To my family

“You must do the things you think you cannot do”
E. Roosevelt
Abstract

Objective. Despite general improvements in oral health status during the last few decades, not all the individuals in society enjoy good oral health. Thus there is a need to find methods to explain differences in oral status and factors contributing to the maintenance of oral health, where the causal pathways of an individual's life context are included. The overall aim of this thesis was to describe an individuals' ability to maintain health, based on the concept of sense of coherence (SOC), in an adult population and to analyse the relationship between SOC in relation to health behaviours, knowledge of and attitudes to oral health and oral health status. Materials and Methods. The thesis was based on two cross-sectional epidemiological studies from different parts of Sweden. Three studies (Paper I, II, III) were performed in Jönköping in 2003 and were based on a random, age-stratified sample of 910 individuals, aged 20, 30, 40, 50, 60, 70 and 80 years, of which 589 agreed to participate in an oral health examination. In addition, the participants answered Antonovsky's 13-item questionnaire and self-reported questions about oral health habits and knowledge of and attitudes to oral health and sociodemographic information. Paper IV was based on the population from the northern Sweden MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) project screening in 1999, where 7,629 individuals in the age 25-74 years were invited and 6,000 participated. Apart from the 13-item Antonovsky questionnaire, diet was recorded by an 84-item self-administered food frequency questionnaire. Results. The mean SOC scores increased with age but varied within the age groups and between genders for the older ages. Twenty year olds had statistically significantly lower SOC scores compared with all the other age groups and 50% of all 20-year-old individuals had low scores, i.e. ≤ 66 points (Study I). Individuals with higher SOC scores had more healthy behaviour, such as a lower frequency of snacks between meals, and displayed a higher degree of knowledge about caries and how to prevent it. Moreover, individuals with higher SOC scores had more positive attitudes, such as the importance of having their own teeth when getting older, satisfaction with their teeth, better
perception of their teeth and no dental anxiety, compared with individuals with lower SOC scores (Study II). Higher SOC scores were related to oral status, indicating less plaque and periodontal disease measured by teeth with a probing pocket depth of $\geq 4\text{mm}$ (Study III). Both women and men with higher SOC scores had healthier food choices with a favourable impact on both oral and general health (Study IV).

**Conclusions.** Sense of coherence scores were generally high in the study samples and varied with age and gender. To some extent, individuals with a strong SOC had more positive health-related behaviour with a favourable impact on both oral and general health and more knowledge of caries, as well as positive attitudes to oral health. A strong SOC was related to oral status with regard to better oral hygiene and periodontal health. Higher SOC scores may be a determinant of positive oral health-promoting behaviour, leading to the maintenance of oral health.
Original papers

This thesis is based on the following papers, which are referred to by their Roman numerals in the text:

Paper I

Paper II
Lindmark, U., Hakeberg, M., Hugoson, A. Sense of coherence and its relationship with oral health-related behaviour and knowledge of and attitudes to oral health. Submitted

Paper III
Lindmark, U., Hakeberg, M., Hugoson, A. Sense of coherence and oral health status in an adult Swedish population. Submitted

Paper IV
Papers I and IV have been reprinted with the kind permission of the respective journals.

**Abbreviations**

<table>
<thead>
<tr>
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<tr>
<td>ANOVA</td>
<td>Analysis of variance</td>
</tr>
<tr>
<td>BMI</td>
<td>Body mass index</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
</tr>
<tr>
<td>CIOMS</td>
<td>Council for International Organisations of Medical Sciences</td>
</tr>
<tr>
<td>DFS</td>
<td>Decayed filled surfaces</td>
</tr>
<tr>
<td>DMFT</td>
<td>Decayed missed filled teeth</td>
</tr>
<tr>
<td>DS</td>
<td>Decayed surfaces</td>
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<td>FS</td>
<td>Filled surfaces</td>
</tr>
<tr>
<td>GI</td>
<td>Gingival index</td>
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<tr>
<td>GLM</td>
<td>General linear model</td>
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<td>GRR</td>
<td>General resistance resources</td>
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<tr>
<td>MONICA</td>
<td>Monitoring trends and determinants in cardiovascular disease</td>
</tr>
<tr>
<td>OR</td>
<td>Odds ratio</td>
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<tr>
<td>PLI</td>
<td>Plaque index</td>
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<tr>
<td>PLS</td>
<td>Partial least squares</td>
</tr>
<tr>
<td>PPD</td>
<td>Probing pocket depth</td>
</tr>
<tr>
<td>SAS</td>
<td>Statistical analysis system</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
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<tr>
<td>SEK</td>
<td>Swedish currency</td>
</tr>
<tr>
<td>SOC</td>
<td>Sense of coherence</td>
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<tr>
<td>SPSS</td>
<td>Statistical package of social sciences</td>
</tr>
<tr>
<td>VIP</td>
<td>Variable of importance in the projection</td>
</tr>
<tr>
<td>WMA</td>
<td>World Medical Association Declaration of Helsinki</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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Introduction

The oral health status of children, adolescents and adults and also of the elderly has improved during the last three decades [1-10]. Despite improvements, not all groups in society, either in Sweden or internationally, enjoy the same oral health [1-4, 7, 8, 11]. This raises the question of why there are differences in oral status as well as the importance of finding new methods for maintaining oral health. It has been demonstrated that social determinants, such as economic, environmental and lifestyle factors, have an impact on oral health [12]. However, a theoretical framework explaining the causal pathways, including both individuals’ internal and external resources in society, is lacking [13-16]. There is a need to focus on patient-centred perspectives, where the individuals’ complex and causal life pathways are included [13, 16, 17]. We may then have a better knowledge and understanding of the causes of different behaviours, attitudes and choices, leading to a healthy or an unhealthy direction. This knowledge may help dental professionals when guiding individuals or groups in a healthy direction.

The direction of methods used by practitioners, educators and researchers depends on the influence of the current health paradigm, i.e. knowledge and beliefs about health and illness [18-20]. The literature describes three major health care paradigms; the treatment of disease, the disease prevention- and the health promotion paradigms [18]. The view of health changed in the 20th century, when scientists in the mid-1970s started to question the dominance of the biomedical approach to health, focusing on the cause of disease, i.e. the disease treatment paradigm [12, 21]. In 1974, Lalonde’s report [22] pointed out the importance of the environmental causes, individuals’ behaviours and the influence of lifestyle factors on the cause of death and diseases, i.e. the disease prevention paradigm. At the Ottawa Conference in 1986, the WHO developed and defined the meaning and potential of health promotion [23], where interest focuses is on creating environments that enable people to increase control over and improve their current and future health, i.e. the health promotion paradigm.
In accordance with the general health field, oral health science and clinical practice have traditionally adopted a biomedical approach to disease, but they have changed interest to focus on a more multifactorial perspective, which is a movement into a health paradigm in accordance with disease prevention and education \(^\text{15}\). Even if we now know that oral diseases are multifactorial, we have still not reached the health promotion paradigm, where oral health is seen as a whole, when it comes to well-being and showing an interest in every aspect of the individual, i.e. an holistic perspective. This perspective also aims to focus on healthy resources in maintaining health, i.e. a salutogenic approach, rather than simply focusing on risk factors for oral diseases, i.e. a pathogenic approach \(^\text{18, 24}\).

One goal for dental professionals is to achieve oral health for the individual through prevention and promotion \(^\text{18}\), and the global goals for oral health in 2020 include the “development of oral health programmes that will empower people to control determinants of health” and “integrate oral health promotion and care with other sectors that influence health, using the common risk factor” (p.286) \(^\text{25}\), which are two of ten objectives.

Knowledge of a health theory, health behaviour and the mechanism for change in a healthy direction is the key to health promotion within the dental hygiene. There is therefore a need for more knowledge about the relationship between oral health and the psychosocial dimensions of health, focusing on a salutogenic perspective with the aim of influencing health promotion among practitioners and educators within oral health.

**Epidemiology**

The definition of epidemiology has been described as “the study of the distribution and determinants of health-related states or events in specific populations, and the applications of this study to control of health problems”, (p.3) \(^\text{26}\). The human population is the target in epidemiological studies and this definition emphasises the fact that it focuses on positive health states with the means of improving health, and not simply on the causes of certain diseases \(^\text{27}\). Epidemiology (also called the public health model) is one of the major disciplines that have developed within health-care. However, epidemiological research has traditionally searched for ways of preventing disease and risk
factors, i.e. a pathogenic focus. The focus of epidemiological research changed in the 19th and 20th centuries where the literature describes three periods in the evolution of modern epidemiology. The first was sanitary statistics, also known as miasma, where the preventive approach comprised drainage, sewage and sanitation. The second was infectious disease epidemiology, called germ theory, which had a preventive approach and focused on interrupting transmission through vaccines. The third era was chronic disease epidemiology, also called the black box paradigm, which focused on the prevention of risk factors by modifying lifestyle or environment. A new era, called life-course epidemiology, has recently been discussed and applied in oral health research. Life-course epidemiology is defined as “the study of long term effects on later health or disease risk of physical or social exposures during gestation, childhood, adolescence, young adulthood and later adult life” (p.778). It aims to clarify the highly complex and dynamic life-course to which oral health is well suited.

In spite of this, there is a lack of epidemiological studies with a theoretical framework based on the complex and causal context between oral health and psychosocial factors. Traditional epidemiological studies usually target separate factors such as social class, environmental factors and behaviours in relation to oral health, without taking account of a wider approach, explaining why individuals choose to engage or not to engage in healthy activities. However, there is some research studying the relationship in this area and sense of coherence has been described as one example.

**Oral health**

**Changes in oral health status**

According to epidemiological studies based on clinical measurements, the prevalence of periodontitis and dental caries has changed over the 30 last years in both Scandinavia, and also in parts of Europe and the USA. Studies from Scandinavia have shown that periodontal health has generally improved during this period at population level. The frequency of edentulous people has decreased to 3% and the number of teeth, especially premolars and molars, has increased during the same period. Moreover,
according to the severity of the periodontal disease experience, the number of individuals with no alveolar bone loss and no or low scores for gingivitis, i.e., periodontally healthy people, increased from 8% in 1973 to 44% in 2003, as one study from Jönköping, Sweden, has shown. In terms of caries prevalence, the results of cross-sectional epidemiological studies in Scandinavia show a continuing reduction in caries in general. However, there has been an increase in the number of proximal decayed surfaces (DS), i.e., restricted to the enamel, for the 20- to 50-year age group, which may explain the evolution of a new treatment strategy suggesting prevention before restoration. Moreover, there has been an increase in the mean number of decayed and filled surfaces (DFS) in the 40- to 80-year age groups, where the authors raise the questions about the need for complex restorative treatment but also, due to the risk of secondary caries, highlight the importance of resources for preventive care at all ages. Even if there appears to be a general improvement in oral health, there are reports of differences in oral status, which appear to be universal, even for countries with a developed dental health service and prevention programmes.

**Prevention – a biomedical and biopsychosocial approach**

Traditionally, oral health has been evaluated by clinical measurements of oral diseases, such as decayed, missing and filled teeth/surfaces (DMFT/DFS), probing pocket depth, gingivitis and plaque and it is based on the professionals’ biological assessments of the presence of oral disease. Based on these biomedical measurements, treatment and disease prevention has then been performed. In Sweden since the 1970s, the education and training of dental care professionals has been implemented, and it has contributed to preventive dental care programmes for children and adolescents, including tooth cleaning and the use of fluoride, as well as fissure sealant on molars. Moreover, knowledge from the Vipeholm Study from 1950s resulted in information about the frequency of a sugar-added diet and the risk of caries. These factors may have had an effect on oral health. Numerous studies have also increased our knowledge of different risk factors for dental caries and periodontitis, such as age, gender, marital status, income status, education, ethnicity and birth region. Moreover, lifestyle and oral health-related habits, such as smoking, diet, tooth-brushing, use of fluoride and dental visits, have been seen to be
associated with differences in disease and disease progression \cite{4,11,39,50,51}.

However, focusing on disease and risk factors, i.e. biomedical approach, has been shown to have limitations, since psychological and social factors are not included \cite{52}. Moreover, disease prevention may have reduced oral diseases in general, but at the same time, it has resulted in inequalities in oral health due to the ignorance of underlying factors. Individuals who have a willingness and capacity to use different kinds of knowledge or other resources designed to produce health and well-being, also appear to be more able to benefit most from interventions compared with those who do not have this capacity \cite{15}.

As for general health, the content of oral health has changed over the years and now has a more holistic approach, which can be seen in the following definition:

\textit{"Oral health is a standard of health of the oral and related tissues which enables an individual to eat, speak or socialize without active disease, discomfort or embarrassment and which contributes to general well-being"}, (p.11) \cite{53}.

Oral diseases are multidimensional and are caused not only by biological factors but also indirectly by non-biological factors, such as environmental, material, cultural, psychological and social factors \cite{16,54-58}. A broader view of the cause of oral diseases has been described by the WHO, where caries is also linked to social and behavioural factors, such as the health system and oral health service, socio-cultural factors, such as education, occupation, income, ethnicity, lifestyle and social network and environmental factors, such as drinking-water, sanitation, hygiene and nutrition \cite{38,41}. These factors influence individuals’ way of living and behaviour and they may subsequently influence oral health outcomes \cite{41}. In order to obtain a better understanding of differences in oral health, there is a need to include psychological and sociological theories focusing on people’s whole life context and not simply focus on separate risk factors \cite{13,57,59}. Moreover, a broader conceptual approach, including a biopsychosocial perspective \cite{21}, to the measurement of oral health status could provide a better understanding of the way individuals perceive and evaluate oral health \cite{56,29}.

Holst et al. \cite{16} have described a theoretical framework including social structure, social context, individual internal factors (individual level) and its consequences for caries (biological level), (Figure 1), which has been put forward as an example of a biopsychosocial perspective of oral health.
Behaviours, knowledge and attitudes

From a social perspective, non-biological factors such as different types of behaviour are important factors within oral health prevention. Moreover, associated factors in this area are oral health knowledge and attitudes to oral health. Behaviour, knowledge and attitudes are often linked and influence each other, which complicates the concepts. Sometimes these three components are used as separate factors, while, within the social sciences, cognitive, emotional and behavioural aspects are included in the attitudinal concept. An early concept of behavioural change was based on the assumption that information designed to increase knowledge will lead to a change of attitude that is followed by a behavioural change. This idea has been developed and begins with a knowledge of patterns of behaviour and attitudes that are established in childhood or early adulthood. These factors are in turn an expression of several underlying factors, such as environmental, material, cultural, psychological and social factors, into which we are born and live. We learn from our positive and negative experiences and in interaction with other people. Specific behaviour has also been associated with specific personality traits, where consciousness is associated with positive health behaviours and neuroticism with negative health behaviours. In this thesis,
behaviour and knowledge have been used separately and attitudes are regarded as an emotional aspect.

