process of enabling individuals and communities to increase control over the determinants of health thereby improving health to live an active and productive life” (WHO, 1986). Health promotion represents mediating strategies between people and their environments and mobilising personal choices and social responsibility in relation to health to create health.

The salutogenic idea defines health as a movement on the axis between ease and disease. SOC is recognised as an ability of people to move toward health end by identifying and utilising health resources to improve and maintain health (Antonovsky, 1996). This is in contrast to the biomedical model, which sees health more narrowly as the absence of disease. As a result, people who do not have disease or who are not at risk tend to be excluded. The ultimate outcome of health from the salutogenic idea is beyond clinical outcomes, capturing all aspects of health, including psychosocial well-being, general health perception and quality of life.

5.3 Predictors within the Wilson and Cleary model

In the present study SEM was used to identify predictors of variables within the Wilson and Cleary model. However, as the measures for GHP and overall QoL relied on single indicators these variables were not included in this analysis. Single item measures are not sufficiently stable, causing low reliability. As a result only associations and predictors of other variables on OHRQoL are discussed.

5.3.1 Relationships between clinical status and oral health related quality of life

The findings did not indicate relationships between clinical status and OHRQoL.

Previous studies carried out to investigate relationships between clinical factors and subjective health outcomes have showed inconsistent findings. Some previous studies did not find any relationships between clinical factors and OHRQoL (Barbosa *et al.*, 2009; Marshman *et al.*, 2005). Explanations for these weak or inconsistent relationships include the disease level of the sample, types of disease, different measures, models tested in the study and the interaction of other factors such as environmental and individual characteristics.

Levels of disease

The studies with low disease samples (e.g. Marshman *et al.*, 2005) may not detect associations because of the limited impacts of mild disease on OHRQoL. Oral diseases that are not life-threatening may have immeasurably low impacts.

Alternatively, relationships are found in high disease samples. Jokovic and colleagues (2002) found links between dental caries (DMFT > 10) and OHRQoL measured with CPQ₁₁₋₁₄. However, relationships are evident in studies in which the sample had low levels of disease. Robinson and colleagues (2005) found relationships between dental caries (DMFT 0.68), fluorosis and OHRQoL among 174 Uganda children. A study conducted in children who had DMFT 0.23 also found the association between dental caries and OHRQoL (Baker *et al.*, 2010).

Sample sizes

Some studies have detected associations between clinical status and OHRQoL in large samples. Foster-Page and colleagues (2005) found an association between dental caries (DMFS) and OHRQoL in 430 12 year olds in New Zealand. Children with untreated caries had more impacts on OHRQoL measured by CPQ₁₁₋₁₄ in a

study of 792 children aged 12 year-olds (Piovesan *et al.*, 2010). A longitudinal study in 455 Thai students (Gururatana *et al.*, 2011b) and 439 Malaysian 12-13 year olds (Baker *et al.*, 2010) also found relationships between dental caries and OHRQoL.

Interactions with other factors and statistical methods

Another explanation is related to the interaction of others factors such as environmental and individual factors. These factors include self-esteem, SOC, coping strategies and self regulation (Locker, 2007; Locker, 2009; Savolainen *et al.*, 2005a; Savolainen *et al.*, 2005b). The relationships between clinical status and OHRQoL may be mediated by these factors (Baker, 2007). Accordingly, powerful statistical analysis is needed to explore complex direct and indirect relationships between multiple factors. Using the same data, Mat and colleagues could not find relationships between clinical status and OHRQoL (symptoms and functional status) using the multiple regressions when data analysis (Mat *et al.*, 2009) whereas Baker and colleagues (2010) found causal relationships in the same data identified predictors of OHRQoL using SEM.

These findings may also be explained by the use of SEM to determine direct and indirect effects as it conveys two important aspects of the procedure; that the causal processes are represented by a series of structural equations and that the model generated explicitly conceptualise the theory underpinning the study (Byrne, 2010). Thus, other research using regression analysis is confined to detecting associations between only two variables and may not have been able to assess the multidimensional predictors of OHRQoL and both direct and indirect pathways.

Types of disease

The type of disease may also explain why clinical status only sometimes relates to OHRQoL. Vargas-Ferreira and colleagues (2010) did not find the relationships between tooth erosion and OHRQoL in 11-14 years old in Brazil and concluded that the lack of the impact may be because the low severity of tooth erosion. A study conducted to assess the impact of dental injuries in 11-14 year olds showed that dental injuries were not associated with OHRQoL (Bendo *et al.*, 2010). Bendo and colleagues claimed that lack of associations may be due to the choice of instruments. They did not detect the associations using CPQ₁₁₋₁₄- ISF:16 but other studies using the Child-OIDP did (Cortes *et al.*, 2002; Ramos-Jorge *et al.*, 2007). One interesting

explanation of traumatic dental injuries is related to dental-facial aesthetics, which play an important role in social interaction and perceptions of others regarding dental appearance. Particularly in adolescence, any changes in dental appearance tend to have a negative impact on OHRQoL. Children with oligodontia had worse OHRQoL than those with dental caries (Locker *et al.*, 2010). Paedodontic patients had better OHRQoL measured by CPQ₁₁₋₁₄ than those with malocclusion (McGrath *et al.*, 2008).

Different measures

The instruments used to measure OHRQoL have been the subject of ongoing debate in terms of sensitivity to detect impacts of clinical status. The CPQ₁₁₋₁₄ may not be sensitive enough to detect the impacts of oral conditions of OHRQoL in low disease populations and in small samples (Marshman *et al.*, 2005). Gururatana and colleagues (2011b) did not detect any impacts of dental fillings on OHRQoL in Thai children (DMFT 1.97) using CPQ₁₁₋₁₄.

Chid-OIDP and COHIP may be more sensitive measures. Tuber-Jeanin and colleagues (2005) detected the impact of clinical status on OHRQoL using Child-OIDP in 414 children aged 10 years old (DMFT 0.86). Another study by Broder and colleagues (2007) detected the impact of clinical status on OHRQoL measured by COHIP in 523 children mean aged of 11.6. Children who had greater caries reported worse OHRQoL.

Different concepts of health and disease

Another explanation is related to the model used to guide the studies and the choice of measurement instruments. The biopsychosocial model combines two distinct concepts of health; clinical factors reflect disease, whereas subjective outcomes may record health. Locker and Slade (1994) suggested that health and disease may be conceptually distinct rather than causally related. Therefore, there may be no relationships to detect.

The Wilson and Cleary model attempts to relate these two different concepts of health. Yet, Locker (1997) claimed that not all disease contributed to health. Furthermore, other factors may play a mediating role on OHRQoL. The magnitude of impact on OHRQoL may be more influenced by patients' perceptions of their

symptoms, psychological well-being (Baker *et al.*, 2010) and personal and social circumstances (Locker and Slade, 1994) than disease.

It is likely that all the above explanations contribute to the weak relationships between clinical status and OHRQoL.

5.3.2 Relationships between socioeconomic status and oral health related quality of life

Socioeconomic status (SES) formed a latent variable comprising parental income, paternal and maternal education and parent work status. SES did not predict OHRQoL in this study. This finding is not consistent with earlier studies of subjective measures of oral health (Sabbah *et al.*, 2009; Tsakos *et al.*, 2009). Piovesan and colleagues assessed the relationships between child OHRQoL and socio economic and clinical status. Children whose mothers had not completed primary education and those from lower income households had poorer OHRQoL (Piovesan *et al.*, 2010). Locker found that Canadian children from low income families had worse OHRQoL. Children's behaviours and oral health perceptions are influenced by the environments where they live and grow up (Locker, 2007). Moreover, children's oral health outcomes are also influenced by mother's education level (Pine *et al.*, 2004). Adolescents with lower SES reported more oral symptoms (Jung *et al.*, 2011). The longitudinal study carried out by Gururatana and colleagues (2011b) found a direct relationship between SES and OHRQoL and a mediated effect of SES via SOC on OHRQoL in Thai children aged 10-14.

However, the lack of effect of SES on OHRQoL in this study supported the prospective longitudinal study carried out by Baker and colleagues (2010) who found a relationship between parental income and overall quality of life but not OHRQoL in Malaysian children.

One reason for the lack of apparent relationships may be because the sample was relatively homogenous for SES. Almost 70% of the children's parents had only attained primary school education and 55% had income lower than 5,000 baht/month. With little variability, any effect of SES on OHRQoL might be obscured. Another possible explanation is the reliability and precision of the measures. The measure of SES in this study was slightly adapted from one used in

the Sixth Thailand Oral Health Survey (Ministry of Public Health, Thailand, 2007). As for any measure, those testing the effect of SES on health must be appropriately constructed and cover different levels of SES (Shaver, 2007).

5.3.3 Relationships between socio-economic status and sense of coherence

SES did not predict SOC in this present study. Again this contrasts with evidence from previous research, which indicates that family environments are associated with the development of SOC. Higher socioeconomic environments during childhood influence and support the development of SOC in children and are positively correlated to a stronger SOC in adults (Feldt *et al.*, 2005; Sagy and Antonovsky, 2000; Volanen *et al.*, 2004; Volanen *et al.*, 2007).

One reason why SOC did not relate to SES may relate to the particular characteristics of SES assessed in the present study. Family environments involve many aspects such as parental education and work status, household income, the quality of parent-child relationships and parents' mental health and behaviours. Environmental factors that have been connected to SOC are the quality of relationships between parents and children (Volanen *et al.*, 2004). Families that are supportive of children and offer them opportunities to make decision contribute to the development of SOC. SOC is better associated with psycho-emotional circumstances than socioeconomic resources (Volanen *et al.*, 2004). However, quality of relationships was not evaluated in this study.

5.3.4 Relationships between sense of coherence and oral health beliefs

SOC and OHB were not related to one another in this study (Figure 24).

'Beliefs' are individual resources that dominate personal life by making differences in how people feel, think and act (Bandura, 1997). Beliefs make people more confident in what they believe or perceive. Nevertheless, the relationships between SOC and OHB in this research were not detected. The quality of the OHB scale may have masked relationships between these variables. The measure used in the present study was Broadbent and colleagues' scale (2006) but may not measure the children's beliefs. It seems to measure behaviours rather than beliefs. In addition, the internal consistency of OHB was quite low ($\alpha = 0.55-0.72$, ICC = 0.14-0.34 see section 4.2.7). A more appropriate OHB measure is needed for future research.

5.4 Methodological strength

Over the past two decades there have been studies investigating the role of SOC in dentistry, investigating relationships between SOC and oral clinical status, oral health behaviours and OHRQoL. Evidence from systematic reviews and high quality studies has related SOC to OHRQoL. However, no study has investigated the effect of an intervention to improve OHRQoL via SOC. This study is the first randomised controlled trial to investigate the effect of an intervention to enhance SOC and improve OHRQoL in children. Randomised controlled trials (RCTs) are the gold standard amongst studies collecting primary data to test the effect of interventions.

WHO (1998) has suggested that the use of the randomised controlled trials (RCTs) to evaluate health promotion may be inappropriate, misleading and unnecessarily expensive. The reasons behind this have included the strict control of environments leading to restricted external validity; the low power for subtle effects; the narrowly specified outcomes; the large samples needed and ethical dilemmas when withholding interventions.

Most studies evaluating the relationships between SOC and oral health are cross-sectional. Few are longitudinal. This study is the first study investigating the relationship between SOC and OHRQoL using an experimental design and has provided experimental evidence that SOC determines OHRQoL.

It has been suggested that theoretically driven research is essential in order to truly understand the relationships between variables that influence OHRQoL. This study is one of few studies within the field of dentistry that has tested the relationships between factors influencing OHRQoL in children using the Wilson and Cleary model (1995) that links clinical status and quality of life.

5.5 Methodological limitations

Like any research, these results should be considered with caution as there are several methodological limitations to this project.

Estimated sample size

The main idea behind sample size calculation is to have a high chance to detect differences as significant if true differences exist. Normally, the power of a hypothesis test is set between 80-90% to calculate the appropriate sample size for a given difference between groups (Altman, 1991). The sample size used in present study did detect significant differences in SOC and OHRQoL (primary outcomes) and thus it can be regarded as adequately powered. The study could not be powered a priori because this is the first study evaluating the effect of an intervention to enhance SOC in dentistry. In addition, cluster randomised trials require intra-cluster correlation coefficients or design effects to calculate appropriate sample sizes. This pilot study has provided the data on which future trials can be planned.

The follow-up period

The previous literature did not indicate an appropriate follow-up period for the intervention. At 3 months the effect of the intervention remained. It may be possible that the improvement of SOC may last longer. To evaluate how long the effect of the intervention lasts the further research having a longer follow up is needed.

Single item questionnaires.

