

Oral health, experiences of oral care, associated factors, and mortality among older people in short-term care

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Abstract

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Objective: The overall aim of this thesis was to describe oral health and oral health-related quality of life (OHRQoL), to compare self-perceived oral health with professional assessment, and to examine associated factors of importance for oral health, experiences, and mortality among older people in short-term care. Paper I describes oral health, daily oral care, and related factors among older people in short-term care and compares the older people's self-perceived oral health with professional assessment of oral health. Paper II describes OHRQoL among older people in short-term care, and identifies associated factors. Paper III investigates the association between poor oral health, swallowing dysfunction, and mortality in older people. Paper IV describes how older people in short-term care experience their oral health and daily oral care.

Methods: The thesis is part of a Swedish research study: Swallowing Function, Oral Health, and Food Intake in Old Age (SOFIA). In total, 391 older people from 36 short-term care units from 19 Swedish municipalities in 5 regions were included. Papers I–II are based on descriptive cross-sectional studies, Paper III is a prospective cohort study, and Paper IV is a descriptive qualitative study. Oral health was assessed professionally by clinical oral assessment (Papers I–II) and the Revised Oral Assessment Guide (ROAG) (Papers I–III). The older people's perceived oral and general health was measured via self-reported questions (Papers I–II). Self-care ability was assessed with the Katz Index of Activities of Daily Living (Katz-ADL) (Papers I–III), OHRQoL was measured using the Oral Health Impact Profile (OHIP-14) (Paper II), and swallowing function was assessed with the Timed Water Swallow Test (TWST) (Paper III). Qualitative data were collected through fourteen individual interviews using a semi-structured interview guide (Paper IV). Data were analysed with descriptive statistics, Cohen's kappa coefficient, logistic regression models, survival analysis, and inductive content analysis.

Results: Papers I–III: The median age of the 391 participants was 84 years, and 209 (53%) were women; 167 (43%) had at least 20 remaining teeth and 74 (19%) were completely edentulous. A need for dental treatment was identified among 148 (41%) of the older people. A total of 74 (19%) participants received some or entire help with oral self-care, and 190 (54%) had less good to poor oral hygiene (Papers I–II). Oral problems according to ROAG were identified in 297 (77%) participants, with the most frequent problems being related to teeth and dentures (Papers I–III). There was a low level of agreement between the clinical assessment based on ROAG and the older people's self-perceived oral health (Paper I). Poor OHRQoL was reported by 125 (34%) and associated factors were swallowing problems according to ROAG; quite poor/poor self-perceived physical, psychological, and oral health; and being a woman (Paper II). Poor oral health and swallowing dysfunction were both independently associated with 1-year mortality, and in combination they predicted the highest mortality rate (Paper III). The older people's experiences of oral health and daily oral care could be expressed as one main category: Adapting to a changed oral condition while striving to retain independence (Paper IV).

Conclusion: Oral problems were identified among most older people in short-term care, although the participants claimed that they were satisfied with their oral health. There was an association between OHRQoL and self-perceived health and oral problems. Poor oral health and swallowing dysfunction were risk factors for 1-year mortality. These results show the importance of both asking older persons about how they perceive their oral health and making systematic assessment of oral health status and swallowing function. The ability to perform daily oral care and need for assistance with oral care should be included in the individual care planning. A close collaboration among different health professionals is important to support older people's oral health and quality of life.

Keywords: older people, oral care, oral health, oral health-related quality of life, self-perceived, short-term care, swallowing dysfunction, mortality

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List of Papers

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

- I Koistinen S, Olai L, Ståhlacke K, Fält A, Ehrenberg A. Oral health and oral care in short-term care: prevalence, related factors and coherence between older peoples' and professionals' assessments. *Scandinavian Journal of Caring Sciences*. 2019;33(3):712–722.
- II Koistinen S, Olai L, Ståhlacke K, Fält A, Ehrenberg A. Oral health-related quality of life and associated factors among older people in short-term care. *International Journal of Dental Hygiene*. 2019;18(2):163–172.
- III Hägglund P, Koistinen S, Olai L, Ståhlacke K, Wester P, Levring Jäghagen E. Older people with swallowing dysfunction and poor oral health are at greater risk of early death. *Community Dentistry and Oral Epidemiology*. 2019;47(6):494–501.
- IV Koistinen S, Ståhlacke K, Olai L, Ehrenberg A, Carlsson E. Older people's experiences of oral health and assisted daily oral care in short-term facilities. 2020 (submitted).

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Abbreviations

ADL	Activities of daily living
BMI	Body mass index
CI	Confidence interval
HR	Hazard ratio
Katz-ADL	Katz Index of Activities of Daily Living
OHIP	Oral Health Impact Profile
OHRQoL	Oral health-related quality of life
OR	Odds ratio
RDH	Registered dental hygienist
ROAG	Revised Oral Assessment Guide
SOFIA	Swallowing function, Oral health, and Food Intake in old Age

Preface

I have always enjoyed working with older people, because it is interesting to listen to their stories and they appreciate and are grateful for the help they receive. I started to work at a nursing home during the summer holidays in elementary school, and worked there from time to time until my permanent employment in 1998 as a dental hygienist in the Swedish public dental service. In my duties as dental hygienist I have worked with older people both in the clinic and via the annual oral health assessments conducted among older people in need of extensive care from the community, living at home, or in special accommodation. My interest in research increased after my master's degree. Over the years I have seen many older people with poor oral health, especially among those in special accommodation. One common aspect was a lack of proper oral hygiene resulting in poor oral health status. The nursing staff often considered assistance with daily oral care to be an important work task, but they had difficulty actually providing this, sometimes because of resistance from the older person. I have often wondered why older people do not always find it easy to get assistance with oral care, while assistance with other personal hygiene is more easily accepted.

It has now been five years since I was invited to be a part of the multidisciplinary and multicentre project Swallowing function, Oral Health, and Food Intake in old Age (SOFIA). The overall aim of the SOFIA project is to describe and analyse oral health and oral health-related quality of life, swallowing and eating ability, nutritional risk, and care quality in relation to oral health and eating; and to study the effectiveness of a swallowing training programme among older persons who are admitted to short-term care. I have had the privilege of being able to collect data in short-term units in Region Västerbotten together with another PhD student who is a speech language pathologist, as well as conducting interviews with older people in short-term care. During this time I met many old people in short-term care who were frail and in need of care. One thing I noticed was that the oral care of older people is not paid the same attention as other nursing care efforts. I hope this thesis will contribute knowledge about the importance of oral care for older people, which can be used in the future to design intervention studies aimed at improving oral health among older people in need of care.

Introduction

Oral health is an essential factor for quality of life and well-being, and should be seen as a natural and integral part of general health. Good oral health is important for well-being, proper healing, nutrition, social satisfaction, self-esteem, quality of life, and general health. Oral health among older people has improved in recent years, with increased retention of natural teeth often with a combination of dentures, bridges, and implants. With increasing life expectancy the probability of older people needing care will also increase, due to disease and disability, and this may also affect a person's ability to take care of their oral health. The proportion of older people is increasing in many high-income countries such as Sweden, and many go from being independent to being frail and dependent on help from others. This frail period may include being cared for in short-term care. It is important to pay attention to older people's oral health status and eating and swallowing ability, because the frail period may have a negative impact on their oral health. Poor oral health can affect a person's general health, oral health-related quality of life (OHRQoL), and risk of mortality. Although there are some studies describing oral and dental health among older people living in special accommodation, knowledge is limited about oral health among older people in short-term care. This thesis therefore focuses on oral health assessed by professionals and by older people's self-perceived oral health, OHRQoL, daily oral care, and mortality among older people in short-term care.

The thesis has been performed in a PhD-program in care sciences within the area of health and welfare with focus on evidence-based practice. Evidence-based practice should be underpinned by scientific knowledge, clinical experience and patient perspectives and preferences. The results of this thesis contribute with knowledge on the current practice of oral health care in short-term care settings. This is important knowledge in relation to the national guidelines for best oral care practice. Also, the results add knowledge on older people's perceptions of their oral health and needs for oral care, which is an important perspective in evidence-based practice.

Background

Oral health

Oral health is an essential component of general health and quality of life [1]. The World Dental Federation (FDI) defines oral health as a holistic and multifaceted phenomenon that includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with confidence and without pain, discomfort, or any disease of the craniofacial complex [2]. The psychosocial impact of diseases affecting the ability to, for instance, speak, smile, chew, and swallow often significantly reduces quality of life [3]. Oral diseases include chronic clinical conditions that affect the mouth and teeth, and are among the most prevalent diseases globally [4]. Dental caries is the most common chronic disease in the world, and severe periodontal disease is the 11th most prevalent disease globally [5]. The prevalence and severity of oral diseases are associated with socioeconomic status; that is, income, occupation, and educational level [4].

Ageing population

The world's population is becoming older; the fastest growing age group is those 65 years and over [6]. In Sweden, it is estimated that the number of people aged 80 years and over will increase by 50% by the year 2028 [7]. Older people are more likely to develop diseases and disabilities, and so higher life expectancy means that the number of older people in need of care will also increase [8]. When a person becomes older there is a risk for diseases and disabilities that may affect the person's ability to manage activities of daily life (ADL). Multimorbidity and frailty are two related conditions among older people [9]. One definition of multimorbidity is the presence of three or more diagnoses involving a minimum of three different organs/organ systems [10]. However, older people may also have extensive care needs not caused by medical conditions, which is often referred to as a condition of frailty. Frailty describes a state of increased vulnerability due to diminished strength, endurance, physical status, and activity [11]. Multimorbidity is not synonymous with frailty, but the two conditions are known to be linked [12].