Health behaviour

Behaviour is linked to health and has been defined as a health activity designed to prevent diseases, which is a medical perspective assuming that healthy people behave in a particular way purely to prevent the risk of disease. Health behaviour have also been described as an health activity independent of health state, but for the person, an activity in a healthy direction. Behaviours can have a negative effect, i.e. behavioural pathogens, such as smoking, eating greasy or sweet food or drinking a large amount of alcohol. However, behaviour can be protective and a have a promotional effect on health, such as tooth-brushing, seeking health information and regular check-ups, which is sometimes called ‘behavioural immunogens’. Health behaviours are generally regarded as behaviours related to the health status of the individual, where behaviours such as eating and smoking habits play an important role in long-term health. Diet and smoking can have a positive or a negative influence on both general health and oral health. The WHO and various publications suggest a common risk approach with the aim of promoting healthy behaviours which have a favourable impact on several diseases, rather than focusing on specific risk groups. This approach invites a wider view of oral health, including general health, as well as co-operation between different health disciplines, which is also in line with health promotion. Diet and smoking habits are complex and are influenced by cultural, social and psychosocial factors. It is important not only to have a knowledge of the effects of certain behaviours on health but also to develop an understanding of psychosocial factors that influence oral health behaviours and choices in order to obtain answers about inequalities in oral health. A certain behaviour does not exist independently of other human factors and it is therefore important to include the context of a behaviour with the aim of better understanding a person’s actions and thoughts on health. Health promotion programmes will then have a greater success.

Knowledge

Health education is an important part of health promotion and has an impact on both knowledge and behaviour. It has been defined as “any planned
combination of learning experiences designed to predispose, enable, and reinforce voluntary behaviour conducive to health in individuals, groups, or communities” (p.124). Knowledge has been described as power, as it enables individuals or groups to make decisions regarding health, i.e., in this context, oral health. However, the role of the patient appears to undergo a change from a passive to a more active role. A recent review revealed that clinical prevention through health education, i.e. information to the patient, and expert advice are ineffective. It implies generally passive patients where the physicians’ do not have a knowledge of the patients’ behaviours, attitudes and beliefs. The information that was given was perceived as being vaguely remembered and not always applied in practice. A qualitative study found that patients want to have more relevant, individually adapted knowledge and to be more involved in decision-making. Moreover, research has shown the importance of focusing on integrating dental knowledge into a person’s belief system and not just lecturing them on what they should do. Knowledge has to be complemented with reflections and considerations in interaction with the individuals life context. When working with professional and patient communication, it is important to reach patient centredness, where an interaction between the two is central and the patient has a feeling of shared decision-making, participation and partnership. These factors also have an influence on the individual’s feeling of empowerment, which is an important factor for sustainable health.

**Attitudes**

Attitudes have previously been described as a general common-sense representation of an object, people or event. Attitudes have then developed to include three related components; cognition – belief about the object; emotional – feeling towards the object; behavioural – intended action towards the object. When all the parts have same direction, i.e. a healthy or unhealthy direction, attitudes may influence a specific behaviour. However, an attitude does not always predict a behaviour. Depending on the context, a person can have different and also contradictory attitudes towards an object, which may not lead to a change in behaviour. A person’s motivation to change could be due to ambivalent attitudes, i.e. simultaneous duality between the cognitive or the emotional attitudes. A person who has negative attitudes towards smoking but is unable to quit is an example of this. Having both a positive and a negative feeling towards an object, i.e. an ambivalent attitude, has been shown
to have a weak relationship with an intention. The literature has also described the importance of affective beliefs in predicting an action, something that is sometimes neglected in different models within health psychology.

The development of health concepts

Health is a concept which has had and still has different meanings for different people, depending on times in history, culture, society and different ages. Historically, the philosopher Hippocrates’ *humoral theory* was one of the first health theories. According to his theory, a person was healthy when there was a balance between the four bodily fluids, called humours (yellow bile, phlegm, blood and black bile). For a long time, because of the dominance of the church in society and the fact that medical understanding was limited, health was tied to faith and spirit. The scientific revolution in 17th century led to a huge development in medical science, where Descartes (1596-1650) introduced the theory of *dualism*, i.e. the idea that mind and body were separate, where the body was considered as ‘material’ and the mind was ‘non-material’. This dualism had a reduction approach, where the body was seen as a machine with different parts. Health was seen when all the parts of the body functioned, and treatment focused on the cause of the disease in this bodily machine. This approach is called the *biomedical model*, a belief that diseases and symptoms have an underlying physiological explanation and the individual is of minor importance and is passive. This theory was adopted and developed by Christopher Boorse during the 1970s and he defines health as ‘...normal functioning, where the normality is statistical and the functions biological’ (p.542).

After the Second World War, the WHO for the first time proposed a definition of health with a positive and an holistic view of health;

“...a state of complete physical, mental and social well-being, and not, merely the absence of disease and infirmity.” Since then, the WHO has also developed the definition to a wider concept, including the individual as an active part in life where health is seen as a resource.
the environment. Health is, therefore, seen as a resource for everyday life, not an
object of living; it is a positive concept emphasizing social and personal resources, as
well as physical capacities.”

Health from an holistic angle, has been described by several philosophers and
from different perspectives and it is now accepted that health and illness are a
result of an interaction between biological, psychological and social factors,
i.e. the biopsychosocial model, which has been described by Engel.

**Health psychology and sociology**

Health psychology, which has developed from fields within social sciences,
integrates many cognitive, developmental and social theories and explanations
and can help us to understand biopsychosocial factors involved in the
promotion and maintenance of health, for example. To promote a healthy
behaviour, health psychology theories can help us to understand not only the
role of the behaviour but also the beliefs that predict behaviours, thereby
enabling these beliefs to be targeted. Social and personality factors are two of
the key determinants of health and well-being, where factors such as the
individual cognition and view of and reaction to the environment are essential.
A person who experiences his/her life as purposeful and understandable and is
able of managing problems is therefore thought to be more able successfully
to deal with situations threatening health. According to the biopsychosocial
model, a person’s psychological and social factors are not included in the
biomedical model. The biopsychosocial model includes factors that propose a
combination of physical, social, cultural and psychological factors, which affect
and are affected by the person’s health. However, it has been shown that the
use of biopsychosocial models in medical research is still rare. This model is
strongly related to health promotion, where the determinants of health include
the individual in his/her social context, at socio-economic and societal level.

A recent review of the evaluation and effectiveness of models of health
behaviour changes with regard to health education, counselling, psychological
models of behaviour change and motivational interviewing has shown that there
is a need to develop effective approaches to health promotion in the clinical
context. It is important to understand the broader context of underlying
factors behind a behaviour to identify the individual’s specific needs and
support his/her skills and ability to maintain oral health. To integrate new skills and knowledge in everyday life the person has to have the feeling of self-efficacy, confidence in his/her ability to perform actions and manage challenges and find a personal value to make a change. Psychology and sociology are complementary areas that are necessary in order to understand how people behave and act.

The biopsychosocial approach calls for greater knowledge, time investment and a new approach for the patient-professional relationship in order to reach an understanding of the person’s context to better understand his or her situation and not simply focus on the illness.

### The salutogenic theory

Salutogenesis searches for “the origin of health” rather than focusing on the cause of disease, and the philosophical “salutogenic” question of what creates health was raised by a sociologist, Aaron Antonovsky (1923-1994), and is established as a key term in public health promotion. About 40 years after the Second World War, he was conducting epidemiological studies of problems in the menopause of women from different ethnic groups in Israel and he found a group that had the common experience of surviving concentration camps. He found that 29% of the survivors had fairly good mental (and also physical) health. Despite everything they had gone through, they had the ability to maintain good health and had moved on with their lives. This raised the observation and consciousness of the salutogenic theory and the research question of what causes health.

Antonovsky had an holistic view of health and the human being. He claimed that it is important to see the human being within his or her life context. Individuals have different ages, social class, culture, religion and income and are involved in an interaction between people and structures of society. All these factors co-operate and are important for the way in which a person solves problems in a healthy or an unhealthy direction. Chaos and stress are part of life and the interesting questions are how, in spite of this, we can survive. Instead of seeing health and disease as two different dichotomies, where the main focus is on what causes disease (pathogenesis), Antonovsky claimed that
health can be seen as a movement in a continuum on an axis between health (ease) and ill-health (dis-ease), which is also in line with the way health and illness are seen within health psychology\textsuperscript{20}. The salutogenic perspective means that each person can find him or herself on this continuum at a particular time during a life span. The salutogenic perspective leads us to focus on different accessible resources which promote a healthy direction on the continuum. These resources, which Antonovsky called general resistance resources (GRR), can be both external and internal, such as material, knowledge, intelligence, coping strategies, social support, money, cultural condition, religious, philosophical and a preventive health orientation\textsuperscript{28,85,87,88}.

The salutogenic theory has two key elements; focusing on problem solving and the capacity to use resources\textsuperscript{87,89}. Antonovsky has suggested that epidemiological studies could focus on the distribution on the health/ill-health continuum for different groups, i.e. using the SOC scale, and at a clinical level, the professionals could help to promote their patients (or the person for whom they are responsible) in a healthy direction on this continuum\textsuperscript{85}, by improving their skills to make sound choices\textsuperscript{89}. Moreover, to promote salutogenic factors to the population through community action, this could be a way to move the population in a healthy direction\textsuperscript{14}. The theory can be applied to an individual, to a group and at societal level\textsuperscript{87} and has an interdisciplinary approach\textsuperscript{83,90}. Salutogenesis has been defined as “the process of enabling individuals, groups, organizations and societies to emphasize on abilities, resources, capacities, competences, strengths and forces in order to create a sense of coherence and thus perceive life as comprehensible, manageable and meaningful”\textsuperscript{(p.19)}\textsuperscript{81}.

The salutogenic theory has been applied in different areas within health care\textsuperscript{91}, but it has also been used within the learning process, education and communication\textsuperscript{92}.

\textbf{Sense of coherence (SOC)}

\textit{Theoretical concept}

Antonovsky developed the concept of sense of coherence (SOC), which involves the salutogenic theory. According to Antonovsky, sense of coherence is a very important factor when it comes to maintaining a position on the health/ill-
health continuum. Sense of coherence is developed during childhood, adolescence and early adulthood, where the location on the continuum emerges from different life experiences. Life experiences which are “characterized by consistency, participation in shaping outcome, and have an underload-overload balance of stimuli” (p.187) 85, i.e. involving different kinds of experience including a balance of rewards, frustrations and participation (empowering processes), develop SOC 28, 85, 93. SOC is not just a question of having control, it is about a feeling of participating in the life process 28.

SOC is made up of three components: comprehensibility, manageability and meaningfulness and, taken together, they all have an impact on health. A strong SOC, means that all the components are prominent in a person. Between the components, there is, however, a dynamic relationship. Comprehensibility is the ability to understand life events as structured and clear in a cognitive way (I know), “a solid capacity to judge reality” (p.127) 28. Manageability is the feeling of managing the situation and knowing that you have access to internal and/or external resources, i.e. having control (own or through others in a close circle) over the tools (I can). The third component meaningfulness refers to the importance of participation and is the motivational factor and the emotional feeling worthy of investment and engagement (I want). The intercorrelation between these three components is high, but, for different occasional situations or in general life situations, a person can have different levels for the three components. There is a dynamic connection between the three components and Antonovsky described eight different types which appear when dichotomising each of the three components on high and low levels, such as high for meaningfulness and low for manageability and comprehensibility, for example. Even if all the components are therefore of more or less central importance, Antonovsky still believes that meaningfulness is the component which is the most important. However, successful problem-solving is depending on SOC as a whole 85.

An individual’s SOC is based on general resistance resources (GRR), and is a result of early experiences in life until 30 years of age 28, 85. These resources, which make up life experience, make it easier for people to perceive their lives as consistent, structured and understandable 28, 85, 91, 94. People who have a large
amount of general resistance resources and have the ability to use them in a healthy way have a strong SOC. People with a weak SOC can be described as the opposite. Antonovsky claimed that SOC has a global orientation and that it is an orientation rather than a personality trait. It is not a question of how an individual should behave in a fixed situation, like a special coping strategy, nor is it role-specific, because it reflects an individual’s general response to demands. The definition of SOC according to Antonovsky is; ‘a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that (a) the stimuli deriving from one’s internal and external environments in the course of living are structured, predictable, and explicable (comprehensibility); (b) the resources are available to one to meet the demands posed by these stimuli (manageability); and (c) these demands are challenges, worthy of investments and engagement (meaningfulness)’ (p.19).

According to Antonovsky, a person’s SOC appears to be stable after the age of 30 and is then only affected in a minor way. However, it could be reinforced throughout one’s life, especially for an individual with a weak SOC. Earlier studies have confirmed that SOC remains fairly stable over time, but not as stable as Antonovsky assumed, as there are small variations in the mean SOC value and studies have shown that SOC appears to increase with age. Studies have also shown that SOC is lowest and less stable at younger ages i.e. less than 30 years old, and then follow maturation, even if SOC is more stable in older age groups. An independent cross-sectional population study from northern Sweden, comparing the SOC distribution from 1994, 1999 and 2004, revealed that the youngest age group of 25-44, both men and women, had the lowest SOC scores in all three cross-sections, compared with the older age groups. Antonovsky’s hypothesis that individuals with a high SOC remain more stable throughout adult life and low-SOC individuals have a more unstable SOC, has been confirmed in a recent longitudinal study. It is not only reaching adulthood that affect the stability of SOC, the level of SOC also appears to play a crucial role in the stability of SOC in adulthood. Moreover, in a longitudinal study, Volanen et al. found that SOC changes depending on different life events, such as being a victim of violence, having trouble with work, meeting financial hardship or relational problems, independently of strong or weak SOC or the time of the life event. Changes in
SOC due to life events after 30 years of age, such as occupational hierarchy and household income, have also previously been found in a four-year longitudinal study and are confirmed in a longitudinal study of SOC and victims of accidents. Most studies have not been able to demonstrate any significant differences between genders. However, there are some studies that have shown some differences, where men have a slightly higher SOC score than women. Different life events have also been shown to have a different effect on changes in SOC for men and women.

**SOC in relation to health and oral health**

SOC appears to be a health promoting resource and a person with a strong SOC can use his/her ability to manage stressful situations, in order to establish or improve his/her health. SOC alone does not have an influence on health and, it is important to take care not to direction of causal connections. A person with a high SOC does not necessarily always have a healthy lifestyle and the choice to smoke could, for example, depend on socio-cultural factors rather than the individual’s view of life. However, the socio-cultural factors which influence a special behaviour could also have an impact on the origin of a strong SOC, thereby increasing the possibility of a non-smoking behaviour for a person with a strong SOC. From the perspective that SOC is a question of view of life and the ability to use accessible resources for different situations, SOC is associated with health and health behaviours such as smoking, alcohol problems, dietary habits, physical exercise, doctor’s visits, anxiety and depression, optimism, self-esteem, quality of life and wellbeing. However, there appears to be a weaker relationship between SOC and physical health.

Recently, SOC has also been analysed in relation to oral health and oral health-related behaviours. Adolescents with high SOC scores have been shown to have less caries experience than adolescents with low SOC scores. Moreover, high SOC scores have been shown to be associated with a low level of self-reported gingivitis and dental plaque. Mothers’ SOC has also been found to be related to their adolescents’ oral health status. When it comes to oral health-related behaviours, adolescents with a strong SOC were more likely to visit the dentist, primarily for check-ups, compared with those with a weak SOC, and this could also be seen in adolescents whose mothers had a strong SOC. Adolescents with a high SOC have also been associated with a higher
tooth-brushing frequency \(^{127}\). Studies in an adult group population have also revealed associations between a higher SOC and regular dental attendance \(^{117, 118}\) and higher tooth-brushing frequency (twice a day or more) \(^{117, 124, 128, 129}\). SOC has also been shown to have a relationship with oral health-related quality of life, where individuals with a strong or moderate SOC had significantly fewer oral health-related problems and thereby better oral health-related quality of life \(^{130}\). Savolainen et al. \(^{129}\) found an association between strong SOC and positive oral and general health behaviours, as well as good subjective oral and general health.