Single items were used to measure children's global oral health and overall quality of life. Although these items had acceptable construct validity in relation to CPQ₁₁₋₁₄, single item measures are of limited use in SEM. Neither GHP nor QoL was analysed using SEM. Multi-item measures of these factors would be useful in subsequent research.

Factor analysis of the questionnaires

Factor analysis (Appendix D) indicated that for CPQ₁₁₋₁₄, most items loaded onto the four subscales proposed by Jokovic and colleagues (2002). This supports the use of CPQ₁₁₋₁₄ subscales in the analysis. In contrast, the SOC scale showed inconsistency of items loading onto the three components proposed by Antonovsky (1987).

Therefore, the subscales of SOC were not suitable for analysis separately. SOC could not be used as a latent variable but instead as an observed variable in SEM.

Cultural issues

Most instruments used in the current study were developed in western countries and then used in cross cultural studies. The CPQ₁₁₋₁₄ has been translated and widely used in Malay, German, Chinese, Arabic and Brazilian Portuguese (Baker *et al.*, 2010; Bekes *et al.*, 2012; Brown and Al-Khayal, 2006; Goursand *et al.*, 2008; McGrath *et al.*, 2008). The SOC questionnaire has been used in at least 33 languages and 32 countries (Eriksson and Lindstrom, 2005).

All questionnaires used in this study were translated from English to the Thai language. For example, the Thai version of CPQ₁₁₋₁₄ translated by Gururatana and colleagues (2011a).

However, translated and adapted versions may not be successful because of differences in expectations and culture (Touze *et al.*, 2006). For example, the word 'deep pleasure' in the SOC scale was not congruent in direct translation to the Thai language. Instead, a Thai word which means 'happy' was used. In another example, the OHB scale enquired about drinking fluorinated water, which is not used in Thailand. For the Thai translation of version of CPQ₁₁₋₁₄, the word 'klui', a Thai musical instrument was used instead of 'clarinet'.

To overcome these difficulties, rigorous translation procedures were performed so that translated versions were of high quality in Thailand. Back translations were repeated until the measures achieved high quality. Simple language was used for the children. Pretests of questionnaires were conducted in 13 children to test their validity and reliability.

Quality of the questionnaires

Although all questionnaires were tested in the pilot study, there were also some limitations of the mathematical properties of the questionnaires. The internal reliability of the measures varied. The CPQ₁₁₋₁₄ 37-item scale had high internal consistency ($\alpha = 0.90-0.93$) whereas the SOC scale had lower internal consistency ($\alpha = 0.63-0.75$). Low internal reliability, especially for OHB may be related to the small

number of items in the scale (6 items) (Reliability increases with more items). It has been suggested that any scale with at least 20 items can obtain a Cronbach's alpha of more than 0.7 despite small correlations between items.

Test-retest reliability represented by intraclass correlation coefficients (ICC) of CPQ₁₁₋₁₄ scale was acceptably higher than 0.6 but the others, SOC and OHB scales, were lower than 0.6. Low internal consistency (as seen in SOC and OHB) may decrease the validity and hence the discriminative power of an instrument. Likewise, low reliability may mask changes over time, so reducing instrument responsiveness. However, it should be noted that the key relationships hypothesised in this study, between SOC and OHRQoL were detected and responded to the intervention. To find these relationships despite limitations with the SOC scale suggests that the relationships were stronger than indicated by the effect sizes in the analyses.

Children

The children participating in this study were 10-12 years old. It was necessary to work with the children because they have their own perspectives, feelings and experiences that indicate ways to improve their oral health. Children have their own way to view life and health that differs from adults. In addition, they can give reliable information with regard to the impact of oral conditions on their daily living (Barbosa and Gaviao, 2008b).

Age specific instruments were used in this study because children at different ages differ in their cognitive, emotion and social skills (Barbosa and Gaviao, 2008b) which may affect the accuracy of children responses and lead to misclassification errors.

When using CPQ₁₁₋₁₄, the children found it difficult to remember that all items pertained to their teeth, lips, jaws or mouth. To minimise this risk the children were periodically reminded that the questions were about impacts of oral conditions. It is plausible that some children may have forgotten and answered without regard to oral disease.

The SOC scale may have confused the children because the use of 7-point Likert scales without explanations for the answers between 1 and 7 (see Appendix B). This

confusion was reduced by instructions from the researcher (ON). The children were asked to divide the answers into 2 sides before selecting a response. They were also allowed to choose the middle answer (score 4) if they thought it was right for them. A less complicated SOC scale with 16 items was introduced by Margalit (1998) for use in children aged 5-10 years. Although it is less complicated than the 13 item version used in this study, it may not have been suitable for the children in this study because of the age.

Finally, the children completed three questionnaires; CPQ₁₁₋₁₄, SOC and OHB scales, making a total of 56 items. This may have burdened them so that the results do not reflect their true feelings. Children may complete the scales just to meet the requirement. Nonetheless, to obtain the most accurate data, each questionnaire was given to the children separately in order to reduce their concern. A break time was created before answering each scale.

The intervention

The intervention in this study is the first to enhance SOC in relation to oral health. Therefore, the lack of previous work to call on for its design and length may have restricted its effect. It was devised from a literature search and educational advice. Further development and refinement before its use in other settings should be considered in terms of teaching styles and the specific activities. The effect of the intervention may be because of the teaching style of the intervention which directly contrasts with the typical teaching style in Thailand.

As has already been noted, the effect of all of these limitations would be to limit the effect of the intervention. The fact that the key relationships were evident (SOC and OHRQoL) and that the intervention apparently enhanced both SOC and OHRQoL indicates that these effects are powerful. It can be concluded that OHRQoL is determined by SOC and that the intervention was effective in improving both children's SOC and their OHRQoL.

Process evaluation of the intervention

There was an attempt to achieve high feasibility of the intervention by seeking the advice of the teachers on the appropriateness of the activities and the duration of the intervention. Teachers and students accepted the programme with enthusiasm and

they pressed strongly for its continuation after the experimental period was finished. However, an explicit process evaluation to assess the feasibility and acceptability of the intervention may be required in order to gain understanding of the dynamics of intervention delivery. Using valid qualitative methods, rich explanation may identify modifications to the programme if it is needed (Tones, 2000).

One way to evaluate the process of the intervention would be to adopt a mixed method approach. Such mixed methods utilise both qualitative and quantitative approaches in various ways including sampling procedures, types of data, collection procedures, data analysis and conclusions (Tashakkori and Creswell, 2007; Teddlie and Tashakkori, 2009). Using mixed methods studies for triangulation (e.g. data sources, researchers and methods triangulation) is likely to be more appropriate for evaluating oral health promotion as they improve confidence in research findings. Combining information from two sources (qualitative and quantitative) to identify consistency in results can provide powerful evidence of success as well as the process of change in the populations and organisations (Nutbeam, 1998). In the future, research combining with qualitative approaches (e.g. interviews with teachers, children, school managers and parents) can help researchers clearly understand and explain the whole picture of interventions in terms of observed effects and how the interventions work; that is, their mechanisms of action.

Chapter Six

Conclusions and Recommendations

This school-based cluster randomised controlled trial assessed the effectiveness of an intervention to enhance SOC on OHRQoL in children. In secondary analyses, predictors of OHRQoL were also identified using the theoretical Wilson and Cleary model (1995). Twelve primary schools were randomly allocated to intervention and comparison groups. The intervention comprised seven sessions over two months, focusing on child participation and empowerment. The first four sessions were classroom based and the last three involved working on healthy school projects. Interventions were delivered by six trained teachers who received an intensive one-day course. Data included socio-demographic and clinical data, OHRQoL, general health perceptions, overall QoL, SOC and oral health beliefs were collected at baseline, within two weeks after the intervention and at 3-month follow-up.

This study has contributed to current knowledge by providing results about enhancing OHRQoL via SOC. It is the first study to evaluate the effect of an intervention to enhance SOC and improve OHRQoL and provides experimental evidence that SOC influences OHRQoL. Moreover, the study confirmed important predictors of OHRQoL in children.

6.1 Conclusions

6.1.1 The effectiveness of an intervention to enhance SOC and OHRQoL

The primary aim of the study was to assess the effect of an intervention to enhance SOC on OHRQoL.

The school-based intervention established in this study enhanced SOC and improved OHRQoL in children aged 10-12 year olds. The intervention group had significantly higher SOC accounting for 6.39 SOC points at two weeks post the intervention and 4.05 SOC points at 3 month follow-up and better OHRQoL accounting for 6.07 CPQ₁₁₋₁₄ points at two weeks after the intervention and 6.50 CPQ₁₁₋₁₄ points at 3 month follow-up than those in the comparison group.

The study provided experimental evidence that SOC determines OHRQoL. SOC is a possible avenue for oral health promotion and can be considered as a theoretical framework for health promotion as it enables individuals to take control over their lives by managing, identifying and organising health resources to improve and maintain their health together with developing supportive environments.

6.1.2 Conclusions regarding the predictors of OHRQoL within the Wilson and Cleary model

The secondary aim of the study was to identify predictors of OHRQoL in Thai 10-12 year old children.

In structural equation modelling, SOC predicted OHRQoL at 3 month follow-up. Children with greater SOC had fewer symptoms and less functional impacts, representing better OHRQoL than those with lower SOC.

Socioeconomic status did not predict OHRQoL in this study. One possible explanation may be because of the homogenous socioeconomic status of the sample. Clinical status was unrelated to OHRQoL. The possible explanations for this finding may include the low level of disease, too small sample size, two distinct concepts of disease and health and interactions with other factors (detailed in section 5.3.1).

6.2 Recommendations

The recommendations are detailed as follows.

6.2.1 Recommendations for policy

6.2.1.1 Sense of coherence as a framework for health promotion

Salutogenesis warrants further investigation as a framework for oral health promotion.

6.2.1.2 Training in psychological approaches

- Psychological approaches should be further developed to help health professionals to improve population health. Providing dental health professionals with psychological knowledge and combining interventions to enhance psychological factors such as SOC in the health promotion programmes may improve OHRQoL in children.

- Theory should be used to develop and evaluate health promotion interventions

6.2.2 Recommendations for research

- Longer follow-up periods (i.e. at least 6 months) are required to evaluate the effectiveness of this intervention.
- Further studies that evaluate the effect of interventions to enhance SOC on OHRQoL are required in other settings to confirm the effect of SOC on OHRQoL.
- Further studies that evaluate the effect of the intervention to enhance SOC on OHRQoL in high disease samples may be needed.
- Further research with qualitative components would enhance evaluations of the process and effectiveness of the intervention.
- Further refining of the intervention is required, especially for use in other country settings.
- There may be other ways to enhance SOC. Further research may consider various ways to develop and evaluate other SOC interventions.
- Further development of the process evaluation for the SOC intervention is required.

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Appendix A

Research information sheet

Children assent form

Parent consent form

Research Information Sheet

The effect of an intervention to enhance sense of coherence on oral health related quality of life: a cluster randomised controlled trial

Hello!

- You (and your parents) are being asked to help us with a project
- Before you decide if you would like to take part it is important for you to understand what the study is about.
- Please read this information carefully and discuss it with others if you want.
- Please ask us if there is anything you do not understand or you would like more information.
- Take time to decide whether or not you wish to take part.
- Thank you for reading this.

Why is this project being done?

We have discovered that some children are troubled in their everyday life by their mouths even though there is nothing wrong with their mouths. We want to find out and ease this problem by helping children understand about their mouths.

Why have I been chosen?

You have been chosen because you are in fifth grade in primary schools in Khonkaen. We are asking around 200-300 children to join in this study. You are not the only one!

Do I have to take part?

No! It is up to you if you want to take part.

What will happen if we take part?

This study will be conducted in twelve schools. They will be divided into two groups. Everyone will have the same chance of going into each of the two groups. If you decide to take part, for first group, you will have a dental check up and be asked to answer some questionnaires. Moreover, you will be asked to take part in some lessons and play some games to help you understand your mouth. Around 2 months after completing the first copies of the questionnaires you will be asked to answer the question again. Three months after completing the second copies of the questionnaires

you will receive the oral examination and be asked to answer the third copies of questionnaires. For the other group, you will be asked to do the same as in the first group but you might not do some lessons and play some games.

Might anything about the project upset me?

No! We will only ask you to think about yourself. You might take part in some lessons and play some games to help you understand your mouth. However, you do not have to do anything you do not want to.

Will being in this study help me?

The study may not help you but the things you tell us will help us to understand the impact of oral diseases or oral conditions on children's lives. This information will be useful if we can help other children.

What will happen when the study stops?

When the study has finished we will look at all the questionnaires completed by children and their parents as well as the oral examination reports. We will write some reports on our findings and send you and your parents a copy!.