The ageing person

The ageing process is an integral and natural part of life which affects many parts of the body. Changes occur in the structures of the eye, which affects reading and balancing [13]. The salivary glands are also affected; the volume and quality of saliva reduces, which may impact the person's eating [14]. Sense of touch often declines, affecting the ability to feel pain [15], motor skills, hand grip strength, and balance [16]. Reduction of muscle strength and decline in muscle mass increase the risk of falls and fractures [17]. Cognitive abilities such as memory also decline due to the ageing process [18].

Swallowing dysfunction is common among older people [19], and the prevalence is high among older people in short-term care [20]. Impaired swallowing can cause serious complications such as dehydration, malnutrition, respiratory infections, and aspiration pneumonia [21]. Age-related changes resulting in reduced mass and function of muscles involved in the swallowing process can affect the swallowing function [22]. Swallowing dysfunction among older people is associated with neurological diseases, polypharmacy, functional capacity, multimorbidity, and frailty [23,24]. Efficient chewing requires a sufficient number of teeth or functioning prostheses. Reduced chewing function can make it difficult to break food down sufficiently to form a bolus, which can result in impaired swallowing [25]. Older people have an increased risk of undernutrition because of the diseases and impairments associated with ageing [26]. Swallowing dysfunction and poor oral health which affects the ability to chew can affect eating ability [27]; this may result in the person becoming underweight, defined as low body mass index (BMI), which in old age increases the risk of mortality [28].

Older people's health status is often complex, and only rarely can a single aspect serve as the sole predictor of outcomes such as mortality [29]. Risk factors for mortality among older people in need of care have been related to advanced age, care dependency [30,31], malnutrition [30,32], low body mass index (BMI) [33], male sex [31,33], smoking [33], cognitive impairment, multimorbidity [32], and frailty [34], as well as periodontal disease [33,35], poor oral health, poor oral hygiene [35], and impaired swallowing function [36].

The changes that come with ageing may affect an older person's daily life. Many older people go from being independent — that is, managing their daily life without any need for support from others — to being frail. This frail period often implies a gradually increased need for help and support from others to manage their daily living, and later they become dependent; that is, in need of partial or complete help from others [37,38]. Frail older people in need of care are sometimes admitted to short-term care for recovery after hospitalization

and for rehabilitation, and these people may have disabilities which increase the need for help with ADL [39].

Health care for older people

The number of care beds in hospitals has decreased in recent decades, and Sweden has fewer of these per capita compared to other countries [40]. Municipal institutional care has lost 30% of beds since the early 2000s. A consequence of the downsizing of municipal institutional care is that many frail older people are dependent on help in their own homes, and only the most dependent older people can access institutional care [41].

Various forms of transitional care have been developed internationally, including intermediate care, geriatric rehabilitation units, home rehabilitation, and care planning units [42,43,44]. In the Swedish context, facilities providing this type of care are known as short-term care units [45]. The regions are responsible for organizing health and medical care, and the municipalities are responsible for care in special accommodation, short-term care, and home care for older people. Short-term care is intended to meet the temporary care needs of older people following hospitalization and those awaiting a decision on permanent special accommodation and palliative care, as well as providing intermittent care, rehabilitation, and recurrent relief for family caregivers [46]. The majority of people in short-term care units are aged ≥ 80 years and have come to the unit because of acute events such as stroke, fall injury, or new diagnosis [47]. Many are frail with multiple disorders and diseases [46]. Approximately 9000 older people per year are admitted to Swedish short-term care [48]. Unit staff comprise registered nurses, licensed practical nurses, physiotherapists, occupational therapists, and managers [46]. Some units have a rehabilitation profile while others provide care for a mix of purposes. The units can be a part of a special accommodation facility, or a unit with only short-term care [45]. Older people in short-term care are in a form of transition, which could be experienced as a crisis [43,44,49]. In this period of time the older person is often frail and in need of extensive care; caring for their oral health is also important since oral health affects general health and vice versa. Efforts are made in order to support the person to be able to move back to their ordinary home or receive placement in special accommodation. The short-term context is largely unexplored, and more knowledge is needed concerning the care and oral health status of people in this type of unit.

Oral health among older people

Oral health among older people has improved globally, leading to an increased number of older people retaining their natural teeth throughout life [50]. Better oral health and more remaining teeth are considered to be the result of improved prevention and treatment of caries and periodontitis [51]. Today it is common for people >80 years of age in Sweden to have twenty or more teeth [52]. The presence of removable dentures is also decreasing, and many people have fixed constructions such as bridges and implants [53]. Although oral health has improved, both caries and periodontal disease are globally common oral health issues and prevalent among older people [51]. The fact that caries and periodontal disease are common could be because older people now retain more teeth [54,55]. Better oral health status is more common among healthy old people, while poorer oral health is more common among older people with care dependency [37,56,57]. Older people have an increased risk of developing poor oral health due to a combination of risk factors such as dry mouth, dietary changes, decreased oral function, and decreased ability to manage oral hygiene by themselves [58,59].

As noted above, older people's general health can affect their oral health. Dry mouth, also called xerostomia, is common. It is a natural part of the ageing process but primarily an adverse effect of medications, and can also be associated with medical conditions such as diabetes and Sjögren's syndrome [60,61]. Dry mouth can increase the risk of caries and oral infections, as well as creating difficulties with retention of dentures and affecting the ability to swallow [62]. Conversely, oral health also affects older people's general health. Periodontal disease could increase the risk of hypertension [63], and oral infections can contribute to initiation and/or progression of diabetes, rheumatoid arthritis, Alzheimer's disease, stroke, and myocardial infarction [64].

Nutrition and oral health are inseparably associated with each other [65], and there is a relationship between nutritional status and oral problems among older people [58,66-69]. Dietary choice and nutrition can affect the development and progression of oral diseases such as caries and periodontal disease [65]. Poor and impaired oral health involving the inability to chew or swallow food, gum disease, or missing teeth can influence the ability to eat properly, and might lead to poor nutritional status [70].

The ability to perform adequate daily oral hygiene often decreases in old age due to disease and to mental and physical disability [10,71]. Daily removal of dental plaque by toothbrushing is essential to reduce the risk of dental diseases [38,72]. Supporting older people in need of assistance with daily oral care is necessary for good oral health, good general health, and healthy ageing [59,73].

Oral care for older people

The goal for dental care in Sweden is good dental health and dental service on equal terms for the whole population [74]. Preserving older people's oral health when their general health is declining is a challenge for dental care and health care. Regular dental care is important for older people's oral health, but with increasing age older people's regular dental contact often decreases [75].

The Swedish national guidelines for evidence-based treatment in dentistry state that daily oral cleaning with toothbrush and fluoride toothpaste is essential for preserving good oral health. Older people in need of care are entitled to assistance from the nursing staff, including oral care twice a day [76]. Poor oral hygiene is common among care-dependent older people, which indicates that providing oral care is a challenging and demanding task for the nursing staff [77-79]. Barriers to assisting older people with daily oral care usually arise because the person resists assistance with oral care, and nursing staff often feel a lack of knowledge, education, and training in providing oral care [80].

In Sweden, older people living in special accommodation or in need of extensive supportive care from the community for daily living have the right to a free-of charge oral health assessment on an annual basis [81]. The aim of this assessment is to examine the individual oral hygiene and dental care need, and to ensure adequate oral care for those in need of support. Oral health education is offered to nursing staff to support them in assisting older people with daily oral care and learning to detect oral health symptoms that require dental care treatment [82].

Senior Alert is a Swedish national quality register that aims to ensure a preventive approach within the areas of malnutrition, falls, pressure ulcers, bladder dysfunction, and poor oral health. The register is used by health professionals for quality improvement in the care of older people [83]. This preventive way of working is based on steps of care and care processes, and includes identifying risks and analysing causes, planning and implementing preventive measures, following up on these measures, and evaluating the results [84]. The risk assessment is offered to the person soon after admission and on a yearly basis thereafter. In 2018, Senior Alert was used by 277 of Sweden's 290 municipalities, 14 of its 21 regions, and 143 private health practitioners [85]. Assessment of oral health in Senior Alert is performed using the Revised Oral Assessment Guide (ROAG), a systematic assessment tool designed for use by nursing staff to detect problems related to the mouth, teeth, and dentures in older people. ROAG includes nine categories: voice, lips, mucous membranes, tongue, gums, teeth, dentures, saliva, and swallowing [86]. It is an important assessment tool, and is useful both to maintain oral health and to

prevent oral problems for older people in special accommodation [87]. The combination of the free-of-charge oral assessment and the risk assessment in Senior Alert creates good opportunities for preventing poor oral health among older people with care needs [82].

The proportion of older people living in special accommodation is decreasing; older people are living in their own homes for a longer time, and are often in need of help from home care staff [48]. As older people both increase in numbers and retain their own natural teeth to a greater extent, the demand for collaboration between dental care and health care also increases. Professionals offering these types of care must work together in order to increase the focus on oral health among older people in need of care, so that they can maintain good oral health [88].

The free-of-charge oral assessment mainly reaches those living in special accommodation, and to a lesser extent those living in their own homes with help from home care staff. This is despite the fact that home care is becoming a priority and the number of older people in special accommodation is decreasing [48]. There is a need to ensure that those entitled to the free-of-charge oral assessment receive a decision of the free-of-charge oral assessment.

Oral assessment by health professionals through Senior Alert is an important tool to detect older people at risk of poor oral health. This assessment is currently mostly performed in special accommodation facilities, but it would be beneficial to also perform it in primary care and home care [89].