However, Emami et al. \(^{131}\) did not find any relationship between SOC and the effect of the type of prosthetic treatment on oral health related quality of life in edentulous elderly people.

The life orientation questionnaire

SOC is measurable and each of us is located at some point on the SOC continuum, which can be regarded as an ordinal scale \(^{28}\). Antonovsky developed a questionnaire called ‘The life orientation questionnaire’. The original 29-item questionnaire contains questions about comprehensibility (eleven items), manageability (ten items) and meaningfulness (eight items), which combine to measure SOC \(^{132}\). The instrument was subsequently also accepted as a short form with 13 items \(^{85}\), but there are also some alternative questionnaires with fewer items \(^{90, 110, 129, 133, 134}\).

The SOC 13-item questionnaire includes five items related to comprehensibility and four items related to manageability and meaningfulness respectively \(^{85}\). Each question has a seven-point Likert scale from 1-7, with a total range of 13-91 points. High scores indicate a strong SOC and the mean value for the SOC-13 has varied from 35 to 77 in different groups. Although Antonovsky recommended using the SOC scale as a continuous variable \(^{95, 139}\), other researchers have divided the scale into low, intermediate or high SOC scores \(^{91}\). No general recommendation for cut-offs has been suggested \(^{135}\).

The SOC questionnaire has been compared with similar instruments designed to measure health behaviour and coping \(^{95, 135, 136}\). These studies claim that the SOC instrument is a relevant instrument to measure health and point to the appropriateness of using SOC as an instrument for individual prevention and treatment strategies but also as a complement to information already known as health risks. According to Eriksson and Lindstrom \(^{91}\), the instrument is not,
however, recommended for screening but should be used as a perspective in the
daily activities and actions of the professionals, to implement the theory in
practice and enrich the focus on resources rather than problems.
A few large, general, population-based epidemiological studies have been
conducted using the SOC 13-item questionnaire. In Finland, studies have been
conducted \(^{94, 115, 137, 138}\), in which factors contributing to SOC among age groups,
men and women have been studied. In Sweden, some results from a general
population have been published \(^{97, 102, 134, 139-141}\) and the same thing applies in
Finland \(^{96, 100, 115, 115, 15}\), Denmark \(^{142}\), Australia \(^{119}\) and Canada \(^{98, 143}\). Most of the
studies have focused on comparing SOC with health-related factors \(^{99, 115, 119, 130, 137, 138, 140, 142}\)
and the structure of the SOC instrument \(^{98, 100, 144}\). Most
of the studies are cross-sectional, but a few are longitudinal \(^{95, 98}\). As SOC
depends on the cultural context \(^{90}\), it is important to conduct population-based
studies of SOC and to analyse the SOC instrument in each new population \(^{145}\).
So far, SOC has not been studied in relation to oral health in a Swedish
population.

**Validity and reliability**

The SOC questionnaire (both 29-item and 13-item) has been shown to
produce acceptable results in terms of both high validity and reliability. It is also
cross-culturally applicable and has been shown to be psychometrically sound \(^{90}\).
The SOC scale does not appear to be difficult to complete for
most of the respondents. In 2003, the SOC instrument had been translated to
33 languages used in 32 countries \(^{95}\), but it has since been developed to at least
42 countries in at least 53 languages \(^{147}\). The Swedish version of the SOC
questionnaire has been used since 1992 \(^{148}\).
The SOC 13-item scale is used within several disciplines, such as medicine,
psychology, psychiatry, public health, health science, nursing, sociology, social
work and education \(^{95}\). Some researchers have found it difficult to confirm the
SOC structure in factor analyses \(^{95, 98, 139, 144, 145, 149}\). However, other studies have
found that the SOC scale has high construct validity in accordance with
Antonovsky’s theory \(^{100, 146, 150}\). SOC appears to be a multidimensional rather
than a unidimensional concept \(^{85, 90, 135}\).
Criticism of SOC

No theory is stronger than its weakest link and some critical assumptions about the concept of sense of coherence have been put forward. Some of this criticism relates to the validity and reliability, which is referred to above. The SOC concept has been discussed from a psychometric point of view because it is confounded with emotionality. Moreover, it has been stated that concepts other than SOC are available to explain health, that it is a concept full of contradictions and there are discussions about its stability. Lazarus, a contemporary of Antonovsky, has put forward some criticism about the SOC concept in relation to health. He questions SOC as an explanation of people living a perfectly healthy life with a high SOC, which is not possible in a world with war, disease and death. He also argues that the three sub-components should be separated rather than accepting their interdependence, in order to be able to analyse them with regard to their different focus on psychological, physiological and social aspects of health. Moreover, Lazarus claims that SOC "is a global and vague personality trait rather than a detailed and specific set of adaptation processes", (p.390). SOC also appears to contain the same state and processes as health, defined as holistic, which makes it a confounder when compared with health outcomes and a person’s coping secrets should instead be the focal point (a.a). Larsson and Kallenberg have criticised the SOC construct, where the 13-item scale appears to be regarded as a measure of negatively affectivity and to measure something else than health. The critics have also pointed at the involvement of the component of manageability, as it refers to a more concrete level similar to the coping concept. They also raise the question of fewer items in the short 13-item version and recommend the use of the original 29-item scale, as SOC is a complex construct. The SOC sub-scores for the three components are commonly seen in studies using the SOC scale, but there have been some discussions of weaknesses in the three-subscale hypothesis. Flensborg-Madsen et al. question whether the items measure the same thing, i.e. SOC. They raise the meaning of Cronbach’s alpha, where a high alpha value is not an expression of a theoretically meaningful scale, even if it shows that all the items contribute to the concept that is being measured. If the number of items is high and the items that are incorporated resemble each other, the alpha value increases. The authors also question why SOC does not correlate to physical health and suggest a reverse version of the scale.
Geyer claims that, even if Antonovsky can be seen as the main protagonist for the concept of salutogenesis, the central elements of SOC can be found in other concepts such as Kobasa’s ‘hardiness’ and Bandura’s self-efficacy. Furthermore, Antonovsky’s claim that SOC is stable from the age of 30 years has been criticised and discussed.

There are other concepts mentioned in the literature which have also been regarded as having a salutogenic perspective and relate to the capacity to handle strain. Hardiness by Kobasa and resilience by Wagnild and Young are some close concepts and they appear to measure very similar constructs and have all been described as an individual’s inner strength. Self-efficacy by Bandura and locus of control by Rotter have also been regarded as concepts that are close to SOC, even if these relationships have also been criticised. Further concepts, such as sense of performance, social climate, learned resourcefulness and helplessness and theory of life control, have also been mentioned. The concept of coping put forward by Lazarus has been discussed in relation to SOC by Antonovsky himself. There appear to be similarities, differences and some overlapping functions between SOC and these concepts. Some of these concepts, such as resilience, self-efficacy and locus of control, have also been studied in relation to oral health. Moreover, self-efficacy has been studied in relation to dental anxiety. However, sense of coherence is a concept within the salutogenic theory and it has been the main theoretical concept throughout this thesis.

Health promotion

According to the WHO and the Ottawa Charter, the key to the health promotion process is to enable people to gain control of their determinants of health, thereby improving their health to enable them to enjoy a good quality of life. The basic assumption is that people are active, participating subjects in charge of their own lives and an important goal of health promotion is to make it easier for people to make healthy choices. One of the health worker’s aims is to influence and guide health promotion work through education on health, for example, and by facilitating skills development. However, the feeling of control over one’s environment and personal circumstances is an important assumption for sustainable success and the role of empowerment is therefore
essential. Within health promotion, empowerment is considered to be a process through which people gain more control over decisions and actions affecting their health. Empowerment, as it is defined within health promotion, has been suggested to have a theoretical relationship with the salutogenic approach of Antonovsky but also with other related concepts as resilience and hardiness as all these concepts ‘focus on (the availability) of resources and on the (learned) ability to deal with and use those resources’ (p.12).

Health promotion has focused on a number of individualistic psychological models of behaviour change, such as Theory of Reasoned Action, Theory of Planned Behaviour and the Health Belief Model. However, researchers have found that these models have limitations, as they do not include reflections on human beings in their context, where social, environmental and political factors determine human behaviour and choices. To develop and mature, health promotion needs to be based on new theoretical frameworks including the individual’s entire context. Progressive theoretical frameworks have been suggested within oral health promotion: Communication of Innovation, Stage of Change, Theory of Natural Change, Life Course Analysis, Social Capital and the Salutogenic Theory, i.e. Sense of Coherence, but also Social Cognitive Theory.

The Ottawa Charter is the key policy document of the international health promotion movement and it has recently been applied to salutogenic theory, as it focuses on developing the determinants of health and the way health is created. SOC here is used as a tool for health promotion at both individual and social level.

**Oral health promotion**

Cognitive, behavioural and motivational factors are important when working with oral health promotion. These factors are improved by raising the awareness of the population, empowering the population and being involved in areas that are meaningful for the population. Working with a patient-centred approach instead of a professional-centred one, increases the person’s opportunity to making him/her an active participant in the process, which influences the client’s feeling of meaningfulness.
Three strategies to improve adherence are suggested in the literature: satisfaction with the process, understanding of the condition and memory of information given. A person is more satisfied with consultation focusing on social and emotional concerns rather than a pathological focus. It is important that the individual understands the situation and has an opportunity to think of and ask questions at an appropriate time (before during or after a consultation) and that the given information is comprehensible (a.a). These thoughts are in line with a salutogenic approach, focusing on increasing a person’s feeling of meaningfulness, manageability and comprehensibility. Working with health care, focusing on positive factors, i.e. resources, rather than negative factors, has been shown to be a better way to attain health and a salutogenic approach means focusing on the individual’s resources instead of risk factors. Moreover, the salutogenesis also has an interdisciplinary approach suggesting working in several arenas, which is also in line with working on health promotion. Using the salutogenic approach in oral health promotion also contributes to strengthening community actions, re-orienting health services, building healthy public policies and creating supportive environments.

Because of complex causal factors, individuals have different behaviours, attitudes and knowledge and make different choices that have a favourable or unfavourable effect on oral health but also on general health. Working with oral health promotion is one of the purposes of dental professionals, and particularly dental hygienists, which generates a focus on factors responsible for creating and maintaining health. This is in line with the salutogenic theory and the SOC concept as it seeks to explain the origin of health. It has been suggested that the salutogenic theory and the concept of SOC is a useful psychosocial framework in oral health promotion, as it focuses on the ability to use resources in spite of different stressors and a problem-orientated approach. The theory can also be useful as a guide to understanding different life choices that people make and the pathways they pursue. Dental professionals could act as a catalyst to empower their patients by increasing internal and external resources but also by being active in creating new external resources within society, aiming to increase the opportunity for the individual to make healthy choices.
Aims of the thesis

The overall aims of this thesis were (i) to describe an individuals' ability to maintain health, based on the concept of sense of coherence (SOC), (ii) to analyse the relationship between SOC, health behaviours, knowledge of and attitudes to oral health and (iii) to analyse the relationship between SOC and oral health status.

Specific aims:
   I. To describe the distribution of SOC and its components in an adult Swedish population.
   II. To investigate the relationship between SOC, oral health-related behaviours and knowledge of and attitudes to oral health in an adult Swedish population. One hypothesis was that high SOC scores were associated with positive oral health-related behaviour and better knowledge of dental health compared with individuals with lower SOC scores. A second hypothesis was that high SOC scores were associated with a more positive attitude to oral health.
   III. To investigate the associations between SOC and oral health status in an adult Swedish population. One hypothesis was that high SOC scores were related to a healthier oral status.
   IV. To evaluate the associations between dietary intake and SOC in adults. The hypothesis was that low SOC scores were associated with less favourable habits and vice versa.
Methods and Materials

The thesis is based on two cross-sectional epidemiological population studies in Sweden (Table 1). Three studies (Paper I, II, III) were performed in the City of Jönköping, a medium-sized town with around 125,000 inhabitants (2003). Paper IV was part of the northern Sweden MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) project and was conducted in Västerbotten and Norrbotten, the two most northerly counties in Sweden, with a total population of around half a million inhabitants (1999).
Table 1. Summary of design, sample and methods used in the studies included in the thesis.

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Study population</th>
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<th>Age</th>
<th>Data collection</th>
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<tbody>
<tr>
<td>Study I</td>
<td>Cross-sectional study</td>
<td>Jönköping</td>
<td>910</td>
<td>20-80</td>
<td>13-item SOC questionnaire</td>
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</tbody>
</table>
| Study II  | Cross-sectional study| Jönköping        | 910 | 20-80 | 13-item SOC questionnaire
Questions about oral health habits, attitudes towards and knowledge of dental care and teeth
Questions about sociodemographic factors |
| Study III | Cross-sectional study| Jönköping        | 910 | 20-80 | 13-item SOC questionnaire
Oral clinical and radiographic examinations
Questions about sociodemographic factors |
| Study IV  | Cross-sectional study| North of Sweden  | 7629| 25-74 | 13-item SOC questionnaire
84-item questionnaire about dietary intake |
Studies I, II and III

Participants and procedure

The study sample was based on the Jönköping study in 2003, a stratified random sample of individuals from four parishes in the City of Jönköping, Sweden. The sample consisted of 130 randomly selected subjects in each of the age groups, 20, 30, 40, 50, 60, 70 and 80 years of age with birthdates between March and May in 2003, a total of 910 individuals. The sample was selected from the county administrative board. The flowchart of participants in study I, II and III are shown in Figure 2.

Everyone selected for the study received a personal invitation by letter. They were informed of the purpose of the investigation, that they were going to be examined clinically and radiographically and that they would be asked some questions about oral health. If a daytime appointment was inconvenient, the person was examined in the evening. All data collections, i.e. the clinical and radiographic examinations, as well as answering the questionnaires, were performed during one session. The examinations started in September 2003 and were completed in November 2004.

Measurements

Questionnaires

In addition to a clinical examination, and as part of a larger battery of questions, subjects answered the Swedish version of Antonovsky’s sense of coherence (SOC) scale comprising 13 items (see Appendix). The self-reported questionnaires also included items about their attitudes to and knowledge of teeth and dental care habits, together with questions about sociodemographic factors.

The SOC questionnaire consists of three dimensions, comprehensibility (five items), manageability (four items) and meaningfulness (four items). Every item was scored on a Likert scale ranging from 1-7. Before calculating the total score,
the scores from questions number 1-3, 7 and 10 must change to a reverse ranking, i.e. from 7-1. The sum of the scores for SOC is 13 to 91.

Figure 2. Flowchart of participants in Studies I, II and III.
*In Study I, 526 participants were included in the analysis

A high score indicates a strong SOC. To compare individuals with high and low SOC scores, the individuals’ total SOC scores were divided into tertiles, (t) with t₁ ≤ 66 (n=173), t₂ = 67-75 (n=167) and t₃ ≥ 76 (n=185) respectively. Approximately one third of the respondents with the lowest score were included in the lowest SOC, while one third of the respondents with the highest score were included in the high SOC, which is in accordance with some previous studies. Only participants who answered all 13 items on the SOC questionnaire were included. As a result, 64 participants had to be excluded from the analysis.