What if something goes wrong during the project?

We cannot see anything going wrong during this study. But if there is anything going wrong we will take responsibility for whatever has happened. Moreover, if you or your parents feel unhappy about anything with this study, we will be very happy to talk to you at anytime. You are also free to stop being in the study at anytime.

Did anyone else check the study is OK to do?

Before commencing the study, it has to be checked by a special group of people called an Ethics Committee. They make sure that the study is OK to do. This study has been checked by the Ethical Review Committee for Research in Human Subjects: Ministry of Public Health, Thailand.

Will anyone else know they are taking part?

The people who will know you are taking part will be only researchers. All information collected about you and your parents during the study will be kept privately. Nevertheless, if you mention anything that concerns us about your safety we may need to discuss these concerns with other people.

What if me and my parents don't want to do the study anymore?

If you do not want to do the study anymore, you can stop at any time without giving any reason.

Contact details

Dr Orawan Nammontri at the Sirindhorn College of Public Health, Khonkaen.

90/1 Anamai Road, Amphor Muang, Khonkaen, 40000 or

Telephone number: 0-4322-1770, 0-4322-1493, 0-4322-2741

Email address: Orawann16@hotmail.com

Thank you for reading this!

Participant Identification Number.....

Child Assent Form

Title of Project: The effect of an intervention to enhance sense of coherence on oral health related quality of life: a cluster randomised controlled trial

Name of Researchers: Dr Orawan Nammontri, Professor Peter G Robinson
Dr Sarah Baker

Please tick box

1. I have read and understand the information sheet and I have had the opportunity to ask questions.
2. I understand that I do not have to take part in the study and that I can stop at any time.
3. I understand that my answers will be private.
4. I agree to take part in the above study.

_____	_____	_____
Name of Participant	Signature	Date

_____	_____	_____
Orawan Nammontri	Signature	Date

(Please keep one copy and send one copy back)

Participant Identification Number.....

Parent/Guardian Consent Form

Title of Project: The effect of an intervention to enhance sense of coherence on oral health related quality of life: a cluster randomised controlled trial

Name of Researchers: Dr Orawan Nammontri, Professor Peter G Robinson
Dr Sarah Baker

Please tick box

1. I confirm that I have read and understand the information sheet dated for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.
3. I understand that my answers will be private.
4. I agree to take part in the above study.
5. I agree for my child to take part in the study.

Name of Participant

Signature

Date

Orawan Nammontri

Signature

Date

(Please keep one copy and send one copy back)

Appendix B

Ethical approval



The Ethical Review Committee for Research in Human Subjects
Ministry of Public Health, Thailand

Title of Project : The effect of an intervention to enhance sense of coherence on oral health related quality of life: an exploratory study.

Protocol Number : Ref.no. 91/2552

Principle Investigator : Ms. Orawan Nammontri

Place of proposed study : Ban Lengpay School Ban Saard School
Ban Nongkram School Ban Nonghin School
Ban Buengkae School Ban Donbom School
Ban Puep School Prakueknongpowittaya Shool
Bungnaemkrinun School Ban Kotha School

Document Approved :

1. Thai Protocol edition version 1, date 29 October 2009
2. Parent's Information Sheet editon version 2, date 17 December 2009
3. Child Information Sheet edition version 2, date 17 December 2009
4. Parent/Guardian Consent Form edition version 1, date 27 October 2009
5. Child Assent Form edition version 1, date 27 October 2009
6. Handbook for teachers delivering the intervention to enhance sense of coherence in children
7. Case record form
8. Clinical examination form
9. Parent's Questionnaire
10. Impact scale of oral health to quality of life in child population
11. Enhance sense of coherence Questionnaire

We also confirm that we are an ethics committee constituted in agreement and in accordance with the ICH-GCP.

The Ethical Review Committee for Research in Human Subjects Ministry of Public Health, Thailand had reviewed protocol. In ethical concern, the committee has reviewed and approved for implementation of the research study as above mention, therefore the Thai protocol will be mainly conduct. The protocol must be approved by continuation review for the duration of one year until expired.

Tanongsan Sutatam

Chairman

(Mr. Tanongsan Sutatam)

Pakorn Siriyong

Secretary

(Mr. Pakorn Siriyong)

Appendix C

Clinical examination forms

Questionnaires: CPQ₁₁₋₁₄, SOC and OHB scales

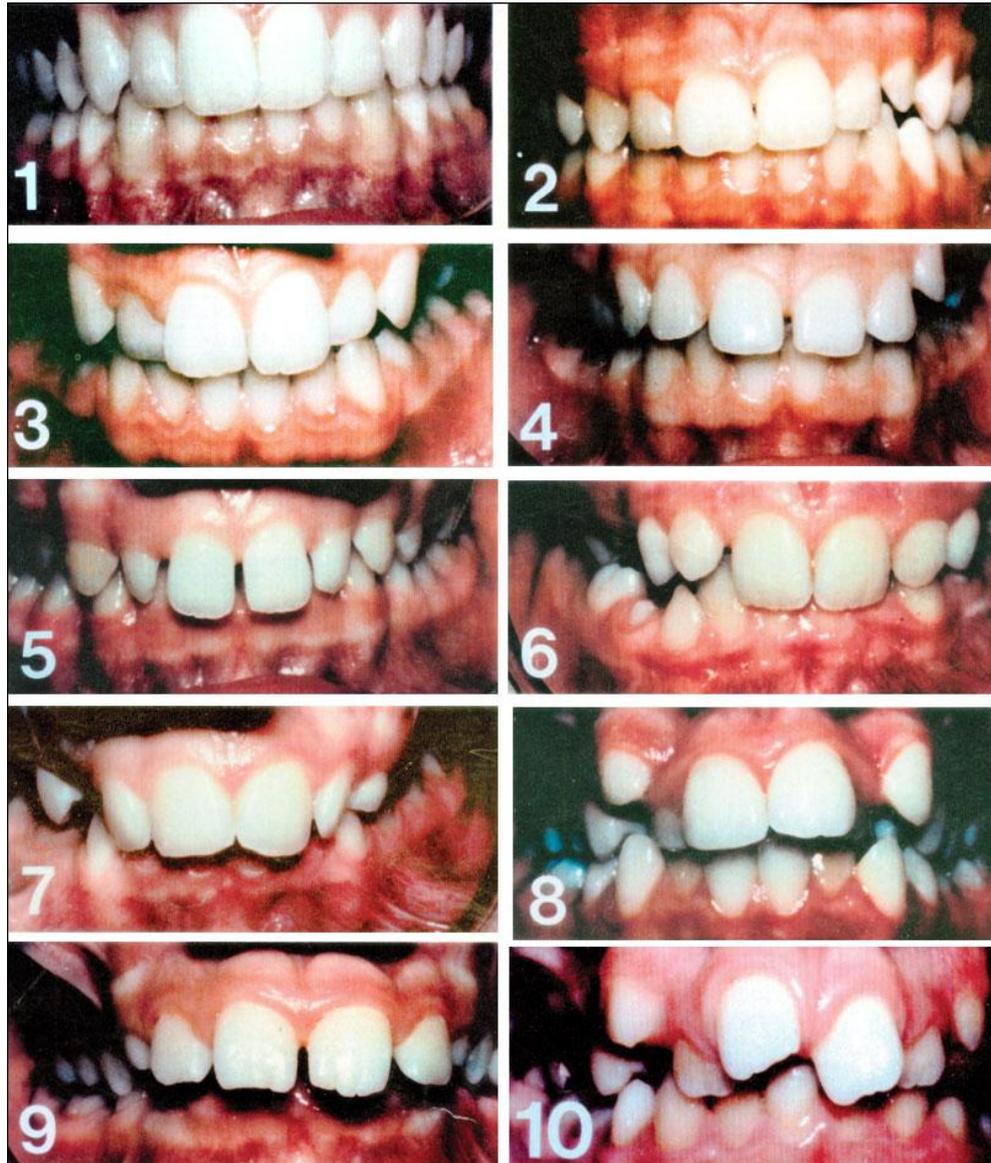
Caries status codes

Codes	Status
0	Sound
1	Decayed
2	Filled, with decay
3	Filled, no decay
4	Missing, as a result of caries
5	Missing, any other reason
6	Fissure sealant
7	Bridge abutment, special crown or veneer/implant
8	Unerupted tooth, (crown),unexposed root
T	Trauma (fracture)
9	Not recorded

Treatment need codes

Codes	Treatment
0	None
P	Preventive, caries-arresting care
F	Fissure sealant
1	One surface filling
2	Two or more surface fillings
3	Crown for any reason
4	Veneer or laminate
5	Pulp care and restoration
6	Extraction
7	Need for other care (specify).....

Aesthetic component of the IOTN



Questions for parents/guardians

We would like to know whether the way young people think about their mouths is affected by their parents' education, career and income.

1. How many children do you have?

2. What is your relationship with the children?

- | | |
|--|--------------------------------------|
| <input type="checkbox"/> Father | <input type="checkbox"/> Mother |
| <input type="checkbox"/> Grandfather | <input type="checkbox"/> Grandmother |
| <input type="checkbox"/> Other (please state)..... | |

3. Please tick one box that best describes father 's education

- Primary school (Grade 1-6)
- Matthayom 1-3 or equally (Grade 7-9) or equally
- Matthayom 4-6 or equally (Grade 10-12) or equally
- Undergraduate
- Postgraduate

4. Please tick one box that best describes mother's education

- Primary school (Grade 1-6)
- Matthayom 1-3 or equally (Grade 7-9) or equally
- Matthayom 4-6 or equally (Grade 10-12) or equally
- Undergraduate
- Postgraduate

5. Please tick one box that best describes your occupation

- | | |
|--|--|
| <input type="checkbox"/> Officials | <input type="checkbox"/> Government enterprise |
| <input type="checkbox"/> Personal business | <input type="checkbox"/> Employee |
| <input type="checkbox"/> Unemployed | <input type="checkbox"/> other (please state)..... |

6. How much salaries or wages do you have on average per month?

- | | |
|---|---|
| <input type="checkbox"/> ≤ 5000 baht | <input type="checkbox"/> 5001-10000 baht |
| <input type="checkbox"/> 10001-15000 baht | <input type="checkbox"/> 15001-20000 baht |
| <input type="checkbox"/> > 20000 baht | |

Questionnaires

Hello,

Thanks for agreeing to help us with our study!

We have discovered that some children are troubled in their everyday life by their mouths even though there is nothing wrong with their mouths. We want to find out and ease this problem by helping children understand about their mouths.

PLEASE REMEMBER

- Don't write your name on the questionnaire
- This is **not a test** and there are no right or wrong answers
- Answer as **honestly** as you can. Don't talk to anyone about the questions when you are answering them. Your answers are **private**; no one you know will see them

Part I : Few questions about you

Please tick one box for each question

1. Are you a boy or a girl?

- Boy Girl

2. How old are you? Date of Birth (dd/mm/yy)

3. We would like to know whether the way young people think about their mouths

is affected by their background and culture.

Please tick one box that best describes your ethnic group

- Thai Thai-Chinese Thai-Malaysian
 Other (please state).....

4. Would you say the health of your teeth, lips, jaws and month is:

- Excellent
 Very good
 Good
 Fair
 Poor

5. How much does the condition of your teeth, lips jaws or month affect your life overall?

- Not at all
 Very little
 Some
 A lot
 Very much

Part II : Child Perceptions Questionnaire

- Read each question **carefully** and think about your experiences in the **past 3 months** when you answer
- Before you answer, ask yourself: “**Does this happen to me because of problems with my teeth, lips, mouth or jaws?**”
- Please tick one box for the answer that is best for you or fill in the blank with a suitable answer

Questions about oral health problems

In the past 3 months, how often have you had

6. Pain in your teeth, lips, jaws or mouth?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

7. Bleeding gums?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

8. Sores in your mouth?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

9. Bad breath?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

10. Food stuck in or between your teeth?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

11. Food stuck in the top of your mouth?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

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

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

12. Breathed through your mouth?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

13. Taken longer than others to eat a meal?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

14. Had trouble sleeping?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

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

15. Difficult to bite or chew food like apples, guavas, corn on the cob or roasted pork?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

16. Difficult to open your mouth wide?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

17. Difficult to say any words?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

18. Difficult to eat foods you would like to eat?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

19. Difficult to drink with a straw?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

20. Difficult to drink or eat hot or colds foods?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

Questions about feelings about yourself

Have you had the feelings because of your teeth, lips, jaws or mouth? If you had this way for another reason, answer 'Never'

In the past 3 months, how often have you

21. Felt irritable or frustrated?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

22. Felt unsure of yourself?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

23. Felt shy or embarrassed?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

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

24. Been concerned what other people think about your teeth, lips mouth or jaw?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

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

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

26. Been upset?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

27. Felt nervous or afraid?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

28. Worried that you are not as healthy as others?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

29. Worried that you are different than other people?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

Questions about schools

Have you had these experiences because of your teeth, lips, jaws or mouth? If was for another reason, answer 'Never'

In the past 3 months, how often have you

30. Missed school because of pain, appointments, or surgery?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

31. Had a hard time paying attention in school?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

32. Had difficulty doing your homework?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

33. Not wanted to speak or read out loud in class?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

Questions about your spare-time, activities and being with other people

Have you had these experiences because of your teeth, lips, jaws or mouth? If was for another reason, answer 'Never'

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

34. Avoided taking part in activities like sports, clubs, drama, music, school trips?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

35. Not wanted to talk to other children?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

36. Avoided smiling or laughing when around other children?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

37. Had difficulties playing a musical instrument such as recorder, flute, clarinet, klui and trumpet?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

38. Not wanted to spend time with other children?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

39. Argued with other children or your family?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

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

40. Other children teased you or called you names?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

41. Other children made you feel left out?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

42. Other children asked you questions about your teeth, lips jaws or mouth?

- Never
- Once or twice
- Sometimes
- Often
- Everyday or almost every day

Part III: Questions about your life orientation

Please tell us how do you feel? Circle from options 1 to 7 the one best describing your opinion.