Oral health-related quality of life

As oral health has an impact on older people's general health and well-being, both physically and mentally, it influences their quality of life [90-92]. The connection between oral health and quality of life is captured by the concept of OHRQoL, which describes the individual's perceived health, well-being, and quality of life in relation to oral conditions [93,94].

In order to improve our understanding of the relationship between oral health and general health, a patient-oriented perspective such as OHRQoL is important [95]. There are several instruments to measure OHRQoL; among the most widely used are the Oral Health Impact Profile (OHIP) and its shortened version (OHIP-14) [93]. The OHIP was developed to be used particularly amongst older adults to examine the impact of oral problems (i.e. problems with the teeth, mouth, and dentures) on a person's daily life [96].

Many factors may affect older people's OHRQoL. Previous research has shown poorer self-reported OHRQoL among people with poor self-rated health [97-99], mental health problems, and poor cognitive status [99], as well as older people dependent on support in their ADL [100]. Various dental factors may also negatively affect OHRQoL, including use of dentures [101,102], chewing problems [102], missing teeth [98], caries and periodontal disease [103,104], poor self-rated oral health [101,105], and problems with brushing teeth [106].

Theory of Selective Optimization with Compensation

Selective Optimization with Compensation (SOC) is a lifespan model of psychological and behavioural management involving adaptation both to changes related to human development and to age-related gains and losses [107]. It is based on an adaptive process of understanding how people manage their lives in a way that promotes their personal development and well-being [108]. The theory proposes that older people can successfully adapt and cope with changed function by focusing on gains and strengths rather than losses, and by finding ways to compensate for other limitations [109]. The model consists of three main points: selection, optimization, and compensation. Selection involves prioritization and concentration on those individual areas that still work and that provide satisfaction. It can be based on losses of different kinds, on decisions to refrain from activities that are no longer felt so keenly, or on choosing the best available option. Optimization involves engaging in activities that can be retained, developed, or improved using any spare capacity or through more efficient solutions and adequate use of available time. It is achieved when goals are reached and the individual is subsequently able to maximize positive life experiences. Compensation means that a declined or lost ability is compensated for by a complementary activity. This is done by using previous life experience, by receiving help from others, or through the use of various aids; for example, using a walker if troubled with dizziness [107].

Rationale

An ageing population with comprehensive care needs creates a high demand for proper oral care for older people in institutions such as short-term care settings. Many of the older people in short-term care are frail, and often suffering from multiple conditions including poor oral health. This means that oral health assessments are very important, since poor oral health can cause pain and discomfort and affect the ability to chew properly, which may influence the person's well-being, OHRQoL, general health, and mortality.

Research has shown that daily oral care is important to prevent poor oral health, but it can be difficult for care-dependent older people to maintain proper daily oral care due to disease and disability. Poor oral hygiene is common among older people in different care settings. Providing oral care is a challenging and demanding task for the nursing staff, usually because the older person resists assistance with oral care. Older people in short-term care are in a form of transition; and many are frail, with extensive care needs. More knowledge is needed about the oral care received and health status among older people in short-term care.

It is important to describe older people's oral health both from a professional perspective and from self-perceived aspects, as well as OHRQoL, associations with mortality, and explore older people's experiences of oral health and daily oral care. Such knowledge could help in better understanding the need for oral care among older persons in short-term care, and hence in designing future intervention studies aimed at improving oral health for older people in different care settings.

Aims

The overall aim of this thesis was to describe oral health and OHRQoL, to compare self-perceived oral health with professional assessments, and to explore associated factors of importance for oral health, experiences, and mortality among older people in short-term care.

Specific aims were:

- I To describe oral health, daily oral care, and related factors among older people in short-term care and to compare the older people's self-perceived oral health with professional assessments.
- II To describe OHRQoL and identify its associated factors among older people in short-term care.
- III To investigate the associations between poor oral health, swallowing dysfunction, and mortality (with follow-up over one year) among older individuals in intermediate care.
- IV To describe how older people in short-term care experience their oral health and daily oral care.

Methods

Design and settings

This thesis is based on two studies and four papers (I–IV). Papers I–III are based on a descriptive cross-sectional study, and Paper IV is based on a qualitative interview study. A summary of the different designs, participants, data collection, and analyses used in Papers I–IV is presented in Table 1. Papers I–III form part of the SOFIA project [110], a multidisciplinary and multicentre project conducted in 36 short-term care units in rural and urban areas of Sweden. Five regions participated: Dalarna, Gävleborg, Värmland, Västerbotten, and Örebro.

Table 1. *Design, participants, data collection, and data analysis in Papers I–IV.*

Paper	Design	Participants	Data collection	Data analysis
I	Descriptive cross sectional study	Older people in short-term care (n=391)	Oral assessment ROAG Katz-ADL Single item	Frequencies, percentages, means, standard deviations, Cohen's kappa coefficient, and multivariate logistic regression
II	Descriptive cross sectional study	Older people in short-term care (n=391)	OHIP-14 Oral assessment ROAG Katz-ADL Single item	Frequencies, percentages, means, standard deviations, and univariate, bivariate, and multivariate logistic regression
III	Prospective cohort study	Older people in short-term care (n=391)	ROAG Katz-ADL TWST Swedish Cause of Death Register	Frequencies, percentages, means, standard deviations, chi-squared test, Mann-Whitney U-test, Kaplan-Meier analysis and Cox regression
IV	Descriptive qualitative study	Older people in short-term care (n=14)	Semi-structured interview guide	Qualitative inductive content analysis

Abbreviations: ROAG=Revised Oral Assessment Guide, Katz-ADL=Katz Index of Activities of Daily Living, OHIP-14=Oral Health Impact Profile, TWST=Timed Water Swallow Test. The Swedish Cause of Death Register was used to assess time of death.

The short-term care units were selected based on their geographical location, number of beds, and estimated number of discharges per month [110]. They provided temporary nursing care for periods of days to several months, and had varying bed capacity. Unit staff comprised registered nurses, licensed practical nurses, nurse aides, physiotherapists, occupational therapists, and

managers. The registered nurses had the overall responsibility for nursing care, and oral care was provided by licensed practical nurses and nurse aids.

Participants

The participants in Papers I–III comprised 391 older people admitted to short-term care units, all meeting the inclusion criteria of being aged 65 years or older, having been admitted to the short-term care unit for at least three days, being able to understand Swedish, and having sufficient cognitive ability to give informed consent and to participate in the data collection. Persons receiving palliative care or with moderate to severe cognitive impairment were excluded [110]. Of the 931 available people in the short-term care units between October 2013 and January 2016, 477 (51%) did not meet the inclusion criteria and 63 (14%) declined to participate, resulting in a total sample of 391 older people. The enrolment is described in Figure 1. All participants received oral and written information about the study and all gave their written informed consent.

The qualitative study (Paper IV) involved fourteen older people admitted to three short-term care units in two regions, Dalarna and Västerbotten.

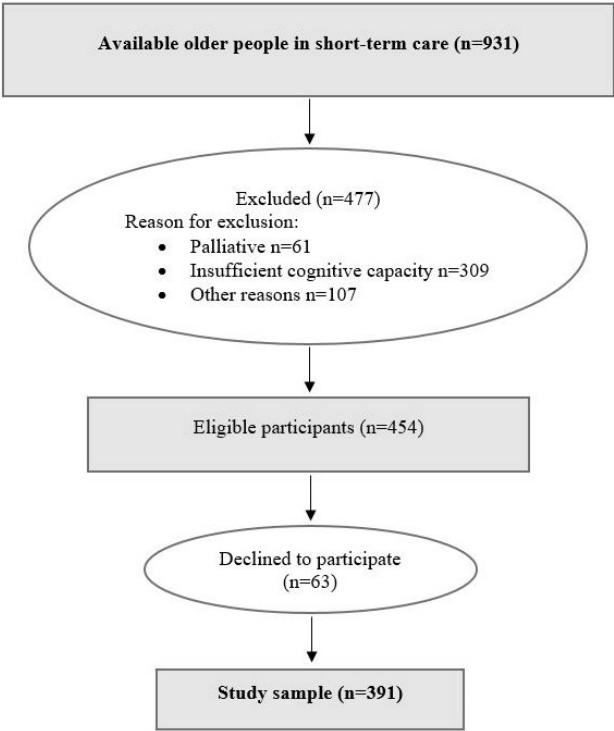


Figure 1. Flowchart showing enrolment in the quantitative study (Papers I–III).

Instruments

The following section describes the instruments used for data collection in the quantitative study (Papers I–III).

Oral assessment

The clinical oral assessment included the number of natural teeth, the presence of bridges, partial or full dentures, and implants, need for dental care, and an estimation of oral hygiene in terms of three categories from good to poor (Papers I–II).

Oral health (Papers I–III) was assessed with the Revised Oral Assessment Guide-Jönköping (ROAG-J) [87], which is an adapted version of the ROAG [86]. Nine categories are included: voice, lips, mucous membranes, tongue, gums, teeth, dentures, saliva, and swallowing [87]. Each category is graded on a three-point scale: 1=healthy, 2=moderate oral health problems, and 3=severe oral health problems [86]. ROAG is a systematic assessment tool used to detect oral health problems among older people, and was designed for use by nursing staff [67,86]. It is a valid instrument with good reliability and high reproducibility [86,111], and has shown high sensitivity and specificity in assessing voice (0.80 and 0.86, respectively), swallowing (1.0 and 0.91), tongue (0.63 and 0.76), and teeth/dentures (0.79 and 0.69) [111].