Specifically for this thesis, questions about health-related behaviours, knowledge of and attitudes to oral health were chosen. These questions were used as
outcome variables and included nine questions related to oral health-related behaviours in terms of tobacco and dietary habits, dental visiting habits and tooth-cleaning habits and four questions relating to knowledge of oral health (including two questions each on caries and periodontitis respectively). Moreover, six questions about attitudes, i.e. emotional aspects, to dental care and teeth were included. Of the 19 questions, eight questions had dichotomous scaling, eight questions were answered on an ordinal scale and three on a continuous scale.

In order to compare good or bad oral health-related behaviours, knowledge of and attitudes to oral health, the outcome variables were dichotomised into two groups. Two questions, i.e. ‘How important do you think it is to have your own teeth as you get older?’ and ‘How do you perceive your oral health?’, had a score of 0 to 10, where the frequency distribution was left skewed (median=1) and normally distributed (median=4) respectively and the cut-off point at the dichotomisations was set at the median value for these variables.

Sociodemographic factors were used as explanatory variables in this study. They were age, gender and marital status (married or cohabiting vs. unmarried, divorced or widow/widower). Moreover, income comprised five levels but was dichotomised into two categories (high, \( \geq 240,000 \) SEK/year, vs. low, \(< 240,000 \) SEK/year), education comprised seven levels in the questionnaire but was categorised into low (less than high school), intermediate (completed high school or vocational training) and high level (university degree), while occupational level was categorised into employed vs. unemployed (including housewife, retired, unemployed and student).

Clinical examinations

Participants were examined clinically at dental offices by one of five dentists who were calibrated in terms of the diagnostic criteria below. Each clinical and radiographic examination took 60 to 90 min. The radiographic examination in 20-, 30- and 40-year-olds consisted of an orthopantomogram and six bite-wing radiographs. For the age group of 50 years and older, an orthopantomogram and a full-mouth, intra-oral radiographic examination, including 16 peri-apical and four bite-wing radiographs, were performed in dentate individuals. For edentulous individuals, only an orthopantomogram was taken. Dental examinations of a few (fewer than ten) disabled or elderly people were performed in their homes or institutions.
Diagnostic criteria: Number of teeth included all permanent teeth, excluding third molars, and was recorded. Clinical caries was recorded according to the criteria described earlier as follows: initial caries was recorded as loss of mineral in the enamel causing a chalky appearance but not clinically classified as a cavity; manifest caries on previously unrestored surfaces that could be verified as cavities by probing and in which, on probing in fissures using light pressure, the probe stuck; radiographic caries was recorded as lesions seen on the proximal tooth surfaces as clearly defined reductions in mineral content. Lesions (i) < 1/3 of the enamel and lesions and (ii) < 2/3 of the enamel but not involving the dentine were recorded as initial caries. Manifest caries was recorded as lesions extending into the dentine. Caries means the sum of initial and manifest lesions at each tooth site (DS) in this study. For each tooth surface, the presence of restorations was recorded (FS). The presence and absence of plaque (PLI) was recorded for four tooth surfaces per tooth and the presence and absence of gingival inflammation (GI) for four sites per tooth was recorded using the Löe criteria. The probing pocket depth (PPD) was recorded in millimetres and was registered only if it was > 4 mm. The presence of supragingival calculus was recorded for each tooth after drying with air. The radiographic alveolar bone level was recorded mesially and distally for each molar and pre-molar tooth in the lower jaw and was calculated as a percentage of the total tooth length.

For each individual, teeth with supragingival calculus, decayed and filled tooth surfaces (DFS), DS, FS, plaque, gingival inflammation and PPD ≥ 4 mm and were calculated as percentage of existing teeth and tooth surfaces and used as outcome variables in the analysis. The frequency of DFS and number of FS were divided into low, intermediate and high levels, where low included one third of the lowest values and high included one third of the highest values. In Scandinavia, 10-15% of the population with the highest caries scores are usually regarded as a risk group. This corresponded to DS ≥ 6 in this study and represented 10.5% of the population and the cut-off points were therefore set at this level. Subjects were classified according to the severity of their periodontal disease experience as follows:

Group 1. Healthy or almost healthy gingival units and normal alveolar bone height; ≤ 12 bleeding gingival units in the molar-pre-molar regions
Group 2. Gingivitis; > 12 bleeding gingival units in the molar-pre-molar regions, with normal alveolar bone height
Group 3. Alveolar bone loss around most teeth not exceeding 1/3 of the length of the roots
Group 4. Alveolar bone loss around most teeth ranging between 1/3 and 2/3 of the length of the roots
Group 5. Alveolar bone loss around most teeth exceeding 2/3 of the length of the roots, including the presence of angular bone defects and/or furcation defects. Individuals classified as belonging to periodontal disease experience groups 3, 4 or 5 were handled as a single variable. This variable was then dichotomised into one healthy group (periodontally treated, n=85) and one diseased group (with gingivitis and a probing pocket depth, n=138). The criteria for the healthy group were ≤ 20% bleeding sites and ≤ 10% sites with PPDs of ≥ 4 mm, while the criteria for the diseased group were > 20% bleeding sites and > 10% sites with a probing pocket depth of ≥ 4 mm.

Non-participants

Not all the selected individuals participated in the study. Depending on age group, 29-36% of the 20 to 70 year olds who were invited to participate in the study declined to take part. Non-respondents were contacted by telephone and asked about their reason for not attending the examination. The reasons for non-participation were mainly expressed as no interest or no time, while others could not be reached, or had disabilities or illnesses that prevented their participation. In some cases, a recent visit to the dentist was also given as a reason for not participating. In the 80-year age group, 53% were non-respondents. Finally, 589 individuals (64.7%), aged 20 to 80 years, took part in the study (Fig. 2). The non-participation analysis has been reported and discussed in a previous publication.

Study IV

Participants and procedures

The study sample was based on the northern Sweden MONICA Project. Surveys were performed in 1986, 1990, 1994 and 1999. In 1986 and 1990,
250 men and 250 women from each 10-year age group, 25-34, 35-44, 45-54 and 55-64 years old, were randomly selected and invited to participate. In 1994 and 1999, the 65-74 year age group was added. In the 1999 survey, all the participants from the three previous cohorts (n=5,129), as well as a new cross-sectional sample of 2,500 randomly selected persons, stratified for gender and age groups, were invited. An updated national database was used for the selection and the register included information on dates of birth and addresses for all residents living in the two counties. If a person had died or moved between the time of the selection but before the examination, a new individual of the same gender and age was selected. In all 6,000 individuals participated in 1999 (Fig. 3). Two teams, one in each county, were operating to perform the survey. The team members were trained in organised training seminars and made an individual examination to ensure correctness and uniformity in the information collection and to make the survey comparable. Every selected person was invited by letter to participate in an examination at the nearest health care centre. The participants took part in several clinical examinations and were asked to complete questionnaires on various lifestyle factors including dietary habits and Antonovsky’s 13-item life orientation questionnaire. The event registration and the survey procedures have been described previously \textsuperscript{179}.
Figure 3. Flowchart of participants in Study IV.

**Measurements**

Among several questionnaires included in the MONICA project, the 13-item SOC questionnaire was used to measure sense of coherence according to Antonovsky \cite{Antonovsky1979, Antonovsky1987, Antonovsky1996} (see Appendix). Only participants who had answered all 13 items were included. The SOC scores were calculated both as a continuous
variable and divided into quartiles. Individuals with the 25% lowest SOC scores was considered as low SOC (Q1), the two middle quartiles (50%) were considered as intermediate SOC (Q2+Q3) and individuals with the 25% highest SOC scores were considered as high SOC (Q4). This categorisation has been used in previous studies. The participants were also asked to answer a self-administered questionnaire with 84 items. Frequencies of consumption of 84 food items were reported on an increasing, nine-level scale, including never, maximum once a month, 1-3 times a month, once a week, 2-3 times a week, 4-6 times a week, once a day, 2-3 times a day and 4 or more times a day. The questionnaire included eight questions on various types of fat, nine on milk and other dairy products, eight on bread and cereals, ten on fruit, greens and root vegetables and nine on soft drinks and sugar-containing snacks and five questions on spirits, wine and beer. Twenty-nine of the remaining 35 questions recorded intake of potatoes, rice, pasta, meat and fish and six varied items, such as salty snacks, coffee, tea and juice. The respondents indicated their average portion of a) potatoes/-pasta/rice, b) vegetables and c) meat/ground meat/ sausages/fish by comparing of four colour photos illustrating four plates with increasing portion sizes of potatoes, vegetables and meat. For the other food items, we assumed gender- and age-standard portion sizes. The reported frequencies of consumption were converted into the number of intakes a day and energy and nutrient intakes were calculated by multiplying these frequencies by portion size and energy or nutrient content from a food composition database from the Swedish National Food Administration. The energy and nutrient contents were calculated using the MAT’s software (Rudans Lättdata, Sweden). Participants who had more than 10% missing answers were excluded. Single missing answers in sections where normally only one of several options is consumed frequently, such as type of milk, were not regarded as grounds for exclusion. Nutrient intake could not be estimated if the portion size indication was missing.
Statistical analysis

Studies I, II, III

The statistical analysis was conducted using the Statistical Package of Social Sciences (SPSS versions 14.0 and 16.0). The mean, standard deviation (SD) (Study I-III) and frequency distributions (Study I) were calculated. The total SOC scores and the three dimensions, comprehensibility, manageability and meaningfulness, were analysed as continuous variables, but the total SOC score was also analysed as a categorical variable divided into tertiles, as mentioned above (study I-III). The internal reliability was tested with Cronbach’s alpha and was 0.86 for total SOC, while it was 0.85, 0.80, 0.84 for comprehensibility, manageability and meaningfulness respectively (Study I). The 13 items on the SOC questionnaire were tested for construct validity using principle component factor analysis with Varimax rotation. The various indicators of factorability were 0.85, 0.80 and 0.90 for the three dimensions of comprehensibility, manageability and meaningfulness and explained 71% of the variance (Study I).

The frequency distribution of SOC scores was tested and regarded as a normal distribution in the analysis. Differences in SOC mean scores in relation to the outcome variables were tested with the t-test and, when there were more than two groups, one-way ANOVA including the Tukey test for post-hoc analysis was used (Study II-III). In Study III, linear regression analysis was performed to evaluate total SOC for associations with different clinical variables and demographic factors. Some of the clinical outcome variables were considered non-normal and transformations of the variables were therefore performed. However, the models did not differ and the untransformed results were thus presented (Study III). Multiple logistic regression analysis was performed to assess the impact of high, intermediate and low SOC scores on each of the outcome variables (Study II, III), i.e. the likelihood that respondents who had high SOC scores had a better oral health-related behaviour, more knowledge of and a positive attitude to oral health. Moreover, the likelihood that respondents who had high SOC scores had a better oral status, compared with respondents with low SOC scores, was also assessed.

The number of individuals in the bivariate and multivariate analyses varies due to some missing values in the questionnaires. Specifically, for the variables of
income, education and occupational level, the missing values vary between 7 and 36. When it comes to the multivariate regression analysis, the number of individuals on whom the analysis was based was 465 to 470 (Study II) and 204 to 470 (Study III) individuals respectively. However, after exploration with multivariate analysis excluding each of the above-mentioned variables separately, the results did not change with regard to the direction and strength of the test statistics (Study II and III). The significance level was set at \( p < 0.05 \) (Study I-III) and \( p < 0.01 \), due to the multiple comparisons in some analyses (Study II).

**Study IV**

Data were analysed separately for men and women using the SAS System for Windows (Release 8.02, SAS Institute, Cary, NC). Dietary variables were logarithmically transformed to improve normality. Univariate Pearson correlation coefficients were calculated between ln-transformed diet measures and SOC scores. Differences between means for men and women were tested with a t-test, and while differences between three or more groups, i.e. age, BMI and educational level groups, were tested by ANOVA. P-values of \( < 0.05 \) were considered significant. Dietary intake and the reporting thereof are highly influenced by gender, age, BMI and educational level. Mean intakes were therefore standardised for age, BMI and educational level using a general linear model (proc GLM). The significance of food item/nutrient predictors was based on (i) type I and (ii) type-III sum of square estimates, where (i) corresponds to a univariate regression, i.e. only the SOC score had been entered into the model, and (ii) corresponds to a multiple regression, i.e. all the independent variables (SOC, gender, age, BMI and educational level) were included in the model. To evaluate food selection pattern in individuals in relation to SOC score, PLS multivariate projection to latent structures was applied. PLS is a method for relating two data matrices, X and Y, to each other by linear multivariate modelling. In contrast to traditional linear modelling, covarying variables may be included. The PLS parameters carrying information about the x- and y- variables, e.g. \( R^2 \), \( Q^2 \) and VIP, were generated as previously described. The \( R^2 \) - and \( Q^2 \)-values give the capacity of the X matrix to explain (\( R^2 \)) and predict (\( Q^2 \); equals cross-validated \( R^2 \)) the variance of the Y matrix. The relative importance of each x-variable for the correlation
structure among X and Y is given as a VIP- (Variables of Importance in the Projection) value; VIP-values of > 1.0 are influential while VIP-values of ≥ 1.5 are highly influential.

**Ethical considerations**

The ethical rules for research described in the Helsinki Declaration (WMA) have been a guideline for three of the studies (Studies I-III). Since all the studies are epidemiological studies, ethical considerations according to the International Ethical Guidelines for Epidemiological Studies have also been taken into account. This guideline can be seen as a complement to WMA within public health and epidemiological research developed by The Council for International Organisations of Medical Science (CIOMS) in collaboration with the WHO. Three general ethical principles which permeates the 24 guidelines are described: Respect for persons, which includes respect for autonomy; Beneficence, which refers to the obligation to maximise benefits and minimise harm; Justice, which refers to the obligation to treat each person in accordance with what is normally right and proper. Moreover, considerations relating to common ethical principles applied in clinical research and guidelines for ethical evaluations in medical human research have also been taken into account. In this context, the fundamental principles are the principle of autonomy (or respect for the person), the principle of goodness, the principle of do no harm and the principle of justice.

*Studies I-III:* Individual voluntary informed consent is an important part of all epidemiological studies and it is a process that begins when initial contact is made. This part also includes important considerations relating to a person’s autonomy. In these studies, the participants were personally invited to take part in the study by a written letter including information about the purpose of the investigation and about the oral clinical and radiographic examination. The opportunity to withdraw from the study without any consequences was also included in the letter. Information was given about the fact that examination was free of charge and that radiographs would be available to their regular dentist, which could be seen as a goodness for the participants but also as a way of minimising harm. All the documents from the examinations were handled to guarantee confidentiality and information about contact persons for possible
questions was given. The letter was written in simple easily understandable language. The voluntary informed consent was given through the subjects’ participation.

All the examinations took place in a dental office and were made by experienced dentists. It is important that all kinds of groups in society can benefit from participating in research. For the participants who were physically unable to come, suitable means of transportation were arranged and, in the case of some handicapped and elderly people, the examinations were performed in their homes or institutions. This made it possible for all the invited individuals to participate, which is in line with the principle of justification. For the radiographic examination, approval was given by the radiographic institution. Oral radiographic examinations can be regarded as a natural part of an oral examination, but, to avoid unnecessary harm, recent available radiographs (within 6 months) were obtained from the individual’s regular dentist. In addition to sending a copy of the X-rays to the regular dentist, individual feedback about general oral health was given throughout the examination. Participants without any regular dentist and in need of treatment, were given a copy of their X-rays, together with a verbal recommendation to contact a dentist. This could be seen as an action both to minimise harm and to do good. The study was approved by the Ethics Committee at the University of Linköping, Linköping, Sweden (ref. no: 02-376).