43. Do you have the feeling that you don't really care about what goes on around you?

1	2	3	4	5	6	7
Very seldom or never						Very often

44. Has it happened in the past that you were surprised by the behaviour of people you thought you knew well?

1	2	3	4	5	6	7
Never happened						Always happened

45. Has it happened that people whom you counted on disappointed you?

1	2	3	4	5	6	7
Never happened						Always happened

46. Until now your life has had:

1	2	3	4	5	6	7
No clear goals or no purpose at all						Very clear goals and purpose

47. Do you have the feeling that you're being treated unfairly?

1	2	3	4	5	6	7
Very often						Very seldom or never

48. Do you have the feeling that you are in an unfamiliar situation and don't know what to do?

1	2	3	4	5	6	7
Very often						Very seldom or never

49. Doing the things you do every day is:

1	2	3	4	5	6	7
A source of deep pleasure and satisfaction						A source of pain and boredom

57. Using fluoride toothpaste

- Extremely important
- Fairly important
- Not very important
- Not at all important

58. Visiting dentist regularly

- Extremely important
- Fairly important
- Not very important
- Not at all important

59. Keeping the teeth and gum very clean

- Extremely important
- Fairly important
- Not very important
- Not at all important

60. Using dental floss

- Extremely important
- Fairly important
- Not very important
- Not at all important

61. Drinking fluoridated water

- Extremely important
- Fairly important
- Not very important
- Not at all important

We appreciate the time and thought you have given to this questionnaire

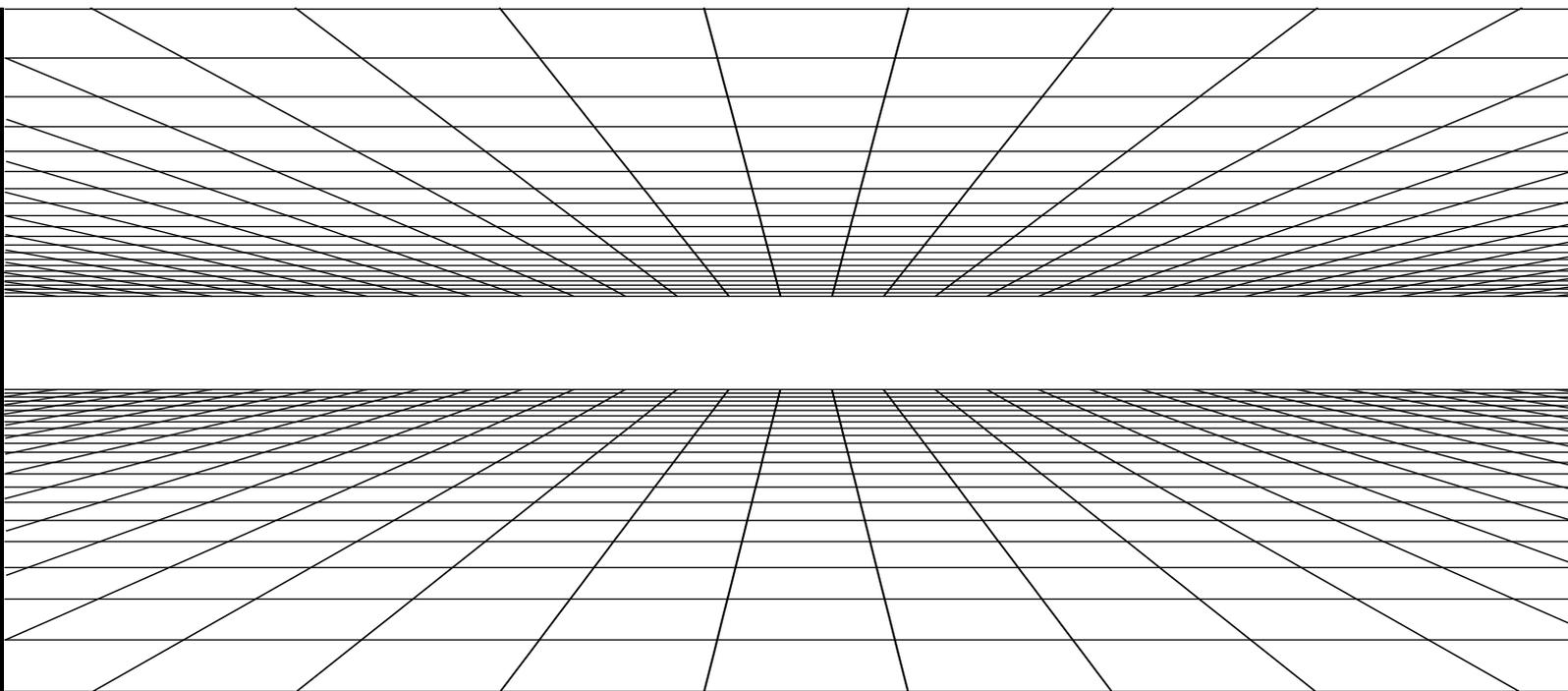
THANK YOU FOR HELPING US!

If you have any other comments about this questionnaire, please write them in the space below.

Appendix D

A handbook for teachers delivering the intervention
to enhance sense of coherence

**A handbook for teachers delivering the
intervention to enhance sense of coherence
in children**



Orawan Nammontri

School of Clinical Dentistry

University of Sheffield

2010

Acknowledgements

I would like to thank you all teachers for reading this handbook and delivering the intervention to enhance sense of coherence in children. I am very grateful for your time and your attention throughout this process of my research.

Overview

This handbook is written for teachers who will deliver an intervention to enhance sense of coherence in fifth grade children in primary schools. It consists of two main parts: 1) basic information about health, oral health and oral health related quality of life , including the definition and determinants of health focusing on an individual characteristic, sense of coherence (SOC). 2) A guide to an intervention to enhance sense of coherence. The intervention contains seven sessions with their own aims, objectives, explanatory terms, activities and resources.

Contents

Part 1 Basic information of health, oral health, oral health related quality of life and their determinants

Session 1: An introduction to health

Session 2: An individual characteristic; sense of coherence (SOC)

Part 2 Intervention to enhance sense of coherence (SOC) in children

Session 1: Healthy mouth

Session 2: Face games

Activity 1: Taking photos of children

Activity 2: Writing nice things about people

Session 3: Name Calling

Activity 1: Making masks

Activity 2: Role playing

Session 4: Changing my life

Session 5: Healthy school Part I (Brain storming)

Session 6: Healthy school Part II (Planning, Implementing)

Session 7: Healthy school Part III (Evaluation)

Part 3 Resources

References

Part I

Basic information of health, oral health, oral health related quality of life and their determinants

Introduction

This part of the handbook will give you a clearer picture of ideas about health, including oral health and oral health related quality of life. It will also describe things that influence the health of the population. An individual characteristic, sense of coherence has been found to be an important psychological factor influencing oral health related quality of life. You will investigate:

- What is the definition of health, oral health and oral health related quality of life?
- What affects health, oral health and oral health related quality of life?
- How psychological factors such as sense of coherence (SOC) influences health, oral health and oral health related quality of life?

This part of the handbook includes two sessions:

Session 1: An introduction to health, oral health and oral health related quality of life

Session 2: An individual characteristic; sense of coherence (SOC)

Session 1: An introduction to health, oral health and oral health related quality of life

Aim:

To provide a foundation of health, including oral health and oral health related quality of life by providing the concepts and determinants of health

Objectives:

By the end of this section, you will be able to

- explain health appropriately
- identify the important factors influencing health, oral health and oral

health related quality of life (OHRQoL)

Explanatory terms:

Well-being is a state of healthy, happiness and prosperity.

Physical well-being is a state of forceful body that can function perfectly such as walking, running and eating without any problems.

Mental well-being is a state of mind related to the ability of people to think clearly, coherently and realistically.

Social well-being is a state of human that can make and maintain relationships with other people.

Health is a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity.

Health related quality of life is the main outcome of health measurement that refers to the quality of life affected by health and its determinants.

Determinants of health are factors influencing health such as individual factors, social factors and biological and physiological factors.

Oral health related quality of life is the impact which oral health or disease has on individuals' daily functioning, well-being or life quality.

Tooth decay or dental caries is the most common oral disease where bacterial processes damage tooth structure, producing holes in the teeth. Dental caries can cause pain, tooth loss, infection and in severe cases, death.

Periodontitis is an inflammatory disease affecting tissues and bones that surround and support teeth. It can lead to the loosening and subsequent loss of teeth.

Plaque is a substance containing bacteria that forms on the surface of the teeth and mouths. It is the major cause of tooth decay, periodontal diseases, including periodontitis and mouth odour.

Health means different things to different people. In the past the medical research emphasised diseases of cells, organs and organ systems. This way of seeing the world believes that people stay well until they encounter a virus, bacteria or an accident which can cause diseases. Therefore, clinical assessments are used to identify the abnormalities and clinical variables are used to explain health. Health is described simply as the state of the absence of diseases.

We all know that health is considered extensively beyond diseases. There are several things used to explain health besides the absence of diseases. The following activity will help you know health broadly in different dimensions.

Activity 1: You are going to find out what being healthy means to you by doing the following exercise.

1. Tick any of statements in column 1 which you think it is a feature of being healthy.
2. Work in pairs by comparing your lists with a partner teacher, discuss about reasons why you ticked on each statement and make an agreement mutually by ticking any of statements in column 2.
3. You and other teacher help each other define health and use the same principle to define oral health

Exercise: What does being healthy mean to you?

In column 1, tick any of statements which you think are the features of health.

<i>For me, being healthy involves:</i>	Column 1	Column 2
1. Having a job	-----	-----
2. Enjoying being with my family and friends	-----	-----
3. Living to a ripe old age	-----	-----
4. Hardly ever taking tablets or medicines	-----	-----
5. Being the ideal weight for my height	-----	-----
6. Feeling at peace at myself	-----	-----
7. Never smoking	-----	-----
8. Never suffering from anything more serious than a mild cold, flu or stomach upset	-----	-----
9. Having clear skin, bright eyes and shiny hair	-----	-----
10. Talking to other people without embarrassment due to healthy mouth (i.e. no bleeding gum, fresh breath)	-----	-----
11. Hardly ever going to the doctor	-----	-----
12. Not getting things confused or out of proportion-assessing situations realistically	-----	-----
13. Enjoying my work without much stress or strain	-----	-----
14. Enjoying some form of relaxation/recreation	-----	-----
15. Having all parts of body in good working conditions	-----	-----

Compare your lists with a partner teacher.

By looking at each other's answers you can see that health is much more than not having disease. People can have diseases but regard themselves as healthy (e.g. with a cold) or be very healthy but feel sick (e.g. morning sickness).

Summary

Health means different things to each people. All of above are the features of health but are in different dimensions of health, for example, physical health such as having all parts of body in good working conditions and the absence of diseases, mental health such as assessing situations realistically and living without much stress or strain and social health such as enjoying being with family and friends and getting on well with other people.

'Health' was defined by the World Health Organization (WHO) as a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1948).

In relation to oral health, it is described by using the same principle above as a comfortable and functional dentition that allows individuals to continue their social role. These ideas see oral health as not only the absence of oral diseases such as tooth decay and gingival diseases but also the interaction between the state of the mouth and everyday life which can be summarised as oral health related quality of life (OHRQoL).