Data collection guide, single item

Data were collected for the SOFIA project using several different instruments and measurements [110]. The questions used for data collection in Papers I–II are described below.

A global question was used to assess the older people's self-perceived oral health: "Are you generally pleased with your mouth and your teeth?", with four response alternatives: 1="very satisfied", 2= "satisfied", 3= "not satisfied", and 4="not at all satisfied" (Paper I) [112].

One question was asked about their ability to brush their own teeth, with three response options: 1="yes, completely able", 2="receive some help", and 3= "no, receive help entirely" (Papers I–II) [110].

Self-rated oral, physical, and psychological health were assessed on a 5-point scale: 1="poor", 2="quite poor", 3="neither good nor poor", 4= "quite good", and 5="very good" (Paper II) [113].

Functional status

In Papers I–III, self-care ability/functional status was assessed with the Katz Index of Activities of Daily Living (Katz-ADL) [114,115], which summarizes a person’s overall performance concerning six functions: bathing, dressing and undressing, going to the toilet, mobility, controlling bowel and bladder, and food intake [114,115]. The Katz-ADL ranges from A to G: A=independent in all functions, B=dependent on help in one activity, C=dependent in two activities, D=dependent in three activities, E=dependent in four activities, F=dependent in five activities, and G=dependent in all six activities [114]. The instrument has been tested in terms of validity and reliability [115], and has shown accuracy in predicting functional outcomes over time for older adults, which supports the external validity. The content validity of the measure has been reported as satisfactory, ranging from 0.74 to 0.88 [115].

Oral health-related quality of life

In Paper II, OHRQoL was assessed using the OHIP-14 [116,117], which is a short form of the original OHIP-49 [93]. This instrument was developed to examine the effects of oral problems (i.e. problems with the teeth, mouth, and dentures) on older adults’ daily lives [96]. OHIP-14 includes 14 items to capture seven conceptual dimensions (Table 2). One question is used for each item: “How often during the last month have you experienced the following situation because of problems with your teeth, mouth, dentures or jaw?”

Table 2. *Dimensions and items in the OHIP-14 [116].*

Dimensions	Items
Functional limitation	Had <i>trouble pronouncing any words</i> Felt that your <i>sense of taste</i> has worsened
Physical pain	Had <i>painful aching</i> in your mouth Have you found it <i>uncomfortable to eat</i> any foods
Psychological discomfort	Been <i>self-conscious</i> <i>Felt tense</i>
Physical disability	Your <i>diet been unsatisfactory</i> You had to <i>interrupt meals</i>
Psychological disability	You found it <i>difficult to relax</i> You been a bit <i>embarrassed</i>
Social disability	You been a bit <i>irritable</i> with other people Had difficulty <i>performing daily tasks</i>
Handicap	Felt that <i>life in general was less satisfying</i> Been totally <i>unable to function</i>

The questions are answered on an ordinal scale from 0 to 4: 0=“not applicable” or “never”, 1=“hardly ever”, 2=“occasionally”, 3=“often”, and 4=“very often”. A total score (range: 0–56) is obtained by adding up the points for the individual questions [118], with higher scores indicating poorer OHRQoL [119]. The OHIP-14 questionnaire has shown good reliability, with a Cronbach alpha coefficient of 0.87–0.93 [102,118-120], and good validity [119,120].

Swallowing function

In Paper III, the Timed Water Swallow Test (TWST) was used to evaluate swallowing function [121]. Each participant was initially given three teaspoons of water. If swallowing was successful with no sign of aspiration, they were then given a glass with 150 mL of water and instructed to drink the water as rapidly as possible, but safely, and to stop if they experienced any difficulties. Swallowing capacity was calculated as the amount of water swallowed divided by the time (mL/s). Normal swallowing capacity was defined as ≥ 10 mL/s, and swallowing dysfunction was defined as a swallowing capacity < 10 mL/s [121,122]. The TWST is a valid tool to assess swallowing dysfunction in an aged population, and has high test-retest reliability [121-123] and high criterion validity [123].

Clinical data regarding number of chronic diseases and BMI was provided by the registered nurse in charge at each unit. Participants with at least three diagnoses from a minimum of three different organs/organ systems were considered multimorbid [10]. BMI (kg/m²) was calculated using clinical data on weight and height, and was considered low if < 20 (age ≤ 69 years) or < 22 (age ≥ 70 years) [124,125] and high, including overweight or obesity if < 29 (age ≥ 65 years) [126]. The Swedish Cause of Death Register was used to assess time of death. Causes of death were not registered.

Data collection

Papers I–III

All the heads of social welfare services for older people in each municipality were informed about the study and asked to give their approval to contact the short-term care units. Next, all managers in each short-term care unit were given information on the study and asked to approve the inclusion of the unit. The registered nurse in charge at each unit made an initial assessment of which older people fulfilled the inclusion criteria and could be invited to participate in the study. This nurse also provided clinical data from the participants' patient records regarding age, gender, height, weight, medical diagnoses, and cause of stay. Assessment of mild cognitive impairment was based on patient records and judged subjectively by the registered nurse. Socio- demographic data were collected from self- reports. The clinical assessment was performed by research assistants, including eight registered dental hygienists (RDHs) and one speech- language pathologist (SLP). All research assistants were trained and calibrated in how to perform the assessments prior to study start, and met regularly with the research group during data collection. Both the RDHs and the SLP collected self-reported questionnaire data by reading the questions aloud to the participants, and assessed swallowing function. The RDHs carried out oral assessments using a mouth mirror and flashlight. Each data collection lasted about 30–60 minutes and was conducted in the participant's room in the short-term unit. Data were collected from October 2013 to January 2016 in order to achieve sufficient power for the intervention of the larger SOFIA study [110].

The interviews

Qualitative data for Paper IV were collected between November 2018 and December 2019 through fourteen face-to-face interviews using a semi-structured interview guide developed for this purpose (Appendix). Three short-term units in two regions were contacted and asked for their informed consent by the head of social welfare services in each municipality. Nursing staff and short-term care managers were given information about the study, and the nursing staff were asked to assist in including participants because of their knowledge of the older persons' health status. Inclusion criteria were that the participant

should be 65 years or older, be able to communicate in the Swedish language, and have sufficient cognitive ability (based on patient records and judged by registered nurses) to give informed consent to participate in an interview. Older persons performing daily oral care themselves, those who needed help with daily oral care but declined assistance, and those who had assistance with daily oral care were recruited. The participants received oral and written information about the study, and all invited gave informed consent. The interviews were audio-recorded, lasted 10–34 minutes, and were conducted in the short-term care units in the participants' own rooms.

Analyses

Quantitative data analyses

In Papers I–III, descriptive statistics were calculated as frequencies with percentages or means with standard deviations (SD). In Paper I, percentage agreement and Cohen’s kappa coefficient (k) were calculated to measure the agreement between the professional clinical oral assessment (ROAG: no oral problems vs. oral problems) and the older people’s self-perceived oral health (satisfied vs. not satisfied). Two separate multivariate logistic regression analyses were conducted, yielding adjusted odds ratios (ORs) with 95% confidence intervals (CIs). Self-perceived oral health was dichotomized as 0=“very satisfied” or “largely satisfied” and 1=“not very satisfied” or “not at all satisfied”. The dependent variable in the first analysis was self-perceived oral health (0=satisfied; 1=not satisfied) and the dependent variable in the second analysis was oral problems based on clinical assessment (ROAG; 0=no oral problems, 1=oral problems). The teeth and denture items in ROAG-J were merged into a single item, giving eight items with a total score ranging from 8 (healthy) to 24 (severe oral health problems). The total score was then dichotomized as 0=no oral problems (score 8) and 1=oral problems (score 9–24) [58]. The Katz-ADL index was divided into three categories: A = independent, B–D = partly dependent and E–G = completely dependent [115] (Paper I–II). The independent variables in both analyses were gender, age, education, number of teeth, removable dentures, oral self-care, need for dental care, and Katz-ADL index.

In Paper II, univariate logistic regression was performed with OHIP score 0=“good OHRQoL” and 1=“poor OHRQoL” as dependent variable. The OHIP score was dichotomized as 0=score ≤ 7 and 1=score ≥ 8 (equating to two items at the “very often” level) [97]. Independent variables were gender, age, education, ROAG, oral self-care, and self-perceived physical, psychological, and oral health. Multivariate logistic regression analyses were used to calculate ORs and 95% CIs with OHIP score 0=“good OHRQoL” and 1=“poor OHRQoL” as dependent variable. One regression model included items from ROAG as independent variables, and a second model included the ROAG score (no oral problems vs. oral problems) as independent variable. A third model was included with various demographic and clinical characteristics as covariates. All models were adjusted for sex, age, and education. Data

were checked for multicollinearity. Statistical significance was set at $p < 0.05$. Data were analysed using version 22 of the IBM SPSS software package (IBM, Armonk, NY, USA).