Study IV: According to the guiding principles for using data from the MONICA project, an application to use data from the MONICA project from 1999 to this study was approved by the board of the MONICA project in the north of Sweden. All data were handled as non-identifiable material and this was then regarded as a waiver of consent requirements. The MONICA project was approved by the Humanistic Ethics Committee at the University of Umeå. Approval to establish a register was given by the Swedish Data Inspection Board. A full description of the survey procedure has previously been published.

To conclude, as the studies in this thesis are all epidemiological studies, the results were presented at group level, thereby minimising the risk of personal identification and the risk of harm. The beneficence in this epidemiological research is predominantly theoretical as it produces new knowledge within oral
health sciences. This can hopefully generate practical beneficence in the future within oral health promotion.

**Results**

**Study I**

For the total sample examined (589 individuals), the response rate was 89%. A total of 525 individuals, 261 men and 264 women, aged 20 to 80 years, answered all the items in the questionnaire, while 64 respondents did not answer all 13 items in the SOC questionnaire and were therefore excluded from the analysis. The distribution of the total sample, gender, age, and mean SOC scores are presented in Table 2.

Table 2. The number of subjects, gender, age groups and the mean SOC scores for the total sample, n= 525 (Studies I, II, III).

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
<th>Mean (SD)</th>
<th>Men</th>
<th>Mean (SD)</th>
<th>Women</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>78</td>
<td>63.3 (13.3)*</td>
<td>43</td>
<td>65.1 (12.0)</td>
<td>35</td>
<td>60.8 (11.5)</td>
</tr>
<tr>
<td>30</td>
<td>87</td>
<td>70.0 (11.1)</td>
<td>40</td>
<td>67.6 (11.7)</td>
<td>47</td>
<td>72.1 (10.1)</td>
</tr>
<tr>
<td>40</td>
<td>74</td>
<td>69.6 (11.6)</td>
<td>44</td>
<td>68.5 (11.2)</td>
<td>30</td>
<td>71.1 (12.1)</td>
</tr>
<tr>
<td>50</td>
<td>86</td>
<td>70.2 (10.6)</td>
<td>40</td>
<td>71.2 (10.1)</td>
<td>46</td>
<td>69.3 (11.1)</td>
</tr>
<tr>
<td>60</td>
<td>76</td>
<td>71.5 (10.4)</td>
<td>38</td>
<td>74.6 (7.9)*</td>
<td>38</td>
<td>68.4 (11.8)*</td>
</tr>
<tr>
<td>70</td>
<td>73</td>
<td>72.7 (10.1)</td>
<td>36</td>
<td>75.5 (9.3)*</td>
<td>37</td>
<td>69.9 (10.2)*</td>
</tr>
<tr>
<td>80</td>
<td>51</td>
<td>74.7 (9.4)</td>
<td>20</td>
<td>76.6 (8.35)</td>
<td>31</td>
<td>72.5 (10.9)</td>
</tr>
<tr>
<td>Total</td>
<td>525</td>
<td>70.0 (11.5)</td>
<td>261</td>
<td>70.7 (10.9)</td>
<td>264</td>
<td>69.3 (12.0)</td>
</tr>
</tbody>
</table>

* p<0.05
* Stress significantly lower mean total SOC score for 20-39-year-olds compared with the other groups
* Statistically significant difference between men and women in the 60- and 70-year-olds
The total SOC score ranged from 27 to 90 points, with a mean of 70.0 points (SD=11.5), 70.7 (SD=10.9) for men and 69.3 (SD=12.0) for women. The mean SOC scores for the 20 year olds was statistically significantly lower compared with other age groups (p < 0.05) and there was a tendency for the SOC scores to increase with age. The frequency distribution showed that the SOC scores also differ within each age groups and gender (Fig. 4). However, among 20 year olds, 55% had low SOC scores, i.e. less than 66 points. There were no differences between gender in the total mean SOC score, but when categorised into age groups and gender, the 60- and 70-year old men had a statistically significantly higher scores compared with women in the same age groups (Fig. 4).

![Figure 4](image)

Figure 4. Frequency distribution (%) of the individual total and gender SOC scores for 20-to 80 year olds (n=525)

When analysing the three sub-components, the scores increased with age in all three components, as they did for total SOC. When analysing different age
groups, the 20 year olds had a statistically significantly lower mean score for comprehensibility compared with the other age groups. Moreover, 60-year-old men had a higher mean score for all three components (p < 0.05) and 70-year-old men had a higher score for comprehensibility, compared with women in the same age groups, 28.6 (SD=4.4) and 25.1 (SD=4.8) respectively.

As a complement to this study, further analysis was performed to explore differences in SOC in relation to sociodemographic factors included in the multivariate analysis. Individuals with high SOC scores were more frequently married/cohabiting and had a higher income and a higher educational level with regard to the total mean SOC score and mean scores for the subcomponents (p < 0.05). There were no statistically significant differences between SOC scores and occupational level (Table 3).
Table 3. Total mean SOC scores and mean scores for the three components of comprehensibility, manageability and meaningfulness, in relation to sociodemographic factors (n=525). Means and standard deviations (t-test, ANOVA).

<table>
<thead>
<tr>
<th>Sociodemographic factors</th>
<th>n</th>
<th>SOC Mean (SD)</th>
<th>Comprehensibility p-value Mean (SD)</th>
<th>Manageability p-value Mean (SD)</th>
<th>Meaningfulness p-value Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>261</td>
<td>70.7 (10.9)</td>
<td>26.3 (5.0)</td>
<td>21.7 (3.6)</td>
<td>22.7 (4.0)</td>
</tr>
<tr>
<td>Female</td>
<td>264</td>
<td>69.3 (12.0)</td>
<td>ns</td>
<td>.027</td>
<td>.025</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/cohabiting</td>
<td>318</td>
<td>71.9 (10.6)</td>
<td>26.6 (5.1)</td>
<td>22.0 (3.5)</td>
<td>23.3 (3.7)</td>
</tr>
<tr>
<td>Unmarried/divorced/widow</td>
<td>194</td>
<td>67.1 (12.1)</td>
<td>&lt; .000</td>
<td>24.6 (5.4)</td>
<td>20.2 (4.3)</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>215</td>
<td>66.2 (12.8)</td>
<td>24.3 (5.8)</td>
<td>20.2 (4.6)</td>
<td>21.7 (4.3)</td>
</tr>
<tr>
<td>High</td>
<td>283</td>
<td>72.7 (9.4)</td>
<td>&lt; .000</td>
<td>26.9 (4.5)</td>
<td>22.1 (3.1)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>128</td>
<td>68.7 (12.6)</td>
<td>25.4 (5.7)</td>
<td>21.1 (4.3)</td>
<td>22.2 (4.1)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>255</td>
<td>69.0 (11.4)</td>
<td>25.5 (5.3)</td>
<td>21.0 (4.0)</td>
<td>22.5 (4.0)</td>
</tr>
<tr>
<td>High</td>
<td>124</td>
<td>73.5 (9.4)^d</td>
<td>.002^a</td>
<td>26.9 (4.7)</td>
<td>22.3 (3.0)</td>
</tr>
<tr>
<td>Occupational level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>294</td>
<td>70.4 (10.6)</td>
<td>25.9 (4.9)</td>
<td>21.4 (3.6)</td>
<td>23.0 (3.8)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>195</td>
<td>70.1 (12.0)</td>
<td>ns</td>
<td>25.9 (5.5)</td>
<td>21.4 (4.1)</td>
</tr>
</tbody>
</table>

ns = p > 0.05
a = statistically significant difference between high and low education
b = statistically significant difference between high and intermediate education

52
There were 64 participants who did not answer all 13 questions in the SOC questionnaire and they were therefore excluded from the analysis. Further analysis was conducted on this group to find out how the missing answers were distributed. Half the respondents did not answer any questions (n=33), 16 individuals answered 12 questions, 5 answered 11 questions and 10 individuals answered between two and 10 questions (Table 4). There appears to be an equal number of internal missing answers through all items except for question number 11, i.e. ‘When something happened, have you generally found that: You overestimated or underestimated its importance (score 1) ……You saw things in the right proportion (score 7), where 54 individuals did not answer this question. There were statistically significantly (p = 0.020) more women than men who did not complete the questionnaire (66% and 34% respectively) and there was a tendency towards an increase in age, from six drop-outs among the 20-year-olds to 16 drop-outs among the 70-year-olds. However, there were nine drop-outs among the 80-year-olds.

Table 4. The distribution of internal missing answers (n, %) in relation to the number of SOC questions (n=64).

<table>
<thead>
<tr>
<th>Number of SOC questions</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>33</td>
<td>5.6</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>1.2</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>11</td>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td>12</td>
<td>16</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Study II

There was an overall tendency towards higher mean SOC scores and healthier behaviour, knowledge and attitudes in relation to oral health, even if not all the variables reached statistical significance. The results of this study revealed that individuals with higher total mean SOC scores, as well as the three sub-components, had a statistically significant associations with oral health-related behaviour, such as dietary habits, knowledge of caries and attitudes to oral health. Non-smokers had significantly higher scores for manageability and individuals who brushed their teeth twice a day or more had statistically higher scores for meaningfulness (p < 0.01). After adjustment for all the explanatory variables included in the analysis (age, gender, marital status, income, education and occupational level), almost all the associations still remained significant (p < 0.05) (Table 5). High SOC scores were significantly associated with a lower frequency of eating snacks and drinks between meals (OR=1.90;CI:1.10-3.29), compared with individuals with low SOC scores. A high SOC score was also related to several attitudinal issues, such as “important to have own teeth when getting older” (OR=1.81; CI:1.11-2.96), “satisfaction with their teeth” (OR=2.21; CI:1.18-4.13), “having a good perception of their own teeth” (OR=2.27; CI:1.37-3.76) and “don’t have bad feelings before dental visits” (OR=2.05; CI:1.22-3.46). The test-statistics of the models varied between 0.053 to 0.118 as measured by the Nagelkerke’s estimator. Moreover, high SOC scores were statistically significantly associated with a knowledge of caries, i.e. the question about the cause of decayed teeth and how to prevent it, after adjustment for gender and age (OR=2.18; CI:1.25-3.79).
Table 5. Results of multivariate logistic regression analysis of the associations between SOC categories of low (≤ 66 points), intermediate (67-75 points) and high (≥76 points) scores respectively, oral health-related behaviours, knowledge of and attitudes to oral health. Adjusted for the explanatory variables of age, gender, marital status, income, education and occupational level.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Oral health-related behaviours</th>
<th>SOC</th>
<th>p-value</th>
<th>Variables</th>
<th>Attitudes to dental care and teeth</th>
<th>SOC</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>n = 152</td>
<td>OR (95% CI)</td>
<td>1</td>
<td>Satisfied with dental care?</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>1</td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.21 (1.53-2.41)</td>
<td>ns</td>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.24 (1.59-2.61)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.21 (1.53-2.41)</td>
<td>ns</td>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.24 (1.59-2.61)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>.059</td>
<td>1.21 (1.53-2.41)</td>
<td>ns</td>
<td>SOC high</td>
<td>.059</td>
<td>1.24 (1.59-2.61)</td>
<td>ns</td>
</tr>
<tr>
<td>Sweet drinks</td>
<td>n = 152</td>
<td>OR (95% CI)</td>
<td>1</td>
<td>Important to have your own teeth when you get older?</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>1</td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.25 (1.62-2.54)</td>
<td>ns</td>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.24 (1.60-2.64)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.25 (1.62-2.54)</td>
<td>ns</td>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.24 (1.60-2.64)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>.059</td>
<td>1.25 (1.62-2.54)</td>
<td>ns</td>
<td>SOC high</td>
<td>.059</td>
<td>1.24 (1.60-2.64)</td>
<td>ns</td>
</tr>
<tr>
<td>Frequency of snacks between meals</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>.025</td>
<td>Satisfied with your teeth?</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>.041</td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.20 (1.62-3.43)</td>
<td>.011</td>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.20 (1.62-3.43)</td>
<td>.011</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.20 (1.62-3.43)</td>
<td>.011</td>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.20 (1.62-3.43)</td>
<td>.011</td>
</tr>
<tr>
<td>SOC high</td>
<td>.059</td>
<td>1.20 (1.62-3.43)</td>
<td>.011</td>
<td>SOC high</td>
<td>.059</td>
<td>1.20 (1.62-3.43)</td>
<td>.011</td>
</tr>
<tr>
<td>Toothbrushing frequency</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>.025</td>
<td>How do you perceive your own teeth?</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>.007</td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.26 (1.71-3.29)</td>
<td>.011</td>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.26 (1.71-3.29)</td>
<td>.011</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.26 (1.71-3.29)</td>
<td>.011</td>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.26 (1.71-3.29)</td>
<td>.011</td>
</tr>
<tr>
<td>SOC high</td>
<td>.059</td>
<td>1.26 (1.71-3.29)</td>
<td>.011</td>
<td>SOC high</td>
<td>.059</td>
<td>1.26 (1.71-3.29)</td>
<td>.011</td>
</tr>
<tr>
<td>Knowledge of oral health</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>.025</td>
<td>Feelings before dental visits?</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>.006</td>
</tr>
<tr>
<td>Do you know the cause of decayed teeth and ways to prevent it?</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>1</td>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
<td>SOC high</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
<tr>
<td>Overall knowledge of oral health</td>
<td>n = 153</td>
<td>OR (95% CI)</td>
<td>.025</td>
<td>COC low (reference)</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
<td>SOC low (reference)</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
<td>SOC intermediate</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
<td>SOC high</td>
<td>.059</td>
<td>1.24 (1.66-2.33)</td>
<td>ns</td>
</tr>
</tbody>
</table>

* p < 0.05

a) Statistically significant after adjustment for gender and age (OR=2.18; CI=1.25-3.79)
Study III

The results revealed an overall tendency for individuals with higher total mean SOC scores to have a healthier oral status, even if it was not always statistically significant (p < 0.05). However, as a first step, the bivariate analyses showed that individuals with higher total mean SOC scores had a higher frequency of DFS, lower DS, a higher FS and a lower frequency of teeth with calculus, compared with individuals with lower SOC scores. Moreover, individuals belonging to any of the periodontal disease experience groups 3, 4 or 5 had a healthier periodontal status, compared with individuals with lower mean SOC scores. These conditions were almost the same for the three SOC components, apart from high DS and a healthy periodontal status, where manageability and comprehensibility respectively, had higher scores. When analysing SOC as a continuous variable and before any adjustments, the results revealed that SOC could contribute some of the variance according to DFS, DS, FS and teeth with calculus. These relationships failed after adjustment for all explanatory variables included in the analysis (age, gender, marital status, income, education and occupational level) and were then only statistically significantly associated with a PPD of ≥ 4mm with an explained variance of 10.1%. With the aim of analysing the potential chance of having a strong SOC and a healthier oral status, the results of the multiple logistic regression revealed that individuals with high SOC scores, i.e. ≥ 76 points, were more likely to have less plaque compared with those with low SOC scores (p=0.04). Moreover, higher SOC scores showed a tendency towards an association with less risk having gingivitis (p=0.059) (Table 6).
Table 6. Results of multiple logistic regression analysis of the association between SOC scores (explanatory variable), quantified as low (≤ 66 points), intermediate (67-75 points) or high (≥ 76 points) SOC, and various clinical oral health measures (outcome variables). Adjusted for different sociodemographic variables.