Oral health related quality of life is the impact which oral health or disease has on individual's daily functioning, well-being or life quality. Oral diseases and oral conditions such as tooth loss, gingival disease, tooth decay and malocclusion can make people avoid eating food in front of other people, restrict smiling and talking in public and lose the confidence to do any things with others. These can lead to poor quality of life. However, people with some oral diseases such as tooth decay and gingivitis may not have poor oral health related quality of life. There are several factors influencing health, oral health and oral health related quality of life.

Additionally, health, oral health and oral health related quality of life can be changed all the time. It is continuum: a movement towards the health poles (ease/dis-ease) not dichotomous ends (healthy/illness).

The following activity will help you identify the factors influence health, including oral health and oral health related quality of life. These factors can be grouped as biological and physiological factors, environmental factors and individual factors.

Activity 2: Read three given stories and then work in pair to list all factors influencing individual's general and oral health and write down on the paper.

Exercise: Factors influencing general health and oral health

Story I Dang is 12 years old and will soon be leaving school to further his study in secondary school. He lives with his parents who are both working in the city. They have a very comfortable standard of living. Dang is confident, bright and popular. His oral health is very good. He brushes his teeth regularly twice daily and takes at least 5 minutes each time. He has only one filling and his oral hygiene is sound. He attends the dentist on a regular basis.

Story II Som and Ton are both in their mid-twenties and have one daughter aged of five, Chompoo. Ton left school with no qualifications and has never been able to find any permanent work. Som has a part-time job in the local supermarket. Chompoo likes candies very much. She always eats them and often forgets to brush her teeth before going to bed. She has had toothache due to tooth decay for several weeks, and recently attended the local hospital where she had six teeth removed under a general anesthetic. Both Som and Ton are frightened of going to the dentist but they are very anxious that their child should have good teeth.

Story III Tae, a pensioner, is 65, and lives in his house with his wife Tan. He has smoked for the last 50 years and enjoys drinking the liqueur with his neighbours. He has been diagnosed as diabetes and hypertension patient and has taken medicines regularly for 3 years. He is edentulous because his teeth were removed consecutively for the last 10 years due to severe periodontitis. He has worn his present set of dentures for 5 years. For the last two months he has noticed a white mark on the side of his tongue but as this has not caused him any pain or discomfort

he has not bothered going out to the doctor. He last saw a dentist when he had his denture fitted.

List all factors influencing these individuals' general and oral health
Try to group these different factors under suitable subheadings such as biological factor, individual factor and environmental factor.
How do these different factors relate to each other?

The story modified from Daly *et al.* (2002). 'Essential Dental Public Health' p. 22 Oxford University Press.

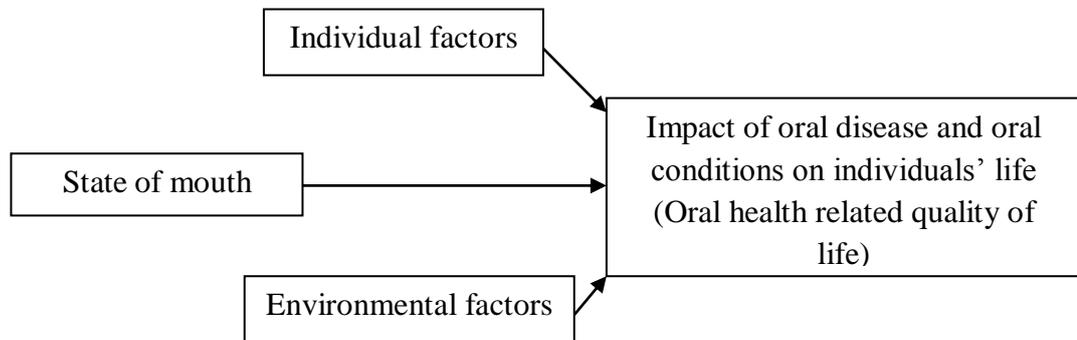
Summary

When asking what factors determine health and oral health, many people always focus on the use of effective drugs, high-tech equipment and health services which are related to biological factors causing diseases. Indeed, medical and dental treatments have contributed only 17% to gain life expectancy. The key factors are not only biological factors resulting in diseases but also individual factors such as individual beliefs and behaviours as well as social, economic and environmental factors that can affect general health and oral health.

The most common oral diseases, dental caries and periodontal diseases, are caused by plaque which is the substance containing bacteria that forms on the surface of the teeth and mouths. Plaque can cause symptoms such as bad breath, bleeding gums, toothache and tooth loss as a consequence. These symptoms can worsen the function of the mouth such as restriction of chewing and eating, make individual lose confidence to talk, smile and do anything with others because of the unhealthy mouth and thus decrease oral health related quality of life.

Plaque is disease aetiology but we are thinking about oral health related quality of life. Individuals with oral diseases may not always have poor oral health related quality of life. In the mean time, people may have oral health related quality of life problems in the absence of clinical problems such as toothache without clinical abnormality.

Another important factors besides plaque or any disease aetiology, for example, individual factors such as self-esteem, oral health beliefs, sense of coherence and personal behaviours, and environmental factors such as parent's education, income and work status can influence oral health related quality of life particularly in children.



The diagram above shows the set of factors influencing oral health related quality of life. To improve the oral health related quality of life, it is necessary to modify the factors influencing oral health related quality of life. The individual factors are more likely to be changed easily when compared with others. Sense of coherence is an individual factor which plays an important role in oral health related quality of life. Enhancing sense of coherence may help children reduce symptoms and change their view of thinking and acting by mobilising resources around them and then improve their oral health related quality of life.

Session 2 Individual characteristics; sense of coherence (SOC)

Aim

To help you get better understanding of an important individual factor, sense of coherence (SOC) that influence oral health related quality of life.

Objectives

By the end of this session, you will be able to

- describe the features of sense of coherence (SOC)
- indicate the importance of sense of coherence (SOC)
- illustrate how sense of coherence influence oral health related quality of life

Explanatory terms:

Empowerment is to give individuals official authority to do something which makes people more confident and makes them feel that they are in control of their lives.

Comprehensibility is the extent to which students understand clearly what happen in their life such as understanding their health.

Manageability is the extent to which students can mobilise or organise resources such as knowledge, beliefs, coping strategy to meet their demands or cope with problems.

Meaningfulness is the extent to which students feel that their lives make sense emotionally. Difficulties and demands are worthy of effort, investing energy and engagement.

Self-esteem is the degree of feeling that people like and value themselves.

Self-efficacy is an individual's belief in his or her ability.

Activities:

Read the following information and discuss to each other

We have seen now the state of mouth can affect people's quality of life. But it is also influenced by the way people think (individual factors) and the environment they live in.

Sense of coherence (SOC) is a personality trait to view life as comprehensible, structural, manageable and coherent. It is a method of thinking and acting which can lead people to benefit, use and re-use resources to deal with their difficulties or problems. These resources involve knowledge, social support, coping strategies. SOC comprises three things: comprehensibility, manageability and meaningfulness.

- Comprehensibility is the extent to which individuals perceive the stressors or difficulties that they encounter as information that is structured, clear rather than chaotic.
- Manageability is the extent to which individuals perceive resources can meet their demands when they confront stressors such as diseases.
- Meaningfulness is the extent to which people feel that their lives make sense emotionally. Difficulties are worthy of effort, investing energy and engagement.

SOC is an individual resources influencing causes and healing from diseases by the ability to cope. It influences health behaviours that cause and prevent diseases, for instance, preventive behaviours such as eating healthy foods, taking exercise, taking care of personal hygiene and seeking for early treatment and compliance with health professionals.

In relation to oral health, adolescents with higher SOC are more likely to visit dentists for check-up than those who have lower SOC. Moreover, higher sense of coherence is associated with fewer oral health problems. SOC is an essential factor influencing oral health status and oral health behaviours. People with high SOC are less likely to be bothered by oral diseases and conditions than those with lower SOC.

To enhance sense of coherence, we need to act laterally by increasing some psychological factors such as self-esteem and beliefs. Facilitating children's participation and empowerment are believed to be the important method to enhance their feelings of sense of coherence.

Health promoting schools can help children increase their sense of coherence. They are models to help schools in relation to health issues. The approach is relatively extended beyond the formal health education curriculum to the consideration of the physical and psychosocial environment of schools. These ways of working within health promotion are focused on preventive and educational approaches as well as behaviour, environment and social changes. Schools can be healthy places by providing healthy environments and creating conditions through services, policies, physical and social circumstances that are conducive to better general and oral health. Health promoting schools can help children increase their knowledge and

awareness of health, enhance self-esteem and self-efficacy and develop attitudes and personal skills which are part of sense of coherence. The experiences and skills children have at school are more likely to be essential factors determining their health, oral health and oral health related quality of life.

Part Two

An intervention to enhance sense of coherence (SOC) in children

Introduction

This part of the handbook is written to help you deliver the intervention to enhance sense of coherence which is an individual characteristic that plays an important role to oral health related quality of life. People who have higher sense of coherence are more likely to have better oral health related quality of life than those with lower sense of coherence. Enhancing sense of coherence may help students improve their oral health related quality of life, reducing the impact of oral diseases or oral condition on their lives.

The intervention to enhance sense of coherence comprises seven sessions for fifth grade primary school children. Each session has its own objectives, materials and activities that teachers can use to improve sense of coherence in students. **The vital methods used in this section are focused on a participatory approach so that children take part in activities or events. The intervention is to empower students to give them confidence or power to do things.**

It follows that children should sit, learn and play with freedom. Teachers should motivate the children to participate in all activities, praise, support and encourage them when they do the hard work or complete each piece of their work, but the children should be encourage to talk and learn amongst themselves. The lessons should be more like play.

Session 1: Healthy mouth (Dental professionals will help to conduct this lesson alongside the teachers)

Introduction

This session is designed to help the children get a better understanding and awareness of their mouths. They will learn to think positively about themselves in relation to having healthy mouth that can make them eat and chew effectively and smile and talk confidently without embarrassment. In addition, the children will learn how to have healthy mouth by getting rid of plaque, which causes bleeding gum, dentine hypersensitivity and bad breath. They will learn actively how to brush their teeth effectively and check their cleanliness through the VDO clip run by dental professionals and teachers.

Aim:

The aim of this session is to increase student's understanding and awareness of their oral health

Objectives:

The students will be able to

- describe the features of healthy mouth
- explain the main cause of having an unhealthy mouth in terms of plaque accumulation and eating sugary food or confection
- demonstrate how to brush teeth effectively

Timing: 60 minutes

Resources: VDO clip related to plaque accumulation and food that benefit and worsen oral health, disclosing agent, tooth brushes, dental flosses, mirrors, reflection sheets

Explanatory terms:

Plaque is a substance containing bacteria that forms on the surface of the teeth and mouths and lead to oral health problems such as tooth decay, gingival disease and mouth odour.

Disclosing agent is a food dyne that stains plaque on children's teeth.

Activities:

Main (45 minutes)

You ask the children a question 'What does a healthy mouth mean to you?'

Students work in pair and discuss about what a healthy mouth mean to them and write down on the blank paper.

You ask for 2-3 volunteer students to read out their opinion about what a healthy mouth mean to them to the rest of the class.

You and your students summarise mutually about the meaning of the healthy mouth which is not only a set of normal clinical status such as no bleeding gum, no tooth decay, fresh breath and no food impaction but also good body image, smiling with confidence and talking to other people without embarrassment.

You ask a question ‘What do you think interferes with having a healthy mouth?’ to students and leave them to think about it for a minute.

You play a VDO clip related to plaque accumulation and food that benefit and worsen oral health to students.

You ask the same question ‘What do you think interferes with having a healthy mouth?’ and add the question ‘How do we get rid of it?’

You and students have an agreement that some food particular sugary food or confection can lead to unhealthy mouth in terms of the contribution to tooth decay. They will make plaque stick more easily on the tooth surface. Plaque is a main cause of an unhealthy mouth. It is a substance containing bacteria that forms on the surface of teeth and mouths and lead to bad breath, bleeding gum, caries and lack of confidence to smiling and talking to other people. It can be removed by brushing.

You introduce a disclosing agent to students as food dyne that helps students to locate plaque before applying this agent on students’ teeth.

Students inspect each other teeth after being applied with disclosing agent.

Students brush their teeth following the method recommended on the VDO clip before inspecting each other teeth.

Reflection (15 minutes)

You ask students with the following questions

- What did you learn today?
- What have you learned how to do today?
- What did you already know?
- How are you going to use these knowledge and skills?
- Imagine you are tired before you go to bed. How will you make sure

you clean your teeth?

Students write down their answers on a reflection sheet.

You ask students with the following question

- What else with your health could you apply this too?
- From 0 to 10, how many marks would you give yourself for this work?

Students discuss with friends and give themselves marks on the reflection sheet.
Finally, you raise all marks and give children toothbrushes and mirrors as reward.