In Paper III, the following variables were dichotomized to cut-offs: good oral health (ROAG score 8) versus poor oral health (ROAG score 9–24) [58,86], and normal swallowing function (≥ 10 mL/s) versus swallowing dysfunction (< 10 mL/s) [121]. Participants were classified into four groups in order to explore the combined effects of poor oral health and swallowing dysfunction on mortality: good oral health and normal swallowing; good oral health and swallowing dysfunction; poor oral health and normal swallowing; and poor oral health and swallowing dysfunction. Chi-squared tests for categorical variables and Mann-Whitney U-tests for continuous variables were used for group comparison at baseline (survivors vs. deceased). A Kaplan-Meier analysis was performed, and groups were compared with a log-rank test to estimate the impact of oral health and swallowing function (separately and combined) on survival. A mixed effect Cox regression model including cluster (i.e., care units) was fitted as a random effect and all other factors as fixed effects in order to estimate hazard ratios (HRs) with 95% CIs for oral health and swallowing function. The mixed effects Cox regression model was fitted using the R function `coxme` from the `coxme` package (version 2.2-10). Adjusted HRs with 95% CIs were estimated using a multivariable model adjusting for age, sex, multimorbidity, BMI, and mild cognitive impairment. To allow a non-linear relationship between age and mortality hazard, age was modelled using restricted cubic splines with knots at the 10th, 50th, and 90th percentiles. The level of significance was set at $p < 0.05$. All statistical analyses were performed with R version 3.5.1.

Qualitative data analysis

In Paper IV, the data were analysed using qualitative content analysis with an inductive approach based on Elo and Kyngäs (2008) [127]. All authors collaborated in the data analysis. Initially, each author read through each interview individually several times to achieve a sense of the data. Next, the text was divided into meaning units, which were then condensed and labelled with codes. To ensure that the content was not lost, and to maintain the integrity of the transcribed text, the analytical process moved continuously between the meaning units, original interview transcripts, codes, and categories. The next step was grouping the codes into subcategories and categories. Finally, three categories were abstracted and linked together by one main category.

Ethical considerations

The SOFIA project was approved by the Uppsala Regional Ethics Review Board, Sweden (Dnr: 2013/100/1-3). A supplementary application was made prior to the interview study, and approved by the Uppsala Regional Ethics Review Board, Sweden (Dnr: 2013/100/4). All studies were conducted in accordance with the principles stated in the Helsinki Declaration [128]. Older people in short-term care are often vulnerable, with extensive health problems, and in great need of care [129]. Many in this group are frail, and may have impaired cognitive ability which could make it difficult for them to take a stance on participation. The nurses responsible for the short-term care units determined whether each older person's health status made it ethically justifiable for them to be asked to participate in the study. The participants received both written and oral information about the study, and were informed that their participation was voluntary and that they could withdraw from the study at any time without having to provide an explanation. If any severe oral health problem was detected, the research assistant informed the participant and the responsible nurse about the need to contact dental care for treatment.

Results

The main results of the papers included in this thesis are presented in this section; more detailed results can be found in the individual papers.

The results in Papers I–III were based on a sample of 391 older people from 36 short-term care units in five regions. Their ages ranged from 65 years to 100 years (mean: 82.9 years) and 209 (53%) were women and 182 (47%) men. Regarding education, 251 (65%) had completed compulsory education, 99 (26%) had completed upper secondary school, and 36 (9%) had completed university education. The three main medical diagnoses were stroke ($n=87$, 22%), musculoskeletal disease ($n=85$, 22%), and mild cognitive impairment ($n=47$, 12%). More than half of the participants ($n=206$, 53%) were multimorbid, and 192 (50%) were dependent on help with at least four ADL (E–G). The most common reasons for admission to short-term care were respite care ($n=76$, 19%), acute short-term care ($n=70$, 18%), recovery after hospitalization ($n=58$, 15%), rehabilitation ($n=50$, 13%), and awaiting arrangements for permanent housing ($n=33$, 8%).

Oral assessment (Papers I–III)

There were 167 (43%) older people with 20 teeth or more and 74 (19%) who were completely edentulous. A total of 135 (35%) had removable dentures (full or partly), 133 (34%) had bridges, 33 (9%) had implants, and 148 (41%) were assessed to have a need for dental treatment. There were 74 (19%) receiving some or entire help with daily oral care, and 310 (79%) performed their daily oral care independently; data were missing for the remaining 7 (2%). Regarding oral hygiene, 164 (46%) were assessed as having good oral hygiene and 190 (54%) had less good to poor oral hygiene (Papers I–II).

Oral problems according to ROAG (score 9–24) were identified in 297 (77%) older people. The most frequent oral health problems were related to teeth and dentures. Regarding teeth, 183 participants (57%) showed local or general coating or food debris and/or broken teeth, while coating or food debris was present in 77 (57%) of the denture-wearers (Papers I–III; Table 3).

Table 3. *Clinical assessments of oral health among older people (n=390*) in short-term care based on the Revised Oral Assessment Guide.*

Item Category	Grade 1 N (%)	Grade 2 N (%)	Grade 3 N (%)
Voice	Normal 252 (65.1)	Dry, hoarse, smacking 112 (28.9)	Difficulty speaking 23 (6.0)
Lips	Smooth, bright red, moist 322 (83.4)	Dry, cracked, sore corners of the mouth 62 (16.1)	Ulcerated, bleeding 2 (0.5)
Mucous membranes	Bright red, moist 325 (85.8)	Red, dry or with areas of discoloration, coating 52 (13.7)	Wounds, with or without bleeding, blisters 2 (0.5)
Tongue	Pink, moist with papillae 303 (78.7)	No papillae, red, dry coating 79 (20.5)	Ulcers with or without bleeding, blistering 3 (0.8)
Gums	Light red and solid 243 (71.1)	Swollen, reddened 93 (27.2)	Spontaneous bleeding 6 (1.7)
Teeth	Clean; no visible coating or food debris 137 (42.8)	Coating or food debris locally 146 (45.6)	Coating, food debris generally, or broken teeth 37 (11.6)
Dentures	Clean, works 53 (39.0)	Coating or food debris 77 (56.6)	Not used or malfunctioning 6 (4.4)
Saliva	Glides easily 304 (78.4)	Glides sluggishly 78 (20.1)	Does not glide at all 6 (1.5)
Swallow	Unimpeded swallowing 287 (76.3)	Insignificant swallowing problems 66 (17.6)	Pronounced swallowing problems 23 (6.1)

Self-perceived oral health (Paper I)

A large majority of the older people (n=321, 85%) reported being very satisfied or generally satisfied with their oral health. However, the assessment based on ROAG indicated oral problems in 297 (77%) of the total group. Thus, the comparison between the older people's self-reported oral health and the professional assessment based on ROAG showed a low level of agreement, with only 34% perfect match. The percentage agreements between the older people's self-reported oral health and the professional assessment are presented in Figure 2. Only 80 (21%) of the older people who were satisfied with their oral health were assessed as being without oral problems based on ROAG. Oral health was assessed by RDHs as being worse than the participants' perceptions in 238 (64%) of all assessments and better than the participants' perceptions in 7 (2%) of the assessments.

With oral problems	Without oral problems
Satisfied with oral health	Satisfied with oral health
64 % (238)	21 % (80)
13 % (49)	2 % (7)
Not satisfied with oral health	Not satisfied with oral health
With oral problems	Without oral problems

Figure 2. Percentage agreements between older people's self-perceived oral health and professional clinical assessment based on ROAG (n=374).

Associations between different factors and the older people's self-perceived oral health and oral health based on ROAG (Paper I)

Participants with university education had 4.7 times higher odds for dissatisfaction with oral health compared to those with only compulsory education (OR: 4.69; 95% CI: 1.58–13.95), and participants with an observed need of dental care were 8 times more likely to be dissatisfied with oral health compared to those with no such need (OR: 8.38; 95% CI: 3.81–18.43) (Table 4).

Table 4. Logistic regression model for dissatisfaction with oral health as dependent variable in relation to various demographic and clinical characteristics.

	Adjusted model OR (95% CI)	p
Gender		
Female	1.00 (ref)	
Male	1.03 (0.51–2.08)	0.930
Age (continuous)	1.01 (0.96–1.06)	0.713
Education		
Compulsory school	1.00 (ref)	
Upper secondary school	1.01 (0.45–2.29)	0.979
University	4.69 (1.58–13.95)	0.005
Number of teeth		
0	1.00 (ref)	
1–19	2.71 (0.97–7.62)	0.058
20–32	0.48 (0.13–1.82)	0.280
Removable dentures (full or partly)		
No	1.00 (ref)	
Yes	1.64 (0.72–3.70)	0.238
Perform oral self-care		
Yes, completely	1.00 (ref)	
Receive some help	1.21 (0.44–3.31)	0.708
No, receive help entirely	0.29 (0.03–2.86)	0.286
Need for dental care		
No	1.00 (ref)	
Yes	8.38 (3.81–18.43)	<0.001
Katz’s ADL index		
A	1.00 (ref)	
B–D	0.61 (0.17–2.14)	0.439
E–G	0.55 (0.15–1.99)	0.364
Nagelkerke’s Pseudo R²	0.324	

Participants with a need for dental care had nearly 5 times higher odds for having oral problems (based on ROAG) compared to those with no such need (OR: 4.74; 95% CI: 2.41–9.34). Those with 20–32 remaining teeth were 70% less likely to have oral problems compared to those with no teeth (OR: 0.32; 95% CI: 0.11–0.98). Finally, those with dependence in four to all six ADL-activities (Katz index E–G) had 3.4 times higher odds of having oral problems compared to those who were independent in all activities (Katz index A) (OR: 3.36; 95% CI: 1.27–8.92). (Table 5)

Table 5. Logistic regression model for oral problems based on ROAG as dependent variable in relation to various demographic and clinical characteristics.