<table>
<thead>
<tr>
<th>Clinical variables and SOC levels</th>
<th>Nagelkerke R²</th>
<th>β</th>
<th>OR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of teeth (&lt; 20 teeth / ≥ 20 teeth)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>153</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>151</td>
<td>.022</td>
<td>1.02 (.42-2.50)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>166</td>
<td>.490</td>
<td>.401</td>
<td>.67 (.27-1.66)</td>
</tr>
<tr>
<td>Frequency DFS % (low / high)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>101</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>94</td>
<td>-.631</td>
<td>.53 (.13-2.22)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>114</td>
<td>.868</td>
<td>.168</td>
<td>.85 (.24-2.97)</td>
</tr>
<tr>
<td>Frequency DS % (&lt; 6 sites / ≥ 6 sites)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>153</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>150</td>
<td>.475</td>
<td>1.61 (.71-3.61)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>166</td>
<td>.259</td>
<td>.469</td>
<td>1.60 (.65-3.92)</td>
</tr>
<tr>
<td>Frequency FS % (low / high)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>98</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>98</td>
<td>-.647</td>
<td>.52 (.09-2.98)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>113</td>
<td>.912</td>
<td>.269</td>
<td>1.31 (.16-3.82)</td>
</tr>
<tr>
<td>PLI % (≤ 20% / &gt; 20%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>153</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>151</td>
<td>-.407</td>
<td>.67 (.40-1.12)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>166</td>
<td>.103</td>
<td>.547</td>
<td>.58 (.34-0.98)</td>
</tr>
<tr>
<td>GI % (≤ 20% / &gt; 20%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>153</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>150</td>
<td>-.109</td>
<td>.90 (.53-1.52)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>166</td>
<td>.037</td>
<td>.544</td>
<td>.58 (.33-1.02)</td>
</tr>
<tr>
<td>PPD ≥ 4 mm % (≤ 10% / &gt; 10%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>153</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>150</td>
<td>-.378</td>
<td>.68 (.38-1.22)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>166</td>
<td>.175</td>
<td>-.266</td>
<td>.77 (.44-1.35)</td>
</tr>
<tr>
<td>Teeth with calculus % (≤ 20% / &gt;20%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>153</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>151</td>
<td>-.233</td>
<td>.79 (.45-1.39)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>166</td>
<td>.052</td>
<td>-.334</td>
<td>.72 (.40-1.27)</td>
</tr>
<tr>
<td>Periodontal status (healthy/diseased)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC low (reference)</td>
<td>65</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>SOC intermediate</td>
<td>63</td>
<td>-.004</td>
<td>1.0 (.46-2.16)</td>
<td>ns</td>
</tr>
<tr>
<td>SOC high</td>
<td>76</td>
<td>.070</td>
<td>-.197</td>
<td>.82 (.39-1.71)</td>
</tr>
</tbody>
</table>

ns = p > 0.05

Adjusted for gender, age, marital status, income level, educational level and occupational level
Study IV

A total of 4,991 individuals, 2,446 men and 2,545 women, 25-74 years of age, answered the SOC- and food-frequency-questionnaires in such a way that the inclusion criteria were met. This corresponded to 86.6% of the participants in the northern Sweden MONICA 1999 study. The total SOC scores varied between 23 and 91 points and the mean scores increased significantly with increasing age for both men and women \((p<0.0001)\). There were no significant differences between genders, or between different BMI groups or years of education (Table 7).

The results of this study showed several significant associations between SOC-quartile and favourable dietary intake, for both men and women. Even after adjustment for age, BMI and education level, SOC quartile scores still contribute to the variance in the intake of vegetables, sucrose and sweets for women and total fat, vegetables and alcohol in men. When comparing differences in intake in relation to high and low SOC quartiles (age, BMI and education adjusted), both men and women with higher SOC scores had a significantly higher mean intake of vegetables compared with individuals with lower SOC scores. Moreover, women within the higher SOC quintile had a higher intake of fruit, but a lower intake of energy, total saturated fat, sucrose and sweets, compared with women within the lowest SOC quintile. With the aim of evaluating food selection patterns in individuals, the results revealed that both men and women with high SOC scores had a healthy food intake, characterised by a high intake of rye crispbread (whole-meal), boiled potatoes and vegetables. In addition, both genders with low SOC scores had a higher intake of less favourable food choices such as pizza, soft drinks, candies, sausages, hamburgers, mashed potatoes, chips, potato salad, French fries and so on (Table 8).
Table 7. The distribution and differences in total mean SOC scores for gender, age groups, BMI, education and SOC quartile (mean, CI 95%, t-test and ANOVA).

<table>
<thead>
<tr>
<th>SOC quartile</th>
<th>WOMEN</th>
<th></th>
<th></th>
<th>MEN</th>
<th></th>
<th></th>
<th>P-VALUE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>MEAN (95% CI)</td>
<td>N</td>
<td>MEAN (95% CI)</td>
<td>T-TEST BETWEEN GENDER</td>
<td>WOMEN</td>
<td>MEN</td>
<td>ANOVA AMONG GROUPS</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,545</td>
<td>68.5 (68.1-68.9)</td>
<td>2,446</td>
<td>68.4 (68.0-68.8)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ns</td>
<td>0.039</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>25-34 yrs</td>
<td>217</td>
<td>67.6 (66.0-69.1)</td>
<td>189</td>
<td>65.5 (64.1-67.0)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-44 yrs</td>
<td>512</td>
<td>67.6 (68.1-68.8)</td>
<td>450</td>
<td>66.4 (65.5-67.4)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-54 yrs</td>
<td>641</td>
<td>68.6 (68.1-68.8)</td>
<td>653</td>
<td>68.3 (67.6-69.1)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-64 yrs</td>
<td>659</td>
<td>68.7 (68.1-68.8)</td>
<td>619</td>
<td>69.7 (68.9-70.4)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65-74 yrs</td>
<td>516</td>
<td>69.5 (68.1-68.8)</td>
<td>535</td>
<td>69.6 (68.7-70.4)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>1,131</td>
<td>68.4 (67.7-69.0)</td>
<td>775</td>
<td>68.4 (67.5-68.9)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥25-&lt;27</td>
<td>440</td>
<td>69.2 (68.4-70.1)</td>
<td>609</td>
<td>68.6 (67.9-69.4)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥27-&lt;30</td>
<td>489</td>
<td>68.6 (67.6-69.5)</td>
<td>665</td>
<td>68.6 (67.8-69.3)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥30</td>
<td>478</td>
<td>68.2 (67.2-69.1)</td>
<td>397</td>
<td>67.9 (66.9-68.9)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>≤9 yrs</td>
<td>870</td>
<td>68.9 (68.2-69.9)</td>
<td>967</td>
<td>68.9 (68.2-69.6)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥10-≤12 yrs</td>
<td>1,007</td>
<td>68.7 (67.4-68.7)</td>
<td>997</td>
<td>68.0 (67.4-68.5)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥13 yrs</td>
<td>668</td>
<td>68.6 (67.8-69.2)</td>
<td>482</td>
<td>67.2 (67.3-69.2)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOC quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.035</td>
<td>ns</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Q1 (low)</td>
<td>618</td>
<td>54.2 (53.7-54.7)</td>
<td>588</td>
<td>55.0 (54.6-55.5)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>663</td>
<td>65.7 (65.5-65.9)</td>
<td>689</td>
<td>65.8 (65.6-65.9)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3</td>
<td>640</td>
<td>72.9 (72.8-73.1)</td>
<td>634</td>
<td>73.0 (72.8-73.1)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4 (high)</td>
<td>624</td>
<td>81.2 (80.9-81.4)</td>
<td>535</td>
<td>80.9 (80.6-81.2)</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8. Food selection pattern by SOC scores. VIP-values denotes the influence in explaining variations in SOC scores. VIP values of ≥ 1.2 are listed and + denotes associations with high SOC and – associations with low SOC scores.

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Association VIP</th>
<th>Food Item</th>
<th>Association VIP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Influential for high SOC</strong></td>
<td></td>
<td><strong>Influential for high SOC</strong></td>
<td></td>
</tr>
<tr>
<td>Bread</td>
<td>+ 2.18</td>
<td>Fruits</td>
<td>+ 1.83</td>
</tr>
<tr>
<td>Bread and cereals</td>
<td>+ 1.96</td>
<td>Vegetables</td>
<td>+ 1.83</td>
</tr>
<tr>
<td>Rye crispbread (whole meal)</td>
<td>+ 1.89</td>
<td>Liver paste</td>
<td>+ 1.64</td>
</tr>
<tr>
<td>Fish</td>
<td>+ 1.76</td>
<td>Boiled potato</td>
<td>+ 1.47</td>
</tr>
<tr>
<td>Boiled potato</td>
<td>+ 1.71</td>
<td>Rye crispbread (whole meal)</td>
<td>+ 1.43</td>
</tr>
<tr>
<td>Berries</td>
<td>+ 1.51</td>
<td>Blood foods</td>
<td>+ 1.32</td>
</tr>
<tr>
<td>Wine</td>
<td>+ 1.49</td>
<td>Cereals</td>
<td>+ 1.39</td>
</tr>
<tr>
<td>Light beer</td>
<td>+ 1.32</td>
<td>Oat flake porridge</td>
<td>+ 1.24</td>
</tr>
<tr>
<td>Vegetables</td>
<td>+ 1.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Influential for low SOC</strong></td>
<td></td>
<td><strong>Influential for low SOC</strong></td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td>– 2.41</td>
<td>Mashed potato</td>
<td>– 2.98</td>
</tr>
<tr>
<td>Soft drinks</td>
<td>– 2.23</td>
<td>Sausage as main course</td>
<td>– 2.11</td>
</tr>
<tr>
<td>Pasta</td>
<td>– 2.14</td>
<td>Potato salad</td>
<td>– 1.98</td>
</tr>
<tr>
<td>Candles</td>
<td>– 2.02</td>
<td>Soft drinks</td>
<td>– 1.94</td>
</tr>
<tr>
<td>Sausage as main course</td>
<td>– 1.97</td>
<td>French fries</td>
<td>– 1.89</td>
</tr>
<tr>
<td>Hamburgers</td>
<td>– 1.94</td>
<td>Hamburgers</td>
<td>– 1.82</td>
</tr>
<tr>
<td>Mashed potato</td>
<td>– 1.87</td>
<td>Beer (high alcohol)</td>
<td>– 1.71</td>
</tr>
<tr>
<td>Fried potato</td>
<td>– 1.65</td>
<td>Pizza</td>
<td>– 1.68</td>
</tr>
<tr>
<td>Butter for cooking</td>
<td>– 1.63</td>
<td>Sweets</td>
<td>– 1.67</td>
</tr>
<tr>
<td>Chips, cheese doodles, nuts</td>
<td>– 1.57</td>
<td>Candies</td>
<td>– 1.60</td>
</tr>
<tr>
<td>Potato salad</td>
<td>– 1.48</td>
<td>Rice</td>
<td>– 1.50</td>
</tr>
<tr>
<td>Banana</td>
<td>– 1.37</td>
<td>Pancakes</td>
<td>– 1.43</td>
</tr>
<tr>
<td>French fries</td>
<td>– 1.22</td>
<td>Syrupa</td>
<td>– 1.32</td>
</tr>
<tr>
<td>Traditional broth soaked bread</td>
<td>– 1.21</td>
<td>Cookies</td>
<td>– 1.39</td>
</tr>
<tr>
<td>Fruit soup</td>
<td>– 1.21</td>
<td>Traditional broth soaked bread</td>
<td>– 1.29</td>
</tr>
<tr>
<td>Traditional potato dumpling</td>
<td>– 1.20</td>
<td>Chips, cheese doodles, nuts</td>
<td>– 1.29</td>
</tr>
</tbody>
</table>
Finally, the overall conclusions from the results of the studies included in this thesis are shown in Figure 5.

Figure 5. Schematic conclusions of the main results of Studies I-IV.
Discussion

The main results of this thesis revealed that there was a generally normal SOC distribution within an adult Swedish population. SOC increased with age but varied within different age groups. Younger adults had significantly lower SOC scores compared with all the older age groups, where more than 50% of all 20 year olds had low SOC scores. Men aged 60 and 70 years had significantly higher mean SOC scores compared with women of the same age. There were relationships between higher SOC scores and healthier dietary behaviours, positive attitudes and, to some extent, a better knowledge in relation to oral health. Moreover, higher SOC scores were related to oral health status, such as plaque and probing pocket depth, but also to other oral status variables.

Method

Design

This thesis is based on cross-sectional epidemiological studies, an important tool for analysing populations’ needs of oral health, planning suitable oral health promotion programmes and ensuring quality in dental care. Cross-sectional designs have been found to be useful for identifying correlates and associated features, which may be informative and significant. Moreover, the objective of using this design is to examine factors that are associated with a particular characteristic of interest. However, one important issue when using this design is that the ability to prove causation is very weak, as it provides no direct evidence relating to the time sequence of events.
Sample

The sample was selected according to an age-stratified random selection of the population, which is a strength in all the present studies (Studies I-IV), as it provides high representativeness among the participants included in the study. Moreover, in Study I-III, the ethnic composition of the sample was generally similar to that of Sweden as a whole. When it comes to the age groups, an earlier study included the same population as the current one and found significantly fewer participants among the 20 year olds and more among 70 year olds compared with the age distribution in the city of Jönköping in 2003, whereas it was equal for the rest of the age groups. The results of the distribution of the used variables, i.e. oral health behaviour, knowledge of and attitudes to oral health, as well as clinical variables, have been presented in earlier studies and have been similar to other Swedish studies. These data justify the assumption that data from the present study can be used to draw more general conclusions.

In Studies I-III, the external non-response (29%-36%) for the 20- to 70-year age groups is in accordance with other studies, but, in the 80-year age group, the non-respondents were 53%, which must be considered with caution when interpreting the results. The main reason for non-response was lack of time or no interest, but other reasons were also given. The effect of non-respondents could always impact the results in some way if there are more non-participants from special groups. Moreover, there is always a risk of a health selection, i.e. the most healthy people find it interesting to participate, and thus may influence the results in a certain direction.

In Study IV, the sample size was very large, as was the number of final participants, and can therefore be assumed that there was less risk of bias according to the selection. However, a large sample size usually increases the chance of obtaining many statistically significant differences in the analysis, even though the results indicated strong relationships in the same direction for several variables. Together with the randomised sample selection, this allows for the generalisation of the results at population level.
Data collection

When several different registrars are used, there is always a threat to the validity and the reliability. The data collection in Studies I-III was performed by five experienced dentists, who were calibrated in terms of well-documented diagnostic criteria before the examination took place. Moreover, the instruments and equipments used for the examinations were of the same brand. In spite of this, the clinical measurements may have been affected by examiner variations, even though, the dentists had a great deal of clinical experience, which may have minimised the risk.