Session 2: Face games

Introduction

This session is designed to help students increase their self-esteem and self-efficacy which are individual factors linked closely to sense of coherence. The lesson will be divided into two sessions: taking photos of children and writing nice things. The children will help each other increase their self-esteem and self-efficacy by writing the nice things on other children's photos.

Aim

The aim of this session is to increase students' self-esteem and self-efficacy

Objective:

The children will be able to

- think positively about themselves and others.
- increase in beliefs and confidence in their own ability and value.

Explanatory terms:

Self-esteem is the degree of feeling that people like and value themselves.

Self-efficacy is an individual's belief in his or her ability.

Timing: Split into two sessions:

- 1) Taking photos (30 minutes) (can be done in advance)
- 2) Writing nice things about people (40 minutes)

Resources: Digital camera, sticky glue, colourful paper, pens and pencils, pieces of paper for sticking a photo

Activity 1: (30 minutes)

Take a photo of every child and prepare for session 2

Activity 2: (40 minutes)

Main activity (30 minutes)

You remind students the photos they taken on the last session.

You divide class in half.

You give children contra-lateral photos.

You ask children to write nice things for others such as their good specific ability and good personality etc.

Children write nice things about persons around the photos.

You read out nice things.

Children have to guess who the person is.

You give children their photos

Reflection (10 minutes)

You ask student how they feel today

Children write privately how compliments make them feel

You ask students 'From 0 to 10, how many marks would you give yourself for this work?

Students give themselves marks on their photos.

You raise marks for children.

Session 3: Name Calling

Introduction

This session is designed to help children increase their self confidence which is an individual personality contributing sense of coherence. The lesson is divided into two sessions: making masks and playing act. The children will learn to improve their self confidence by reducing shyness, embarrassment and nervousness from teasing by others through the story between rabbits and elephants played by themselves.

Aim:

The aim of this session is to increase students' self confidence

Objective:

The children will be able to

- decrease shyness, embarrassment and being nervous

Explanatory terms:

Teasing is laughing at someone or saying unkind things about them because of joking.

Timing: Split into two activities 1) Making masks (30 minutes)

2) Roles Playing (40 minutes)

Resources: Colourful pieces of paper, pens, pencils, sticky glues, strings

Activity 1: Making masks (*30 minutes*)

You and children make masks together: elephants with trunks and rabbits with big teeth.

Activity 2: Roles Playing (*40 minutes*)

Main (20 minutes)

You remind children the masks they made on the last session.

Children are asked to work on small groups to play act:

Background: There are many kinds of animal live in the forest. Once elephants and rabbits meet for the first time. They immediately know that they will be best friends.

Scene: 1. Elephants and rabbits meet and introduce themselves by using their own name.

2. They start to get to know each other.
3. After one year they play with each other.
4. During playing they call each other silly names.

Reflection (20 minutes)

You ask students with the following questions:

- What names did they choose for the first time when they meet each other?
- What names did they make later?
- Why didn't they make up silly names for each at first time?
- Do they have silly names for their best friends?
- Do they have silly names for strangers?
- Why the difference?
- Is this teasing?

You facilitate a class discussion, so children see that calling names are names used by people to call each other when they feel familiar with each other or they really know well about someone. These names are just only used to call people. They don't mean anything that will make the children feel upset, embarrassed or nervous. Teasing is laughing at someone or saying unkind things about them because of joking.

Session 4: Changing my life

Introduction

This session is designed to increase children's belief in their own ability to control their lives. The children will learn to comprehend, rate their lives, and reckon their oral health through the story of the health continuum introduced by the teacher. Moreover, the children will think of any things they can do to improve their lives and oral health by mobilising any resources they have and complete their personal posters.

Aim:

The aim of this session is to empower children in relation to their ability and beliefs to control their lives.

Objectives:

Students will be able to

- increase their self confidence to organise their lives
- evaluate their life and oral health (comprehensibility)
- reinforce ideas of empowerment (manageability)
- plan their lives (manageability and meaningfulness)

Timing: 60 minutes

Resources: Personal posters, colour pens and pencils, blank pieces of paper

Activities:

Main (50 minutes)

You give students five minutes to think about their life that may be related to family, friends and schools.

You write the scale of 0 to 10 on the blackboard and ask the children 'How would you rate your life today?' on scale of 0 to 10 where 0 is worst or very dissatisfied and 10 is best or very satisfied?

Students are requested to write down a number they rate themselves as well as the reasons for this i.e. why not 6 instead of 3 or 5 not 8 on the blank paper.

You tell the students not to forget what they have done because they will be using the information later.

You ask the students whether any of the 'things I like about me' and 'three things I am good at' before giving them each a personal poster.

Students are asked to work on their own posters.

After that you introduce health as a continuum: a movement towards the health poles (ease/ dis-ease) not dichotomous ends (healthy/illness).

You give an example to the children. For instance, people with medical problems such as heart diseases and oral diseases such as tooth decay can be happy even though they have abnormalities. It depends on the ability of people to cope with their problems such as seeking for useful information that help them take a good care of themselves, behaving in the right way to prevent the complication or reduce symptoms. People who pay attention to themselves and believe in their ability are more likely to take more control over their life than those who ignore themselves and believe in others such as fate and luck.

You ask students the same questions but specific to oral health as ‘How do you rate your oral health today?’

Students are requested to write a number they rate themselves as well as the reasons for this i.e. why not 6 instead of 3 or 5 not 8?

You ask students ‘What do you need to do more to move yourself in relation to your life towards 10?’ and ‘What do you need to do more to move yourself in relation to your oral health towards 10?’

Students write what they can do in order to have a better life and better oral health on the poster.

Students present their own information to you and other students.

Reflection (10 minutes)

You ask students about what they have learnt today and how important it is.

You ask students ‘From 0 to 10, how many marks would you give yourself for this work?’

You raise marks for the children.

Overview for sessions 5 to 7

The following three sessions, sessions 5-7, are related to a project that children will carry out at their schools. They will apply what they have learnt from the previous sessions for other students by conducting projects in order to make healthy schools.

Health promoting schools in other words, healthy schools are models to help schools in relation to health issues. The approach is relatively extended beyond the formal health education curriculum to the consideration of the physical and psychosocial environment of schools. These ways of working within health promotion are focused on preventive approaches, behaviour changes, educational approaches, empowerment and social changes. Schools can be healthy places by providing healthy environments and creating conditions through services, policies, physical and social circumstances that are conducive to better general health and oral health. Health promoting schools can help children increase their knowledge and awareness of health, enhance self-esteem and self-efficacy, develop attitudes and personal skills. The experiences and skills children have at school are more likely to be essential factors determining their health, oral health and oral health related quality of life.

The aim of these three sessions is to encourage and empower students to do the projects that they can gain experience from. Working on healthy school projects can help children increase their knowledge and awareness of health, enhance self-esteem, and self-efficacy and develop attitudes, coping strategies and personal skills. All of these can strengthen sense of coherence.

Session 5: Healthy school part I (Brain storming)

This session will increase students' knowledge and awareness of health. They will review the information of health and oral health they had from previous sessions and apply them for other students.

Objective: To increase students understanding of their health (comprehensibility) and apply what they have learnt for others (empowerment)

Timing: 60 minutes

Resources: Blank pieces of paper, colour pens

Activities:

You remind the children what they have learnt in the course such as the information of plaque in terms of the cause of oral diseases and oral conditions such as tooth decay, bleeding gum, bad breath and lack of confidence to talk and smile to others people, the method to remove plaque by effective teeth brushing, kinds of food that benefit and worsen oral health and the idea to change or improve better life, including oral health.

You introduce the idea of creating a healthy school by providing healthy environment through services, policies, physical and social conditions that are conducive to better general health and oral health such as brushing after lunch, healthy packed lunches and eating healthier at school.

The class is divided into small groups and given a chance for each to think about the current situation in school regarding health, including oral health and what they are going to do for healthy school.

Students brainstorm the projects or campaigns they could do to promote a healthy school.

Students write objectives, materials, method and desired outcomes.

The children present what they are going to pursue and how.

Session 6: Healthy school part II (Planning and implementing)

The children will help each other plan the projects they took the responsibility and implement the projects for other children. They will learn to set a goal for their projects and manage things such as time, budget, places and any materials in order to achieve the goal. This can contribute the children's ability to control their lives, increase their self-efficacy and self-esteem.

Objective: To increase students' ability of planning and management.

Preparation: You need to talk to a head teacher about the possibility of students' projects in schools, including any support such as a budget, a period and places. This can help you know beforehand that what projects are more likely to be done at the school by the children.

Timing: Split into two sessions: Planning projects (45 minute) and implementing projects (2 week)

Resources: Project plan sheets, colour pens

Activities:

Planning projects

Students and you discuss about projects and make a decision mutually in regard to projects they plan to do

Children work on groups to write a plan to set up the project for other students in the school community, for example, helping younger classes with brushing after lunch and ways to increase eating fruit and vegetables.

The children present their work and help each other to complete the plan, including prepares things needed in their projects.

Implementing projects

Children conduct their projects over two weeks period and you need to support everything the children need in their projects such as materials, resources and any advice.

Session 7: Healthy school part III (Evaluation)

This session will encourage student to solve the problem they might encounter during projects. They have their own ability to cope with the difficulties and can also ask for help from others such as teachers and friends if they want. They will learn to see the problems as challenges instead of burdens.

Objective: To increase students' comprehensibility, meaningfulness and the ability to cope with their problems

Time: 60 minutes

Resources: Evaluation sheet

Activities:

Main (40 minutes)

You ask students in each group about the hindrance and barrier they faced during implementing projects in relation to the period of the projects, places, resources, the collaboration of other students etc.

The children in each group think about the problems and obstacles they faced during conducting their projects as well as the possible solution they have thought before writing them down on their evaluation sheets.

The representative student from each group presents their projects for 5 minutes regarding the evaluation sheet they wrote to the rest of the class.

The children help one another discuss about problems and solutions regarding projects. The additional methods emerging from the class will be added on the evaluation sheet by the project owner.

Reflection (20 minutes)

You ask the children

- What did they learn from doing these projects?
- Do they think these projects should be continued? If so, why?

You tell the students what they have done is very useful and worthy. They help other students improve their health and oral health and also push the school to be healthy schools following the government policy. In the mean time, the student can see that they can take control over the determinants of health such as improving healthy environment and increasing their ability to take care of their health and oral health. Moreover, they also have their own ability to cope with the difficulties they might face in the future and can also ask for help from their families, teachers, friends or other persons whom they feel comfortable with if they want. The problems can be seen as challenges rather than burdens.

A length of time to deliver the intervention to enhance of sense of coherence (SOC) in children

Sessions	Title	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
1	Healthy mouth	↔						
2	Face games Activity 1: Taking photos of children Activity 2: Writing nice things about people	↔	↔					
3	Name Calling Activity 1: Making masks Activity 2: Role playing		↔	↔				
4	Changing my life			↔				
5	Healthy school part I (Brain storming)				↔			
6	Healthy school part II Planning Implementing				↔	↔		
7	Healthy school part III (Evaluation)						↔	↔

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Part 3

Resources

Session 1 Healthy mouth

What did you learn today?

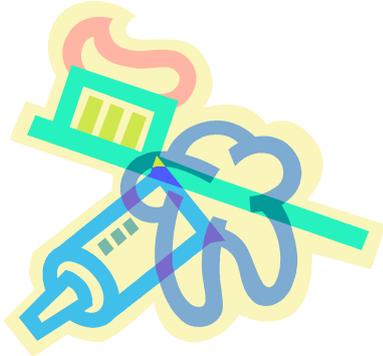
What have you learnt how to do today?

What did you already know?