	Adjusted model OR (95% CI)	p
Gender		
Female	1.00 (ref)	
Male	1.24 (0.71–2.18)	0.456
Age (continuous)	0.99 (0.96–1.04)	0.878
Education		
Compulsory school	1.00 (ref)	
Upper secondary school	0.58 (0.31–1.08)	0.085
University	0.79 (0.33–1.92)	0.606
Number of teeth		
0	1.00 (ref)	
1–19	0.60 (0.24–1.51)	0.277
20–32	0.32 (0.11–0.98)	0.045
Removable dentures (full or partly)		
No	1.00 (ref)	
Yes	0.69 (0.28–1.68)	0.409
Perform oral self-care		
Yes, completely	1.00 (ref)	
Receive some help	2.03 (0.77–5.36)	0.151
No, receive help entirely	1.78 (0.36–8.86)	0.484
Need for dental care		
No	1.00 (ref)	
Yes	4.74 (2.41–9.34)	<0.001
Katz’s ADL index		
A	1.00 (ref)	
B–D	2.30 (0.89–5.95)	0.085
E–G	3.36 (1.27–8.92)	0.015
Nagelkerke’s Pseudo R²	0.205	

Factors associated with oral health-related quality of life (Paper II)

A total of 241 (66%) participants reported lower OHIP scores (≤ 7), and 125 (34%) reported higher scores (≥ 8). The bivariate analysis showed that 30 (50%) of those who perceived their oral health as quite poor/poor (OHIP scores ≥ 8) and 69 (28%) of those who perceived it as very good/quite good had poor OHRQoL ($p < 0.001$). Regarding professional assessments, 100 (39%) of those with oral problems according to ROAG and 19 (25%) of those without had poor OHRQoL ($p = 0.026$) (Table 6).

Table 6. Bivariate analysis of factors associated with oral health-related quality of life in older people (n=366) in short-term care.

	Lower OHIP score (≤ 7) n (%)	Higher OHIP score (≥ 8) n (%)	p-value
Gender			
Men	126 (74)	44 (26)	0.002
Women	115 (59)	81 (41)	
Age			
65–84	136 (69)	61 (31)	0.165
85–100	105 (62)	64 (38)	
Education			
Compulsory school	153 (65)	83 (35)	0.131
Upper secondary school	58 (62)	35 (38)	
University	29 (81)	7 (19)	
Clinical assessment ROAG			
Without oral problems	56 (75)	19 (25)	0.026
With oral problems	154 (61)	100 (39)	
Perform oral self-care			
Yes, completely	200 (68)	95 (32)	0.143
Receive some help/ No, receive help entirely	41 (59)	29 (41)	
Physical health			
Very good/quite good	139 (74)	49 (26)	<0.001
Neither good nor poor	40 (68)	19 (32)	
Quite poor/poor	61 (52)	57 (48)	
Psychological health			
Very good/quite good	159 (71)	64 (29)	0.015
Neither good nor poor	45 (57)	34 (43)	
Quite poor/poor	34 (56)	27 (44)	
Oral health			
Very good/quite good	179 (72)	69 (28)	<0.001
Neither good nor poor	31 (54)	26 (46)	
Quite poor/poor	30 (50)	30 (50)	

A regression model with all nine ROAG items included revealed that older people with swallowing problems were 5.4 times more likely to have poor OHRQoL compared to those with no swallowing problems (OR: 5.43; 95% CI: 2.80–10.55). Other oral problems were not significantly related to OHRQoL.

Associations between poor oral health, swallowing dysfunction, and mortality (Paper III)

A total of 98 older people (25.1%) died within the 1-year follow-up; the median time to death was 125 days. Participants who died were significantly older than the survivors (median ages: 86 vs. 82 years, $p=0.002$), more likely

to have poor oral health ($p<0.001$), had more inefficient swallowing ($p<0.001$), were more likely to have low BMI ($p=0.001$), and were more likely to be dependent in ADL ($p=0.003$). The mortality rate was 28.5% for those with poor oral health and 15% for those with good oral health; and 31% for those with swallowing dysfunction and 17% for those with normal swallowing function. The highest mortality (35%) was seen among those with both poor oral health and swallowing dysfunction (Figure 3).

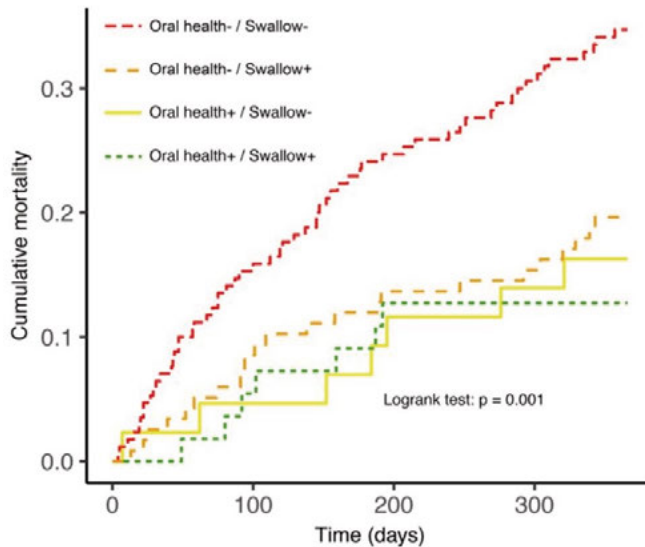


Figure 3. Kaplan-Meier plots of factors associated with mortality in groups with various combinations of oral health and swallowing function among older people in short-term care. Oral health+ represents good oral health, Oral health- represents poor oral health, Swallow+ represents normal swallowing, and Swallow- represents swallowing dysfunction.

Participants with poor oral health (95% CI: 1.20–3.61, $p=0.009$), and swallowing dysfunction (95% CI: 1.29–3.17, $p=0.002$) had two times increased risk for mortality. Another independent predictor for mortality was low BMI (95% CI: 1.04–2.61, $p=0.034$) compared to participants with normal BMI. Age, sex, multimorbidity, and cognition showed no associations with mortality over the 1-year follow-up period.

Experiences of oral health and daily oral care among older people in short-term care (Paper IV)

The qualitative study was designed to describe how older people in short-term care experience their oral health and daily oral care. The qualitative content analysis revealed one main category that was built up from three categories and nine subcategories (Table 7).

Table 7. Main category, categories, and subcategories describing experiences of oral health and daily oral care among older people (n=14) in short-term care settings.

Main category	Adapting to a changed oral condition while striving to retain independence		
Categories	Wanting to manage daily oral care independently	Acceptance of changes in oral condition	Barriers to receiving assistance from staff
Subcategories	Having always brushed my teeth without help	Difficulty in chewing and swallowing	Staff lacking the time to help
	Being satisfied with my mouth and teeth	Difficulty with tooth brushing	Not wanting to be a burden
	Having to accept help if necessary	Not considering a dentist visit to be worth the cost	Lack of confidence in staff's knowledge

The participants' experiences of oral health and daily oral care could be expressed as one main category: *Adapting to a changed oral condition while striving to retain independence*.

In the first category: *Wanting to manage daily oral care independently*, the participants described that tooth brushing was something private and a natural daily activity that they were used to performing by themselves. The thought of having someone else's fingers in their mouth was difficult to imagine, and some of them did not see it as a thing they wanted to consider. They were overall satisfied with their mouth and teeth, and those with natural teeth were grateful for still having teeth in old age. Receiving assistance with toothbrushing was something they would consider if they were no longer able to do it by themselves.

In the second category: *Acceptance of changes in oral condition*, the participants described changes in chewing ability, swallowing problems, and feelings of dryness in the mouth. Toothbrushing was described as difficult due to broken teeth, reduced vision, or impaired balance. They also expressed a lack of motivation to take care of oral hygiene, caused by remaining fatigue after acute illness and hospital care. Those who described having broken teeth and

poorly fitting dentures still did not think a visit to dental care would be important or worth the cost as long as they did not have toothache.

The third category describes: *Barriers to receiving assistance from staff*. The participants perceived that the staff had many work tasks and did not have the time to assist them with oral care. They did not want to nag the staff, because they did not want to become a burden by interfering with the work of staff who were busy with other tasks. The participants also wanted to care for their own teeth in a proper manner, and expressed a lack of confidence in the staff's knowledge and skills in assisting with oral care.

Discussion

The main finding of this thesis is that many old people in short-term care had poor oral health and were in need of assistance with daily oral care, but only 19% received such assistance. Older people perceived their oral health as being better than the assessments made by the dental hygienists (Paper I). Most participants considered their OHRQoL to be good despite poor oral health (Paper II). However, poor oral health and swallowing dysfunction were associated with a greater mortality risk (Paper III). The participants expressed a desire to manage daily oral care by themselves and did not always ask for help, or accept help that was offered. They also described different changes in their oral condition in need of fixing, such as broken teeth and ill-fitting dentures, but they did not think that visiting dental care would be worth either the effort or the cost. They thought they could manage their oral condition, and they were adapting to these changes while striving to retain independence (Paper IV).

These older people in short-term care had a high number of remaining natural teeth, often together with a combination of bridges and implants. A total of 41% of them were assessed as being in need of dental treatment (Paper I). The fact that older people now retain more teeth means that they require a good standard of oral hygiene [130,131], and regular dental care is important in order to follow up the oral health situation [132]. Nevertheless, older people often lose contact with dental care when they become more dependent and in need of assistance with daily living [75]. Half of the participants were assessed as having less good to poor oral hygiene, which perhaps is because performing oral self-care becomes more challenging in old age due to general diseases as well as mental and physical disability [10,71]. This could also help to explain the fact that assessment based on ROAG identified 77% of the older people as having oral problems, with visible coating or broken teeth being the most frequent oral health problems. Another finding was that the odds of having oral problems were higher among those who were dependent on help with four to all six ADL-activities, indicating that those dependent on help with ADL should be assumed to also need help with oral care (Paper I). This was also found in a study among older people in a geriatric rehabilitation ward [58]. It has been argued that oral care should be seen as equally important to other ADL-activities [133]. Because oral self-care is not included in ADL [99], there is a risk that the ability to perform oral care is not assessed in the care of

older people. It has been proposed that assessment of older people's ability to perform oral hygiene and the need for assistance with oral care should be part of the regular health assessments for frail older people [106]. Instruments to assess older people's ability and need for support in daily oral self-care are lacking. However, a new instrument which is currently under development, the Oral Hygiene Assessment Instrument (OHAI) includes measurement of the person's ability to perform oral care. OHAI could be useful for dental and health care staff in assessing older people's ability to perform oral care, causes of impaired oral hygiene, and the possible need for help and support [134].