In Study IV, the data collection was performed by two teams. However, the teams were trained for the purpose by the same teachers at all the seminars, which should minimise the risk of different messages. Moreover, all the members of the team performed an individual examination to ensure correctness. The same team also performed the examinations at the individual health care centres in each of the two counties. Within the MONICA project, extensive quality assessments of various methods and measures were also made. Taken as a whole, this indicates that the validity of the data collection was fairly high.

Questionnaires

When it came to the questionnaires used in this thesis, some considerations must be taken into account. The SOC questionnaire (Studies I-IV) and the 84-item food-frequency questionnaire (Study IV), have been shown to have high validity and reliability. However, there is always a risk of under- or over-reporting when using self-reported questionnaires. As the SOC questions are more general than situation-specific, this can be both positive and negative – positive, in that the participants do not need to demonstrate a specific behaviour, knowledge or habit, but also negative, as it could be difficult to understand the questions because of the loss of a personal relationship to a specific situation. However, in this study only one question appeared to have a higher frequency of missing responses. In most previous studies, the participants do not appear to have had difficulty answering the questions. When it comes to the food questionnaire (Study IV), it has been shown that the
under reporting of energy intake is common and is related to several factors but mainly to body mass index (BMI), as well as age and smoking \(^{102}\), which must be taken into consideration when using a food questionnaire.

This is also the issue as far as the other questions about behaviour, knowledge and attitudes are concerned, as well as the questions about sociodemographic factors (Studies I-III). In questions of this kind, there is always a risk of under- or over-reporting.

The questions about behaviour, knowledge and attitudes were chosen because these three aspects have an influence on oral health status and were included in a larger epidemiological study conducted in the City of Jönköping 2003. Several behavioural aspects, such as tobacco-, dietary-, dental visit- and tooth-cleaning habits, were chosen in order to include a wider perspective of health behaviours. However, even if these data were based on a large epidemiological study, the eligibility of the variables is limited, as there are factors other than those in the present study, that are related to behaviour, knowledge and attitudes, even if it is also important to limit a study.

According to the literature, the concept of an attitude includes three components, such as cognition and the emotional and behavioural aspects of an object \(^{24}\). From this perspective, questions focusing on a feeling towards the object, i.e. emotional aspects, were chosen and used. Questions about cognition and an intended action, i.e. knowledge of and behavioural aspects, were analysed separately.

**Analysis**

In this thesis, the SOC scale was used as both a continuous variable and as a categorical one, which is common in other studies using SOC. Analysing SOC as a categorised variable can be a risk, as the choice of cut-off points can influence the results. Even if other studies have had equal cut-offs, it could be difficult to compare the results, as the levels of low, intermediate and high SOC scores vary, depending on different cut-off points. In the literature, no standard score for cut-offs has been recommended \(^{35}\). However, in the present study, analysis of the SOC scale as a continuous variable did not change the results in the multivariate analysis, except for teeth with calculus, which was significant (\(p = .029\)) when using SOC as a continuous variable (Study III). The statistical
significance remained but with small changes in the p-values and in confidence intervals (Studies II, III).

The multivariate analysis methods were linear regression and multivariate logistic regression. These analyses are very common in epidemiological studies. They are important, as they enable an evaluation of several explanatory variables simultaneously. Moreover, each variable is weighted in relation to the outcome variable, independently of the other incorporated variables.

**Results**

This thesis highlights the importance of implementing a psychosocial theoretical framework designed to complement the biomedical tradition when working with oral health prevention. Moreover, this thesis may be seen as the initiation of a salutogenic approach within dental care and thereby also a focus on oral health promotion. These thoughts can be illustrated by the following figure (Figure 6).
Figure 6. An illustration of a theoretical model, including the salutogenic perspective and sense of coherence (SOC) as part of the biopsychosocial model.
The distribution of SOC in an adult population (Studies I, IV)

SOC has been used in some previous general adult population studies in Sweden \(^{97, 102, 134, 139-141}\) and in other Scandinavian countries \(^{94, 96, 100, 115, 133, 137, 138, 142}\), but also in Europe \(^{195-197}\), Canada \(^{98, 143}\) and Australia \(^{119}\), even if the aim of these studies has been somewhat different. As different SOC scales were used and the SOC scale was applied in different ways in the analyses, it is difficult to comparing the results. However, some comparisons can be made. For the studies in this thesis (Studies I, IV), SOC increased with age, which has been confirmed in other studies \(^{94, 95, 97, 100, 119, 138, 140, 142, 195}\). In addition, the youngest individuals have a significantly lower SOC compared with older age groups \(^{100, 102, 142}\). However, this was not confirmed in an early general Swedish population study \(^{141}\). As this thesis was based on cross-sectional data, it might be difficult to explain the relationships between age and increasing SOC. According to Antonovsky, SOC is fairly stable after 30 years of age, especially for individuals with a high SOC \(^{85}\). Subsequently, longitudinal studies have shown that SOC may change during the course of life, due to different experiences and general maturation \(^{96-101, 105}\). A Swedish study has also reported that a low SOC level is influenced by current life circumstances, such as job strain, low social support and low social anchorage \(^{198}\).

There were no statistical differences in Study I or in Study IV in terms of total SOC and gender. However, when the total population was divided into age groups (Study I), 60- and 70-year-old men had higher mean SOC scores compared with the women in the same age group. Previous studies have produced some divergent results \(^{95}\) where some have shown no gender differences \(^{94, 97, 102, 119, 141}\) and others have done so \(^{137, 138, 140, 195, 197}\), where men have been seen to have higher mean SOC scores than women. The results of Study I also revealed that the sub-components of comprehensibility, manageability and meaningfulness may play an important part in understanding the differences in SOC. Comprehensibility was significant lower for 20 year olds and more than 50% of this group had a weak SOC. This may be explained by more health complaints for this age group, such as anxiety and depression \(^{199}\). In Sweden, young adults have recently finished the free-of-charge system within the dental care organisation and often
start a new independent life. These circumstances, in combination with factors contributing to low SOC, may have an unhealthy impact on oral health in the future, which indicates a need to work in a health promotion direction targeting this group. However, this is contradicted by previous Finnish study which reported that younger people have higher SOC than older people.

Moreover, 70-year-old men also had a significantly higher score for comprehensibility, which may indicate an effect of some life circumstance. Other studies have shown that marital status was associated with SOC among older people and higher perceived health was associated with higher SOC scores among older active people, where comprehensibility explained this association to a greater degree.

Complementary results from the present study revealed that an individual’s SOC scores were also associated with sociodemographic factors such as marital status, income and education. This is in line with the theory that SOC involves general resistance resources (GRR), such as social and cultural capital, education, money, work-related and environmental factors, which characterise a person’s life situation and are important for a person’s SOC level. Other studies have also found an association between high SOC scores and several background factors such as a high education, having a spouse/partner, working life and fewer financial problems in one’s childhood home. Moreover, SOC has been shown to be related to income and education. However, it is important to emphasise the fact that a person’s SOC is not only dependent on different GRRs and also the most important point is that SOC implies an ability to identify and use the available resources for different situations, internal as well as external.

Another aspect of SOC at population level is the mean value in relation to other populations. In this thesis, the mean SOC values were 70.0 points (SD=11.4) for the whole population and 70.7 (SD=10.9) for men and 69.3 (SD=12.0) for women (Study I) and 68.4 (CI=68.0-68.8) for men and 68.8 (CI=68.1-68.9) for women respectively (Study IV). This is fairly high compared with other general Swedish populations and also with other Scandinavia countries, Greece, Australia and Canada, where it has been reported to be five to ten points lower. However, a study based on a general population from
Åland, a Finnish county, showed a mean value of 70.7 (SD = 11.7), which is equal to the value in this thesis. Åland is an example of a population where the health statistics are good, the average life expectancy is higher than in the rest of Finland, the unemployment rate is low and most of the people perceive that they have good subjective health. The high SOC level in the population may be explained by the societal context according to the authors, who raised the importance of a salutogenic framework in a societal context. Moreover, the results of the 2006 Swedish public health survey, reveal regional differences relating to self-reported health, contact with medical care, living habits and social relations. There were also gender differences within individual counties. The higher mean SOC score in the current thesis is based on two different populations in Sweden, and may reflect a different social context within a country and different populations within society. The social context as a whole is also an important factor for oral health, where SOC may be a tool targeting different oral health promotion programmes.

**SOC and oral-health-related behaviours (Studies II, IV)**

The hypothesis about oral-health-related behaviours was confirmed in this thesis and the results revealed that individuals with a strong SOC had healthier behaviour, with a favourable impact on both oral health and general health, compared with individuals with a weaker SOC (Studies II, IV). These results are in line with Antonovsky’s salutogenic theory and also with the findings of other researchers that a strong SOC promotes adaptive health behaviours. There are health behaviours that have a specific relationship with oral-health, such as dental visits and tooth-cleaning habits, and there are also those that have an impact on general health such as tobacco and dietary habits. In this thesis, both these aspects were included with the aim of focusing on the health promotion approach, as this is one of the goals when working within oral health care.

The overall results revealed that individuals with higher mean SOC scores had a tendency towards healthier behaviour compared with individuals with lower mean SOC scores, even if not all the variables reached statistical significance. High SOC scores were associated with eating habits such as fewer sweet drinks, a lower frequency of snacks between meals (Study II) and several health-promoting food choices for both men and women (Study IV). After controlling
for other possible confounding factors included in the analysis, some of these relationships disappeared, but the association between a high SOC and a lower frequency of snacks between meals still remained significant (Study II) and a high SOC still helped to explain a healthier food choice for both men and women (Study IV). This relationship has been confirmed in other studies, where Barnabé et al. found that a strong SOC was associated with a lower consumption of sugar-added products and Wainwright et al. found an association between individuals with a strong SOC and the reporting of a higher consumption of fruit, vegetables and fibre but no association with sugar, sodium and fat. On the other hand, Freire et al. did not find any association between SOC and sugar intake. Even if these finding have some divergent results, the overall impression of these results is that SOC is associated with an individual’s way of making healthy dietary choices, which is an important factor for maintaining oral and general health.

When it comes to smoking habits, non-smokers had a significantly higher mean score for manageability compared with smokers, indicating the importance of reflecting on all three dimensions within SOC. An individual may have the ability to understand the risk of smoking, i.e. comprehensibility, be emotionally engaged and motivated, i.e. meaningfulness, but he/she may not have the ability to find and use resources to manage to stop smoking, i.e. manageability. Smoking is not only related to an individual’s own choice, but it is also an action strongly related to particular social circumstances. In this context, the dental staff may be an important resource as an activator for increasing an individual’s ability to manage to stop smoking, by including the client’s life and everyday perspectives. Other studies have confirmed the relationship between high SOC scores and not smoking, where the sub-component of comprehensibility has been shown to be the strongest predictor of smoking behaviour. On the other hand, this relationship has not been confirmed in some previous studies. However, in these studies, there were some methodological differences, such as one sample consisting of 20-year-old individuals with a mainly high SOC, while another included both snuff users and smokers, i.e. tobacco habits within same variable, which could have produced different results.
As dietary and smoking habits have a major influence on both oral and general health, it is important to be aware of the dental personnel’s responsibility as part of health promotion, in order to increase the individual’s ability to make healthy choices. This can be done at both clinical and societal level.

When it came to oral-health-specific behaviours, no association was found between total SOC and tooth-brushing habits or dental visits. However, individuals with a higher mean value for meaningfulness appear to have better tooth-cleaning habits i.e. they brush their teeth twice a day or more, compared with individuals with lower mean scores. Freire et al. did not find any associations between SOC and tooth-brushing frequency either. However, other studies have found a significant relationship between strong SOC and tooth-brushing twice a day or more and an association with regular dental attendance. These studies came from different countries with different kinds of dental care organisations, which makes it important to consider how a society’s organisation may influence oral health behaviour. The influence of SOC on dental habits may not be as strong in a country like Sweden, as most people visit the dentist regularly and brush their teeth as part of a natural health behaviour which is not based on the individual’s ability to use resources as a main factor.

As some of the correlations disappeared in the multivariate analysis, this indicates that some behaviours are linked to other factors, such as age, socioeconomic status and education, whereas some are more bound to the individual’s SOC, i.e. his or her ability to use resources in a way that favours a health-promoting life.

**SOC and knowledge of and attitudes to oral health (Study II)**

Oral health-related behaviours, such as tooth-cleaning and dietary habits, are an important tool within oral health prevention, which may be influenced by attitudes and knowledge. According to the results, higher SOC scores may have positive associations with knowledge of and attitudes to oral health. Of the four questions included in the analysis, knowledge of dental caries and how to prevent it was significantly related to a higher mean total SOC score and subsequently all three sub-components, which may indicate the importance of involving all three dimensions in patient-therapeutic communication. In other
words, it is important to ensure that the patient understands the massage, has a feeling that the knowledge is a manageable health resource and that he/she has an emotional feeling in which it is worth investing time and involvement in order to understand the complex health-disease relationship. This is also in line with a patient-centred approach. Working with health education by increasing knowledge about health is a common approach in health promotion. However, successful education does not mean giving lectures from one direction, it involves a person’s life context with the aim of increasing the opportunities for that person to engage and participate and to increase his or her empowerment. This may then increase the individual’s opportunity to make sustainable healthy choices. There also appears to have been a change of attitude where the patient plays a more active rather than a passive role. Moreover, patients and dental staff often come from different cultures, i.e. have different perspectives of oral health, which may lead to a lack of adherence with recommended home care routines and failure of treatment. This all underlines the importance of a more patient-centred approach, i.e. focusing on the patient’s life context and participation, which also may influence an individual’s SOC.

There were four questions about knowledge of oral health, which is not enough to measure an overall latent structure of knowledge. However, since the relationship between SOC and knowledge of oral health has not been studied before, this may raise some new thoughts about the importance of a psychosocial aspect in relation to knowledge of oral health and disease. In a recent intervention study, young adults were shown a video about oral health education designed to analyse a new way of improving oral health knowledge and thereby improve oral health and see whether this was related to psychological factors. The results showed that a stronger internal locus of control was related to a higher mean plaque level for males, which was not a positive outcome on the health-disease continuum. This may be due to several factors, such as a homogeneous sample, as was suggested by the authors, but it may also depend on the way the education was given. A video may not be the best way to increase the individual’s feeling of comprehension, manageability and motivation. Studies analysing psychological interventions to improve adherence with oral hygiene instructions showed that psychological interventions, such as cognitive behavioural intervention including problem
solving and verbal reinforcement, improved oral health. This points at the importance of reflecting on the patient’s own resources in several dimensions, such as social, cognitive and emotional, while working with oral health education.

Three of the four questions on knowledge did not reach any statistical significance, which may be explained by a poorer knowledge of periodontitis and gingivitis in general compared with knowledge of caries. People are more aware of caries as a result of information and preventive action since early childhood. However, in the full multivariate analysis models, knowledge of oral diseases was not associated with SOC scores, except when adjusting for age and gender alone. Other parameters are therefore more significant and prominent in explaining the level of knowledge, while these single, global items in our questionnaire did not capture enough variance.