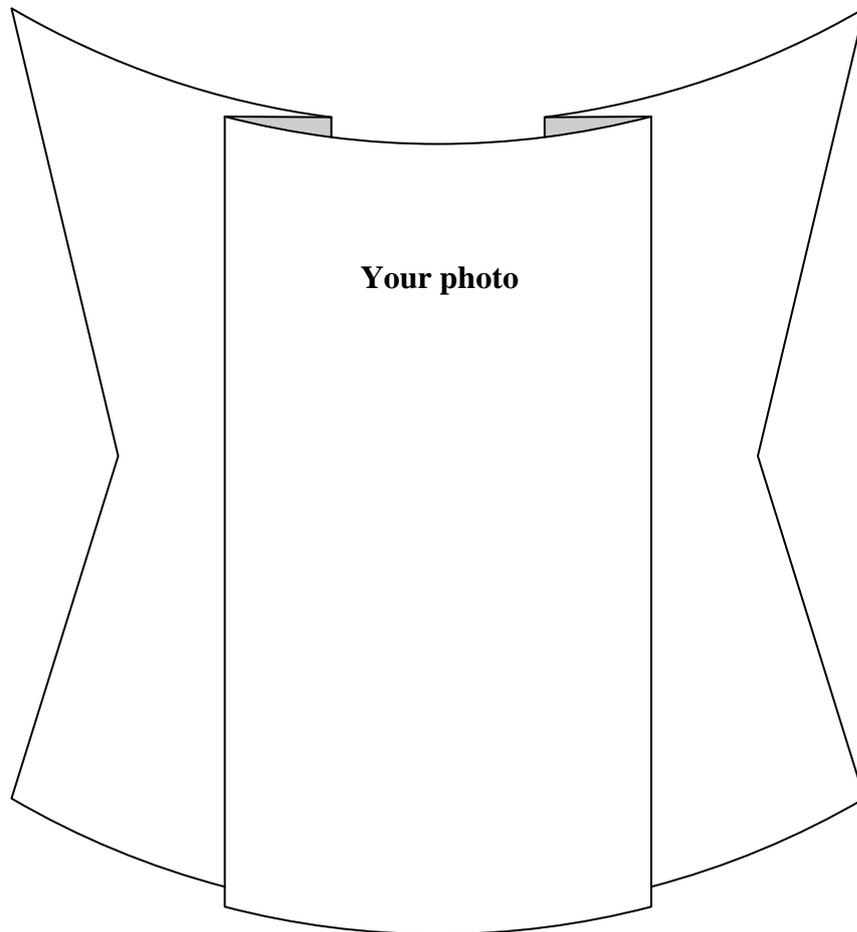
How are you going to use these knowledge and skills?

Imagine you are tired before you go to bed. How will you make sure you clean your teeth?

Marks given by yourself (up to 10).....



Session 2 Face games



How compliments make you feel?

.....

.....

.....

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.....

My Very Own Poster

Things I like
about me

All About ME!!!

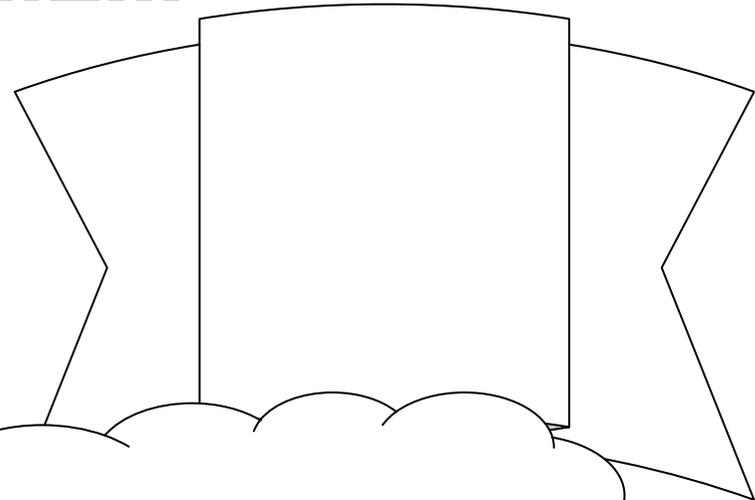
Things I am good at



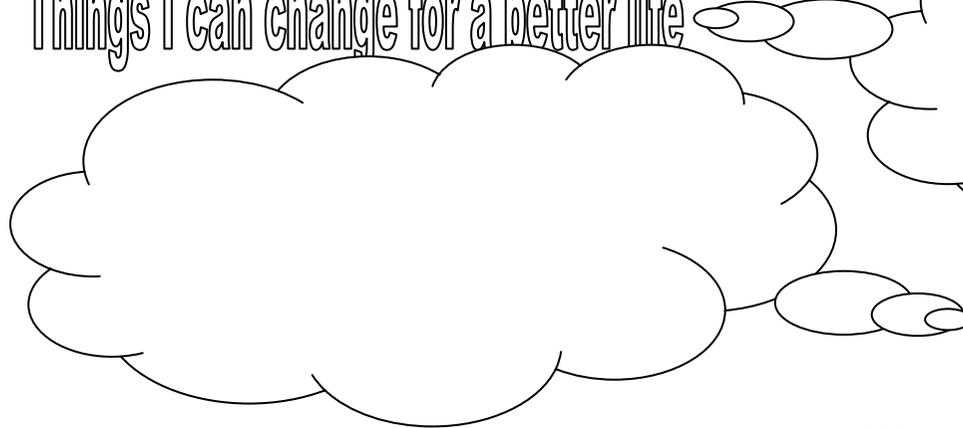
NAME.....

HEIGHT.....

WEIGHT.....

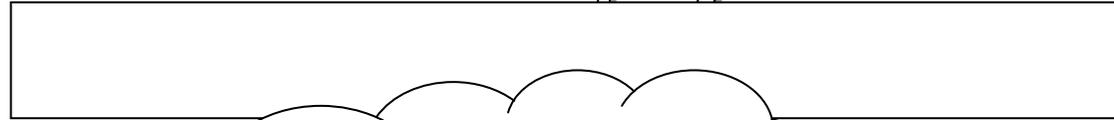


Things I can change for a better life

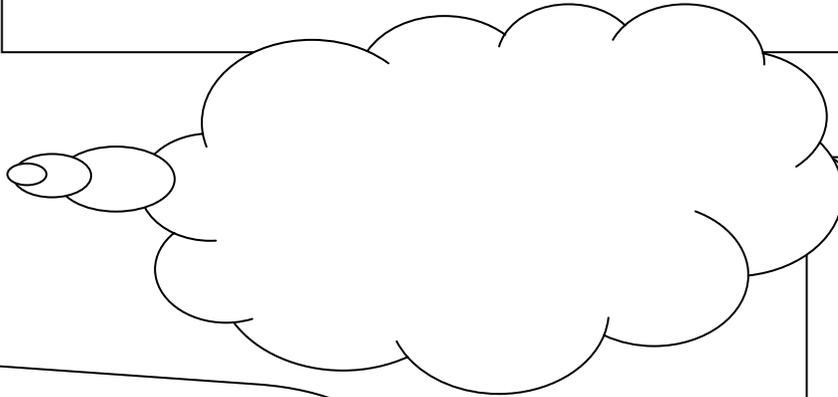


Things I can change for better oral health

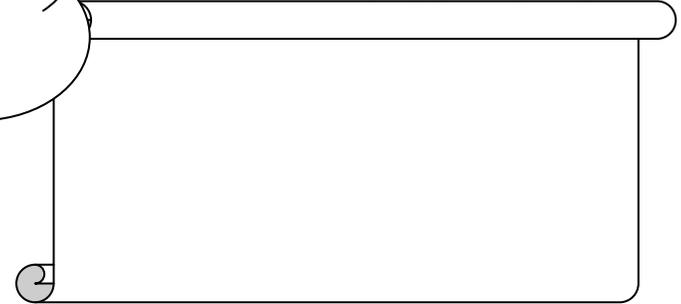
Name of the project



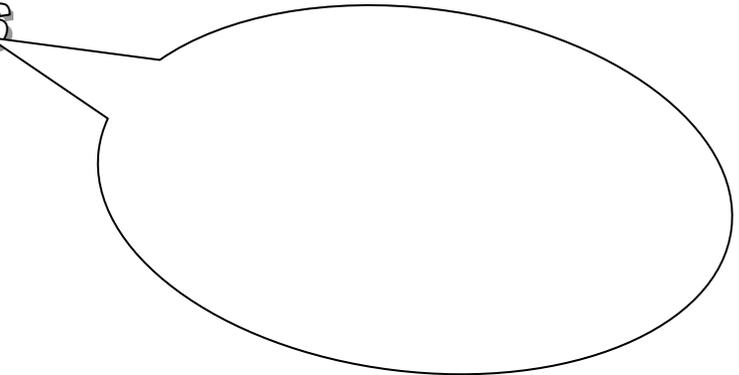
Objectives



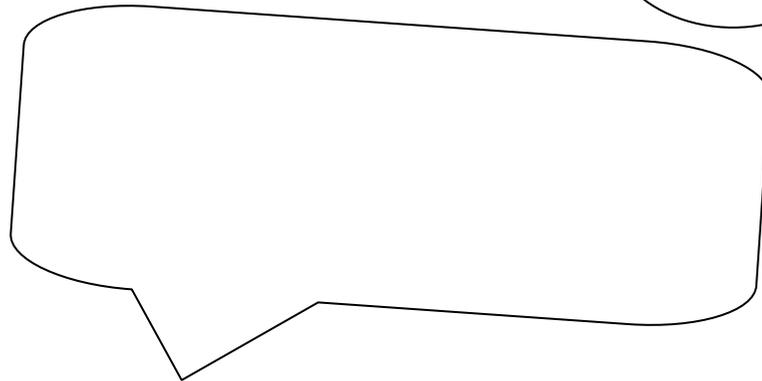
Materials



Outcomes



Methods



Session 7 Evaluation sheet

Projects

Problems

Solutions

Appendix E

Factor analysis of CPQ₁₁₋₁₄

Factor analysis of SOC-13

Factor analysis for CPQ₁₁₋₁₄

The 37-item CPQ₁₁₋₁₄ was subjected to principal component analysis using SPSS. Factor analysis revealed the presence of 4 components with eigenvalues. Variances for each component accounted for 11.33 %, 9.97%, 8.14% and 7.30% respectively. The simple structure with 4 components showing a number of strong loadings and all variables loading was relatively relevant to the original subscales. The results of this analysis support the use of 37-item CPQ₁₁₋₁₄ as separate subscales.

Table 47 Eigenvalues of CPQ₁₁₋₁₄ compared between original subscales and components from factor analysis

S = Symptoms, FL = Functional status, EW = Emotional well-being, SW = Social well-being

Items	Original subscales				Components from factor analysis			
	S	FL	EW	SW	Component 1	Component 2	Component 3	Component 4
Pain	0.50							0.50
Bleed	0.51							0.51
Sores	0.46							0.46
Odour	0.51							0.51
Food@teeth	0.47							0.47
Food@palate	0.36							0.36
Mouth breathing		0.50						0.50
Difficult to eat		0.35						0.35
Sleep		0.56				0.56		
Chewing		0.41				0.41		
Mouth Wide		0.39				0.39		
Unclear		0.45				0.45		
Fast food		0.63				0.63		
Straw		0.58				0.58		
HCFood		0.37				0.37		
Irritate			0.56		0.56			
Unsure			0.71		0.71			
Shy			0.59		0.59			
Concern			0.61		0.61			
Pretty			0.52		0.52			
Upset			0.55		0.55			
Nervous			0.69		0.69			
Healthy			0.63		0.63			
Different			0.39			0.39		
School				0.38		0.38		
Attention				0.44		0.44		
Homework				0.30				0.30
Speak				0.40		0.40		
Activities				0.55		0.55		
Talk				0.44			0.44	
Smile				0.54			0.54	
Music				0.48			0.48	
Friends				0.58			0.58	
Argue				0.35			0.35	
Names				0.53			0.53	
Left				0.60			0.60	
Askq				0.51			0.51	
% of variance					11.33%	9.97%	8.14%	7.30%

Factor analysis for the SOC scale

The 13-item SOC scale was subjected to principal component analysis using SPSS. Factor analysis revealed the presence of 3 components with eigenvalues. Variances for each component accounted for 18.64 %, 12.17% and 9.93 % respectively. The presence of simple structure with 3 components showing a number of strong loadings and all variables loading was not relevant to the original subscales. The results of this analysis do not support the use of 13-item SOC scale as separate subscales.