The clinical assessments performed by dental hygienists based on ROAG showed a low level of agreement with the older people's self-perceived oral health, with the participants perceiving their oral health to be better than assessed by professionals (Paper I). Similar results have also been found in a study conducted at five hospitals in Sweden, where nursing staff's assessments of their patients' oral health were poorer than the patients' self-perceived oral health [135]. The fact that older people perceive their oral health as acceptable could be understood as meaning that they are comparing their oral condition with previous generations who often had dentures or were edentulous. Moreover, deterioration of a person's oral health often occurs gradually, and thus the person may adapt to the changes in oral condition [92]. It is also possible that they might consider their oral problems to be less important when compared to other and more prominent health problems [136]. Older people in short-term care are often in an uncertain period of their lives, not knowing whether they will be able to return home or whether they will have to relocate to special accommodation. They may not consider their oral health problems as being of importance, because they are in a form of transition. This might be experienced as a crisis caused by acute illness that impacts their future life as a whole, or as a step closer to the end of life [43,44,49].

Poor oral health and swallowing dysfunction were identified as independent risk factors for 1-year mortality. Low BMI was an additional predictor of mortality during the 1-year follow up, as seen in other studies among older people in different care settings [28,33,36]. Weight loss and low BMI are associated with edentulousness, chewing problems, hyposalivation, and dysphagia [137,138]. Other studies have also revealed that older people with poor oral health [139] and with swallowing dysfunction [24] are at higher risk of mortality. Our findings, together with previous studies, indicate that poor oral health and swallowing function are risk factors for mortality in older people, and needs to be screened for in short-term care as well as in other care settings.

Many of the older people in short-term care expressed a strong desire to perform their daily oral care independently, which was a barrier to receiving assistance with daily oral care. This was also found in a study conducted among

frail older people in need of care; the older people wanted to remain independent for as long as possible and to be responsible for taking care of their own teeth [140]. Being independent and taking care of oneself also includes other daily activities which have been described in previous studies among older people living at home or in nursing homes [141-143]. For many, taking care of the body independently as before is a means of preserving a sense of self-identity [144]. The participants in the present thesis described different oral problems such as broken teeth and ill-fitting dentures, but they did not think a dental visit would be worthwhile as long as they did not have any pain. Other reasons for not visiting dental care were the cost, and their feeling that they would manage without as long as they did not have any pain. This points to the fact that older people can adapt to changes in their oral health [92] despite a need for dental care. Many older people lose their regular dental contact, and this loss increases with age or when moving to special accommodation [75]. Reasons might include difficulties with transport, financial reasons, or not having the strength to visit dental care [145].

The theory of Selective Optimization with Compensation (SOC) can help us understand older people's experiences of oral health and daily oral care. This theory suggests that older people use three different mechanisms in adapting to ageing and minimizing the impact of functional decline. As people age, they transform dimensions of their life to maintain independence and purpose through reshaping goals, expectations, and activities. The three main points of the theory are selection, optimization, and compensation [107]. The theory posits that when an individual is confronted with declining resources, they engage in a process of selection. Existing goals are re-evaluated, and the individual selects those that are most realistic in relation to their level of resources, and determines how to optimize certain resources while finding ways to compensate for other limitations [109].

The participants described a strong desire to continue performing daily oral care independently by themselves. This could, according to SOC, be a result of selection, because they saw oral care as an activity that gave them satisfaction without taking too much of their energy. Selection of activities is often focused on maintaining activities of daily living as independently as possible, which has also been found in other studies conducted among older people [146,147]. When a person continues to work at maintaining a certain activity, such as tooth brushing, it is also an example of optimization. The use of optimization may be limited because of older people's poor health and decreased mobility and therefore optimization may often be expressed in terms of participant's efforts to retain an existing activity [148]. They may also have had other activities that required help from nursing staff, and therefore it could be a form of compensation, according to SOC, that they wanted to continue with their daily oral care in order to maintain independence. Participants expressed

that they could accept assistance with daily oral care if they were no longer able to do it themselves, which is an example of compensation according to SOC. The participants also seemed to have adapted to their oral health changes, as they did not perceive dental care visits to be of great importance. A visit to dental care could be seen as something difficult to do because of lack of energy or health decline. The participants with dentures described how they had adapted to their dentures over time, choosing to chew carefully and compensate by cutting their food into smaller pieces. This example of compensation has been described in a study by Khabra and colleagues (2017) conducted among community dwelling older people. The participants in that study also described having adapted to their dentures over time and had modified food choices and chewing accordingly [149].

Methodological considerations

The studies included in this thesis had both quantitative and qualitative designs. The combination of these research methods may be considered a strength [150] of this thesis, because it gives a broader picture of older people's oral health.

The registered nurse responsible for each short-term unit made the initial assessment of which older people fulfilled the inclusion criteria and could be asked to participate, based on each person's health condition and ability to participate. This could be a possible threat to the internal validity [151], because the registered nurses might have had different views of the older people's health conditions, and might have underestimated some people's ability to participate. The clinical assessments were performed by nine research assistants: seven registered dental hygienists and two doctoral students with the professions of registered dental hygienist and speech- language pathologist. The dental hygienists performed all the clinical oral assessments. There is a risk of bias when several data collectors are involved [151], because different assessors might assess the same person differently. To minimize the risk of bias, all research assistants and the research group met regularly to ensure agreement and consistency in assessments. Although the research assistants were calibrated during the data collection period on how to perform the oral assessments, the reliability of the results would have been strengthened if an inter-rater reliability test had been performed. Another risk of bias might be that the research assistants read the questions to the participants, which could have influenced the participants' interpretation of the questions. This was done in order to make it easier for the participants to understand and answer all the questions, and to allow possible misunderstandings to be corrected.

A convenience sample of 5 out of 21 Swedish counties was asked to participate based on their geographical location, which enabled efficient data collection. Thirty-six short-term units in 19 Swedish municipalities were included, representing both rural and urban areas and different parts of Sweden. The external validity is limited, since the results are not fully representative of the population studied; over half of the available residents in the short-term care were excluded (Figure 1). No non-response analysis was performed, but this high number of exclusions shows that many older people were too frail to be eligible, and those who were excluded may have had more severe oral health problems. The instruments used for data collection had good reliability and validity, strengthening the internal validity. The assessment of mild cognitive impairment was based on patient records and judged subjectively by the registered nurse. It would have been preferable to do this using a standardized validated evaluation such as the Mini-Mental State Examination [152], but there was a risk that if this had been added to the study protocol then the protocol would have become too extensive for the participants. Older people with moderate to severe cognitive impairment were excluded since they were considered potentially unable to consent to participate in data collection and to participate in the intervention part of the SOFIA project. It is important for studies to include older people with cognitive impairment, since they are more likely to have an increased need of assistance with daily oral care. However, this would require other data collection methods which were not part of the SOFIA project.

Data for the qualitative study (Paper IV) were collected over a period of more than one year, due to difficulty recruiting participants who received assistance with oral care. One reason for this difficulty could be that people in short-term care are in transition; either on their way back home, or on their way to special accommodation. Moreover, the target group of participants receiving assistance with oral care are often unable to participate in interviews because of aphasia, cognitive impairment, or frailty. To ensure dependability of the study, semi-structured interviews were used and the questions from the interview guide were described in the text. Most interviews were short, which could be a potential threat to credibility. The shortness of the interviews might have been because talking about oral health and daily oral care could be perceived as an intimate issue, and something that many people do not feel comfortable talking about. The interviewer was the author of this thesis, who has a background as a registered dental hygienist with a pre-understanding of older people's oral health issues. This might have had an impact on the interviews and data analysis, but the threat of pre-understanding was acknowledged and discussed continuously during the analysis and interpretation of the data, in order to be as transparent as possible. The interviewer's professional background might also be a strength because it provided knowledge about older people's

oral health. To increase the study's dependability and confirmability, the analysis was performed by all the researchers, who had different professional perspectives on oral health and the care of older people (registered nurses and registered dental hygienists). To address transferability, a detailed description of the research process, settings, and participants was provided (Paper IV).

Conclusion

The majority of these older people in short-term care had poor oral health and were in need of assisted daily oral care. They were satisfied with their oral health, although professional assessment revealed considerable oral health problems. OHRQoL was associated with clinically assessed oral problems and poor self-perceived physical, psychological, and oral health. This points to the importance of both asking older persons about how they perceive their oral health and performing an oral assessment. Older people's ability to perform daily oral care and their need for assistance with this should be assessed in a similar way as ADL capacity. Poor oral health and swallowing dysfunction are risk factors for 1-year mortality among older people in short-term care. Systematic assessment of oral health status and swallowing function should be performed to improve older people's care and quality of life.

The care of older people must include their oral health to the same extent as much as their other care needs, in terms of both assessment and assistance. Individual care planning for older people in short-term care should include daily oral care. The collaboration between different health professionals involved in the care of older people should be strengthened. Different health professionals should work together on a regular basis, and share expertise and knowledge in order to provide good quality of care.