The content of the attitude concept can be interpreted in different ways, including cognitive, emotional and behavioural aspects. Attitudes in this study referred to an emotional aspect of an object, including questions about the subjects’ oral status, tooth appearance and dental anxiety. In this thesis, attitudes to oral health were significantly related to several of the items in the questionnaire, even if the differences in the mean values were fairly small. However, these relationships remained significant even after controlling for all the sociodemographic factors included in the analysis. The results showed that a strong SOC was associated with better oral-health-related attitudes, such as the importance of having one’s own teeth when getting older, satisfaction and perception of their own teeth and low dental anxiety levels. To the author’s knowledge, SOC has not previously been analysed in relation to attitudes to oral health used as an emotional aspect. Some previous studies have interpreted attitudes in relation to an intended behavioural action, such as dental attendance, and tooth-brushing habits. This has been described and discussed as a separate area in this thesis, even if the concepts are related. In a study by Savolainen et al., similar results were found and this confirms our findings of a relationship between a strong SOC and positive perceptions of the condition of individuals’ own teeth and oral health. Other psychosocial measurements, such as self-efficacy, multidimensional health locus of control
and life satisfaction, have been studied in relation to emotional aspect of attitudes such as dental fear. A higher value for self-efficacy was related to multiple fears but was not predictive of dental fear 169. Higher levels of dental fear have shown a relationship to locus of control and increased satisfaction with life 211. Moreover, individuals who had a positive attitude to oral health, i.e. who believed that they performed specific, positive oral health behaviours, reported higher levels of self-efficacy 73, 162. Attitudes are crucial when influencing oral health 12, 55, 60 and are an expression of our beliefs and values 24. When it comes to SOC as a health-promoting resource, these results may indicate the importance of understanding and/or changing a person’s attitudes to oral health in a positive direction.

SOC may explain a small part of the variance in the variables of knowledge and oral health attitudes. In addition, the variability was explained to a moderate degree by other variables in the models, such as sociodemographic factors.

**SOC and oral health status (Study III)**

The results pointed at some, albeit weak, associations between SOC and oral health status (Study III). The bivariate analysis revealed a relationship between SOC scores and caries, periodontitis and frequency of teeth with calculus. The main result from the multivariate analysis showed that higher SOC scores were related to less plaque and periodontitis, as measured by fewer teeth with a probing pocket depth of more than 4 mm. The bivariate analysis also revealed significant relationships between a higher mean SOC and a higher frequency of DFS and FS but lower frequency of DS and teeth with calculus, and a healthy periodontal status. The higher mean value for DFS and FS was somewhat surprising, as the hypothesis was that a strong SOC was associated with a healthy oral status. The higher mean value for DFS appeared to be explained by more filled surfaces. These results could be explained by several factors, such as a historical description of a restorative dental treatment and thereby that a lack of knowledge of caries aetiology and prevention, where dental attendance was one way to display a healthy behaviour. Kiyak et al. also demonstrated a relationship between high self-rated self-efficacy and more fillings in older people 75. Dental attendance has also been shown to be related to more fillings and lost teeth in other studies 42, 202, 212.
Other studies have confirmed the relationship between SOC and a healthier oral status, where a strong SOC was related to less caries experience in anterior teeth in adolescents \(^{115}\), less plaque in adults \(^{124}\) and less gingivitis in adolescents \(^{122}\). However, Freire et al. did not find any relationship between SOC, caries severity, plaque and bleeding on probing among adolescents \(^{113}\). Fewer DS, fewer teeth with calculus and a healthy periodontal status confirm previous findings that a strong SOC is associated with a healthy oral status. However, these relationships failed after controlling for other explanatory variables and were somewhat weak. This must be taken into consideration when interpreting the results.

Differences in mean SOC-levels were not large among the different variables and the ability of SOC to discriminate effectively may therefore be questioned. However, it is possible to alter the categorisations of the variables and this could change or vary the results.

SOC has been related to general health, where physical health has been shown to have fairly weak association \(^{91, 121}\). This could depend on the fact that physical health can be seen as just one dimension of health, where SOC reflects a person’s global view of life. SOC may explain some of the variations in oral health and status. However, other factors such as biological and sociodemographic factors also are involved, even if, the results indicate that an individual’s SOC may be a tool to understand differences in oral health status at group level.

SOC has been shown to be strongly related to mental health and quality of life \(^{91, 120}\). Moreover, stress has been found to be related to the progression of plaque and gingivitis levels \(^{54}\) and a recent review has shown that different psychological factors, such as stress, distress, anxiety, depression, loneliness and daily strain, were associated with different clinical variables, such as clinical attachment level and bleeding on probing \(^{56}\). Moreover, individuals with higher levels of empowerment and social capital have been associated with lower levels of caries experience \(^{202}\).

If SOC can be viewed as a global internal resource within individuals, a plethora of social, psychological measures, together with the SOC scale, could
be useful in estimating the inter-relationship with health status, both self-reported and measured objectively. However, this kind of modelling calls for complex statistical analysis. Our future research will aim to analyse several domains, such as social, psychological and biological parameters, to test possible salutogenic models in one and the same statistical analysis, with structural equation modelling or similar analysis tools.
Conclusions

General conclusions

Sense of coherence (SOC) scores were generally high in the study samples and varied with age and gender. To some extent, individuals with a strong SOC had more positive health-related behaviours, with a favourable impact on both oral and general health, and more knowledge of dental caries, as well as positive attitudes to oral health. A strong SOC was related to oral health status with regard to better oral hygiene and periodontal health.

Specific conclusions

- The mean SOC scores were high, which may indicate healthy populations in general (Study I, IV).

- SOC was different for different age groups and increased with age. Twenty year olds had lower SOC scores compared with all other age groups and 50% of all 20-year-old individuals had a weak SOC, which may be explained by lower scores for the sub-component of comprehensibility (Study I).

- Men aged 60 and 70 years had higher SOC scores compared with women in the same age groups and the differences may be explained by the higher scores for comprehensibility (Study I).

- The multivariate analysis predicted that an individual with high SOC scores had healthier dietary habits compared with individuals with low SOC scores (Studies II, IV).

- In an analysis model with adjustment for gender and age, individuals with high SOC scores, displayed a higher degree of knowledge about
caries and how to prevent it compared with individuals with lower SOC values (Study II).

- Individuals with high SOC scores had more positive attitudes to their oral status and teeth appearance as compared to individuals with low SOC scores. Moreover, high SOC scores may have a protective effect on high dental anxiety levels (Study II).

- High SOC scores were related to oral health status, indicating less plaque and periodontal health. However, SOC scores did not statistically predict some other oral health status-related variables, such as caries, gingivitis and number of teeth (Study III).

**Future directions**

This thesis presents the first analysis of the relationship between sense of coherence and oral health in Sweden. This is also one of two international population surveys with an adult population evaluating SOC and oral health. Six studies based on a national Finnish health survey have produced some interesting similar but also divergent results. There is therefore a need to conduct more research in this area. These epidemiological findings can be an important base for investigating the relationship between SOC scores and oral health for different groups and ages and for finding tools to improve SOC at clinical and societal level and also possibly influence oral health.

The results reveal that SOC is associated with oral health in different ways. Using SOC as a salutogenic theoretical base, further research could focus on qualitative studies in order better to understand underlying factors of meaningfulness, comprehensibility and manageability that have a favourable impact on oral health. As the SOC level is dependent on the ability to use resources of different kinds in different situations, these studies should focus on identifying the kind of resources that contribute to SOC in relation to oral health. Using knowledge of these factors, the next step could be to find health-
promoting models for clinical practice and in society, with the aim of increasing comprehensibility, manageability and meaningfulness for everyone involved.
Internationella och nationella studier visar att den orala hälsan generellt har förbättrats under de senaste 30 åren för alla åldersgrupper. Ökade kunskaper om de orala sjukdomarnas etiologi samt förebyggande åtgärdsprogram inom barn- och ungdomstandvården såsom information om tandborstning och socker, tillförsel av fluor samt genomförande av fissurförsegling, kan vara viktiga bidragande faktorer till denna förbättring. Trots dessa förbättringar kvartsår ojämlikheter i den oral hälsan inom många grupper i samhället. Detta faktum leder till frågor om orsakerna till dessa ojämlikheter, men också vilka icke-biologiska faktorer som har betydelse för att bevara munnen frisk? Det finns behov av att finna metoder för att förstå ojämlikheter samt hur man kan främja den oral hälsan. Trots att vi idag har kunskap om att den oral hälsan kan påverkas av sociala faktorer såsom ekonomi, miljö- och livsstilsfaktorer föreligger det ett behov av teoretiska ramar som kan förklara komplexa samband där både individens interna och externa resurser är inkluderade. Bättre kunskap och förståelse för olika beteenden, attityder och vägval skulle kunna vara en hjälp för tandvårdspersonal vid vägledning av individer eller grupper i en hälsosam riktning.

I likhet med övriga hälso- och sjukvården har det traditionellt inom tandvården förelegat en biomedicinsk inriktning där fokus legat på den biologiska orsaken till sjukdom, dvs ett patogent perspektiv. En vidare hälsosyn är att se individen som en helhet i integrering med sin livskontext, där den oral hälsan är en del av. Detta holistiska synsätt inbegriper även en psykosocial aspekt inriktad på individens komplexa och kausala kontext. Att utgå från individens möjligheter och resurser för att sträva mot hälsa, det vill säga ett salutogen perspektiv skulle kunna ses som ett komplement till det patogena perspektivet. Den salutogena teorin (’hälsans ursprung’) handlar om problemorientering samt förmågan att använda tillgängliga resurser för att må
bra. Ett central begrepp inom denna teori är Känsla av sammanhang (eng. Sense of coherence, SOC), vilket är utvecklat av sociologen Aaron Antonovsky. SOC beskriver en persons syn på sin omvärld, och speglar en persons förmåga att använda tillgängliga resurser i riktning mot hälsa. Känslan av meningssfullhet (jag vill), begriplighet (jag vet) och hanterbarhet (jag kan) är tre viktiga komponenter som tillsammans bygger upp känslan av sammanhang, och formas av individens olika livserfarenheter. Erfarenheterna blir sedan till resurser där en person som har en stark känsla av sammanhang har en större förmåga att använda både interna och externa resurser för att göra hälsoamma val. Den salutogena teorin och känslan av sammanhang är etablerade nyckeltermer inom hälsofrämjande arbete.

Ett av målen inom tandvården är att sträva efter oral hälsa för individen genom prevention samt hälsofrämjande arbete med syfte att stärka individens egna förmåga att ha kontroll över sin orala hälsa och att integrera hälsofrämjande arbete med andra arenor i samhället. Kunskaper om en hälsoanalytiskt och mekanismer som påverkar hälsoamma val är centrat för hälsofrämjande arbete inom tandvården. Det finns därför ett behov av mer kunskap om sambandet mellan oral hälsa och psykosociala dimensioner av hälsa, med fokus på det salutogena perspektivet och med syfte att påverka ett hälsofrämjande arbete för kliniker och utbildare inom oral hälsa.

Övergripande målsättning var (i) att beskriva individers förmåga till upprätthållande av hälsa, baserat på känslan av sammanhang (SOC), och (ii) att analysera relationen mellan SOC, oral hälsorelationer, kunskap om och attityder till oral hälsa samt (iii) att analysera relationen mellan SOC och oralt status.

poäng indikerar på hög känsla av sammanhang. Deltagarna i studie I-III, genomgick en klinisk och röntgenologisk undersökning samt besvarade ett större batteri av frågor gällande beteende (nio frågor), kunskap om (fyra frågor) och attityder (sex frågor) oral hälsa och tandvård samt frågor gällande sociodemografiska faktorer. Deltagarna i studie IV besvarade frågor gällande olika kostval bestående av 84 frågor.

Resultaten från studie I, visade att SOC poängen varierade mellan 27-90 poäng i befolkningen, där medelvärdet var 70.0 poäng (SD=11.5) och 70,7 (SD=10.9) för män och 69.3 (SD=12.0) för kvinnor. SOC steg med ökad ålder, där 20-åringar hade statistisk signifikant lägre poäng än övriga åldersgrupper. Av 20-åringarna, hade 55% låg SOC (<66 poäng), vilket kan förklaras av lägre känsla av begriplighet (jag vet). Det var ingen skillnad mellan könen avseende SOC, men efter kategorisering i åldersgrupper och kön visade resultaten att 60- och 70-åringa män hade statistisk signifikant högre SOC jämfört med kvinnorna i samma åldersgrupp. Individer med högre SOC var i större grad gifta eller sammanboende, hade högre inkomst och en högre utbildningsnivå.

Resultatet från studie II, visade på statistiskt signifikanta samband mellan SOC, ett mer hälsosamt beteende såsom färre mellanmål mellan måltiderna, mer kunskap om karies samt att personer som var icke-rökare kände en högre grad av hanterbarhet (jag kan) jämfört med rökare. Dessutom visade resultatet att individer med högre SOC hade en mer positiv attityd till oral hälsa såsom vikten av att ha egna tänder när man blir äldre, vara nöjd med sina tänder, anse sig ha bra tänder samt inte känna något obehag eller ängslan inför ett tandvårdsbesök.

Resultat från studie III, visade en generell tendens på samband mellan individer med högre SOC och ett friskare oral status, även om det inte alltid nådde upp till statistiskt signifikanta skillnader. Bivariata analyser visade att individer med högre SOC poäng hade fler DFS (kariesskadade och fyllda tandytor), färre DS (kariesskadade tandytor), fler antal FS (fyllda tandytor) samt färre tänder med supragingival tandsten, jämfört med individer med lägre SOC. Efter kontrollering av sociodemografiska faktorer visade resultatet att personer med högre SOC var associerat med bättre parodontalt status samt mindre mängd plack på tänderna, jämfört med personer som hade lägre SOC. Det föreläg
också en tendens till att individer med högt SOC hade mindre risk att utveckla gingivit.

*Resultatet från studie IV*, visade att SOC poäng varierade mellan 23-91 poäng, och att medelvärdet av SOC poängen steg signifikant med ökad ålder, där 20-
åringarna hade lägst poäng. Det var ingen skillnad mellan könen, olika BMI
eller utbildning avseende medelvärde i SOC poäng. Individer med högre SOC
hade ett mer hälsosamt kostval, både för män och kvinnor såsom mer intag av
grönsaker, mindre socker och sötsaker samt mindre alkohol. Med syfte att
analysera mönster gällande kostval, visade resultatet att både men och kvinnor
med högre SOC hade ett mer hälsosam kostmönster, vilket karakteriserades av
högt intag av fiberrik kost, kokt potatis och grönsaker. Dessutom hade både
könen med låga SOC poäng ett större intag av mindre hälsosam kost såsom
pizza, söta drycker, godis, korv, hamburgare, potatismos, chips, potatissallad
och pommes frites.

**Slutsats:** Studierna visar att individers känsla av sammanhang varierade i
befolkningen avseende ålder och kön. Individer med högt SOC hade ett mer
positivt hälsorelaterat beteende gynnsamt både för den orala och allmänna
hälsan samt mer kunskap om och hur man förebygger karies. Vidare hade
individer med högre SOC värden en mer positiv attityd till sina tänder och dess
utseende samt upplevde ingen tandvårdsrådsla jämfört med individer med lägre
SOC värden. Stark SOC var också relaterad till oralt status i betydelsen av
mindre plack och parodontal sjukdom, även om dessa samband var något svaga.
Kunskaper om individers SOC skulle kunna ha betydelse för förståelsen för
olika beteenden, kunskap om och attityder till oral hälsa samt skillnad i oralt
status. Avhandlingen kan förhoppningsvis bidra till att förstärka ett salutogent
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References