Table 48 Eigenvalues of SOC scale compared between original subscales and components from factor analysis

Items	Original subscales of SOC			Component from factor analysis		
	C	MA	ME	Component 1	Component 2	Component 3
1			0.38			0.38
2	0.50					0.50
3		0.62				0.62
4			0.71		0.71	
5		0.60		0.60		
6	0.65			0.65		
7			0.62		0.62	
8	0.54			0.54		
9	0.68			0.68		
10		0.64		0.64		
11	-0.52					-0.52
12			0.69		0.69	
13		0.60		0.60		
% of variance				18.64%	12.17%	9.93%

C = Comprehensibility, MA = Manageability, ME = Meaningfulness

Appendix F

Significant direct and indirect effects for the
Wilson and Cleary model at T1 and T3 with different clinical factors

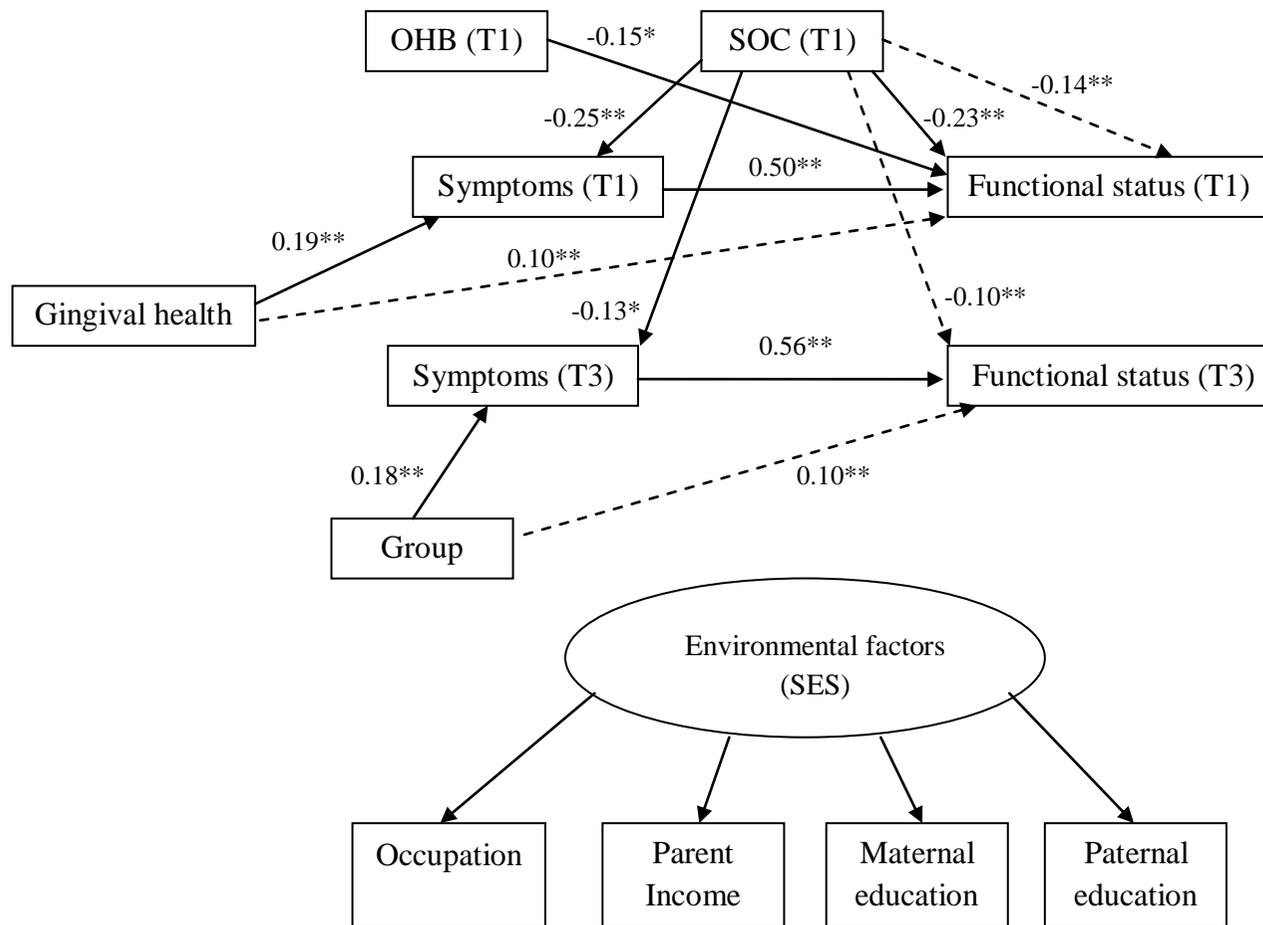


Figure 25 Significant direct and indirect effects for the statistically parsimonious Wilson and Cleary model at T1 and T3 with gingival health as a clinical factor. Note: * $p < 0.05$, ** $p < 0.01$, β = bootstrapped standardised estimate. Solid lines = direct effect; dashed lines = indirect effect; T1= baseline; T3= at 3 month follow-up, the error terms are omitted for the ease of interpretation.

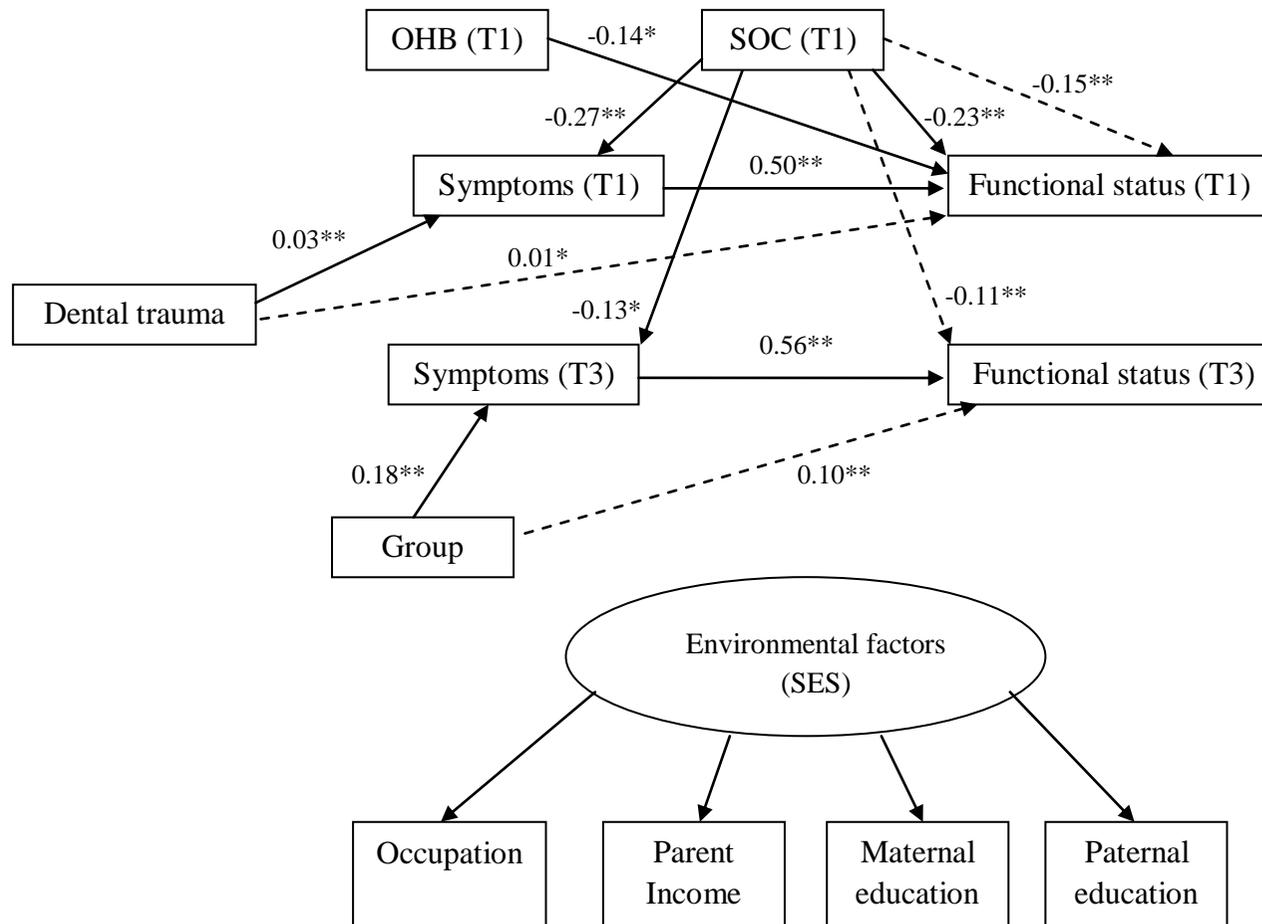


Figure 26 Significant direct and indirect effects for the statistically parsimonious Wilson and Cleary model at T1 and T3 with dental trauma as a clinical factor. Note: * $p < 0.05$, ** $p < 0.01$, β = bootstrapped standardised estimate. Solid lines = direct effect; dashed lines = indirect effect; T1= baseline; T3= at 3 month follow-up, the error terms are omitted for the ease of interpretation

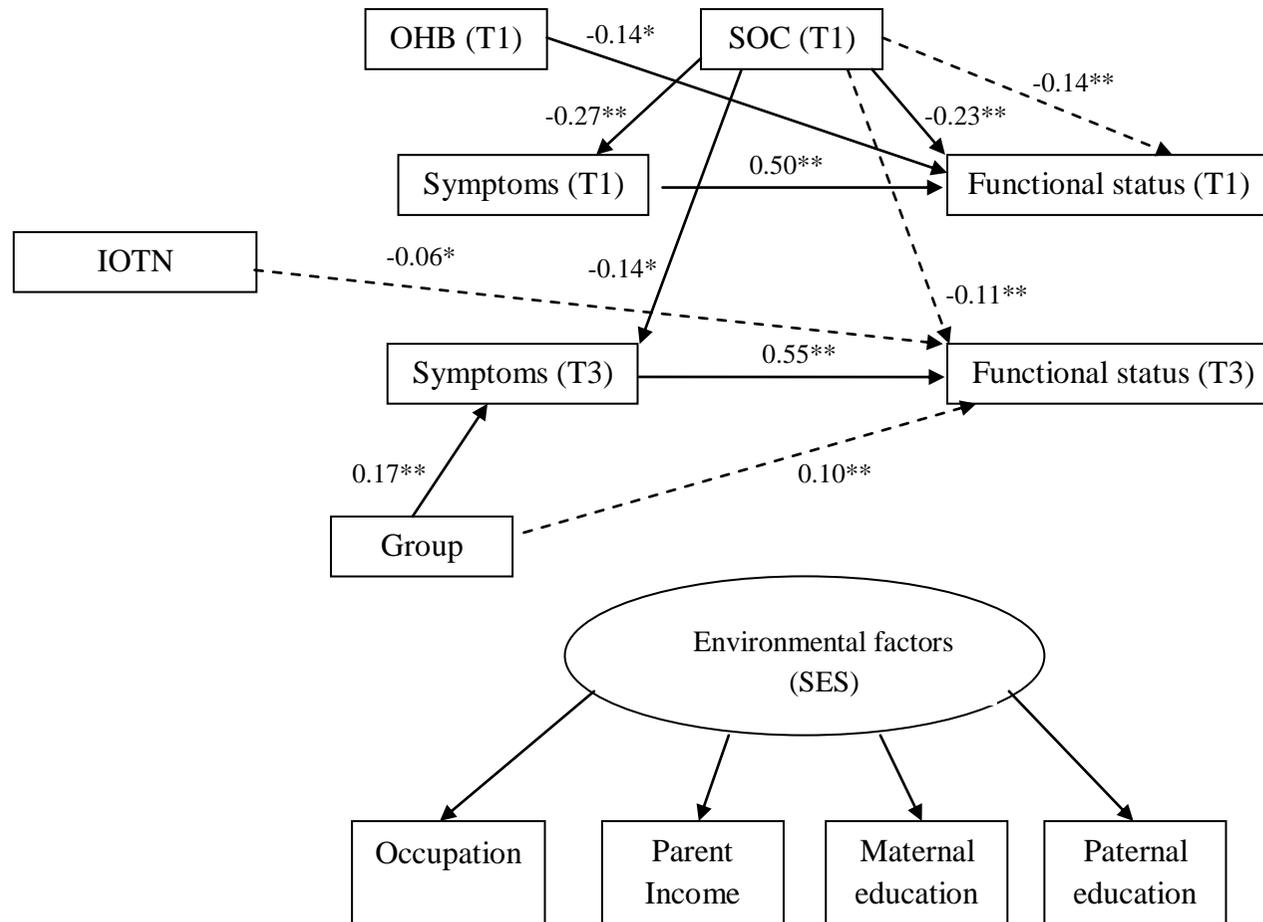


Figure 27 Significant direct and indirect effects for the statistically parsimonious Wilson and Cleary model at T1 and T3 with IOTN as a clinical factor. Note: * $p < 0.05$, ** $p < 0.01$, β = bootstrapped standardised estimate. Solid lines = direct effect; dashed lines = indirect effect; T1= baseline; T3= at 3 month follow-up, the error terms are omitted for the ease of interpretation

Appendix G

Photos of activities in the intervention



Teachers received an intensive one day course



Children learnt with freedom during the intervention



Healthy mouth

Understanding & awareness of oral health



Face games

Helping children to think positively about themselves and others & increased beliefs and confidence in their own ability and value



Games to increase self confidence & reduce shyness

My Very Own Poster

All About ME!!!

Things I like about me

Things I am good at

NAME.....
 HEIGHT.....
 WEIGHT.....

Things I can change for a better life

Things I can change for better oral health

Increasing ability and beliefs to control life



Children working on healthy schools projects



Whole school approaches