Clinical implications and future research

There is a need to improve the regular assessment of oral health and swallowing among older people in short-term care, and the collaboration between dental and health care staff should be strengthened by means of regular meetings with different health professionals. There is also a need to make daily oral care a natural part of nursing care for older people, and to increase the knowledge among nursing staff of the importance of having good oral health in old age. Nursing staff's practical skills in assisting oral care is important and could increase by close collaboration between dental and health care staff. Both the public dental service and private dental practices should develop working methods in order to prevent older people from losing their regular contact with dental care. There is also a need to ensure that the national dental health insurance reaches those older people who are entitled to the free-of-charge oral health assessment. More research into the oral health education that nursing personnel receive within different education programs should be conducted in order to increase the level of knowledge among nursing staff. The findings of this thesis can be used to plan oral care interventions to improve oral health and oral care among older people in different care settings.

Sammanfattning (in Swedish)

Bakgrund och syfte: Munhälsa är en integrerad del av människors generella hälsa som har stor betydelse för god livskvalitet och välbefinnande. Äldre personer har idag allt fler egna tänder kvar och ofta i kombination med broar, proteser och implantat. Det kan vara svårt att upprätthålla en god munhygien på grund av sjukdomar och funktionsnedsättningar vilket ökar risken för att utveckla orala sjukdomar med stigande ålder. God munhälsa ses ofta hos friska äldre personer medan dålig munhälsa är vanligt förekommande hos äldre med behov av vård och omsorg, som ofta har en eller flera långvariga sjukdomar. Många äldre personer som vistas på korttidsboenden är sköra och i stort behov av vård och det är av stor vikt att munhälsan uppmärksammas. Eftersom korttidsvården till stor del är outforskad behövs mer kunskap om munhälsan och munvård för personer inom korttidsboenden.

Syftet med avhandlingen är att beskriva munhälsan och munhälsorelaterad livskvalitet (OHRQoL), jämföra självskattad munhälsa med professionell bedömd munhälsa, undersöka faktorer av betydelse för munhälsa, upplevelser, och dödlighet bland äldre som vistas på korttidsboende. Avhandlingen består av fyra delstudier utförda inom korttidsboenden. Delstudie I är en beskrivning av munhälsan, daglig munvård och relaterade faktorer hos äldre personer och jämförelse mellan de äldres självskattade munhälsa och den professionella bedömningen av munhälsan. Delstudie II beskriver munhälsorelaterad livskvalitet och undersöker vilka faktorer som har betydelse för munhälsorelaterad livskvalitet hos äldre personer. Delstudie III undersöker sambandet mellan dålig munhälsa, sväljningsdysfunktion och dödlighet hos äldre personer. Delstudie IV beskriver äldre personers upplevelser av munhälsan och daglig munvård.

Metod: Delstudie I-III är en del av det svenska forskningsprojektet SOFIA (Swallowing function, Oral health, and Food Intake in old Age). Totalt inkluderades 391 äldre personer från 36 korttidsboende från fem regioner i Sverige. Delstudie I-II är deskriptiva tvärsnittsstudier, delstudie III är en longitudinell kohortstudie och delstudie IV är en kvalitativ intervjustudie. Munhälsan bedömdes professionellt genom kliniska bedömningar (delstudie I-II) och med instrumentet Revised Oral Assessment Guide (ROAG) (delstudie I-III). Äldre personers självskattade munhälsa och allmänna hälsa samlades in via fråge-

formulär (delstudie I-II). Personernas förmåga att utföra sina dagliga aktiviteter (ADL) bedömdes med Katz Index of Activities of Daily Living (Katz-ADL) (delstudie I-III), munhälsorelaterad livskvalitet mättes med frågeformuläret Oral Health Impact Profile (OHIP-14) (delstudie II), och sväljningsfunktion mättes med Timed Water Swallow Test (TWST). Kvalitativa data samlades in via fjorton individuella intervjuer med en semi-strukturerad intervjuguide (delstudie IV).

Beskrivande statistik användes i delstudie I-III. För att analysera överensstämmelserna mellan de äldres självskattade munhälsa och de professionella bedömningarna användes procent och Cohen's kapp. Multipla logistiska regressioner användes för att undersöka vilka faktorer som kunde ha betydelse för orala problem och de äldres självskattade munhälsa (delstudie I). I delstudie II användes Chi 2 test för att undersöka olika faktorer som kan ha betydelse för bra respektive dålig munhälsorelaterad livskvalitet. Multivariat logistisk regression användes för att undersöka vilka faktorer som kan påverka dålig munhälsorelaterad livskvalitet. I delstudie III användes Chi 2 respektive Mann-Whitney U-test för att jämföra variabler mellan de som avlidit och de som överlevt. Kaplan-Meier användes för att undersöka om munhälsa och sväljningsfunktion inverkade på överlevnad (var för sig och i kombination). Cox regression användes för att utvärdera munhälsa och sväljningsfunktion som riskfaktorer för dödlighet. Intervjuerna i delstudie IV analyserades med induktiv innehållsanalys.

Resultat: Deltagarnas medianålder var 84 år, 209 (53%) var kvinnor; 167 (43%) hade minst 20 kvarvarande tänder och 74 (19%) var helt tandlösa. Behov av tandvård identifierades hos 148 (41%) deltagare. Totalt 74 (19%) av deltagarna hade assistans med munvård helt eller delvis, och 190 (54%) bedömdes ha mindre bra eller dålig munhygien (delstudie I-II). Munhälsoproblem, bedömda enligt ROAG, identifierades hos 297 (77%) av deltagarna och de mest förekommande problemen var relaterade till tänder och proteser (delstudie I-III). Överensstämmelsen mellan den kliniska bedömningen med ROAG och de äldres självskattade munhälsa var låg (delstudie I). Det var 125 (34%) deltagare som rapporterade dålig munhälsorelaterad livskvalitet och betydande faktorer var sväljningsproblem enligt ROAG; ganska dålig eller dålig självskattad munhälsa, sämre fysisk och psykisk hälsa; och det var vanligare bland kvinnor (delstudie II). Både dålig munhälsa och sväljningsdysfunktion, oberoende av varandra, visade sig ge högre risk för dödlighet inom ett år, och kombinationen ökade risken för död markant (delstudie III). I intervjuerna med de äldre personerna framkom att de anpassade sig till förändringar i munhålan och strävade efter att bibehålla sitt oberoende i den dagliga munvården (delstudie IV).

Konklusion: Munhälsoproblem var vanligt förekommande hos äldre personer som vistades på korttidsboenden trots att personerna själva var nöjda med sin munhälsa. Resultaten visar samband mellan munhälsorelaterad livskvalitet och självskattad hälsa och munhälsoproblem. Dålig munhälsa och sväljningsdysfunktion medförde en högre risk för att den äldre personen skulle avlida. Dessa resultat visar att det är viktigt att både fråga äldre personer om deras självupplevda munhälsa och att genomföra bedömningar av munhälsan och sväljningsfunktion hos äldre. Äldre personers förmåga att utföra daglig munvård och behov av hjälp med munvård borde ingå i den individuella vårdplaneringen. Ett nära samarbete mellan olika hälsoprofessioner är viktigt för att förbättra äldre personers munhälsa och livskvalitet.

Nyckelord: äldre personer, munvård, munhälsa, munhälsorelaterad livskvalitet, självskattad, korttidsboende, sväljningsdysfunktion, dödlighet

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Appendix

Intervjuguide (in Swedish)

Syfte med intervjun är att få en ökad förståelse för äldre personers upplevelse av sin munhälsa, av att dagligen sköta tänderna samt av att få hjälp med tandborstning.

Inledande frågor

Hur mår du just nu? (i största allmänhet)

Hur är det, klarar du av att tvätta och klä dig själv?

Får du den hjälp du behöver (med dusch och tvätt)?

Upplevelser av munhälsan

Hur upplever du din mun och dina tänder?

Kan du berätta lite mer om vad du menar med att tänderna är bra/dåliga?

Har du egna tänder kvar? Övrigt, kronor, broar?

Hur går det för dig att tugga och svälja?

Har något förändrats med munnen eller tänderna under det gångna året?

Hur viktigt tycker du att det är med dina tänder? Hur tänker du då? (utseende, tugga och svälja)

Assistans med munvård

Har du det du behöver här på boendet, tandborste och tandkräm?

Berätta, hur upplever du att det går att sköta tänderna (tb 2ggr/dag, tandtråd/tandstickor)?

Kan du berätta hur du brukar göra då du ska rengöra dina tänder?

Hur är det nu när du är här, borstar du tänderna själv/får du hjälp att borsta tänderna??

Har du varit med om att få hjälp med att borsta tänderna? Berätta!

Har personalen erbjudit hjälp med tandborstning?

Behöver du be om hjälp? Har du frågat om att få hjälp med tandborstning?

Får du den hjälp du behöver med tandborstningen?

Upplever du att personalen har tid för att hjälpa dig med tandborstningen?

Ser personalen tandborstning som en viktig uppgift?

Hur känns det när någon annan (personalen) hjälper till med tandborstning?

Har alla ett mjukt handlag eller finns det de som är hårdhänta? Känns det bra eller gör det ont ibland?

Känns det rent och fräscht efter att personalen borstat?

Om du tänker lite framåt, hur tänker du då angående att få hjälp med tandborstningen (vid hemkomst/annat boende)?

De som inte vill ha hjälp – vad är orsakerna till att inte vilja ha hjälp?

Eller vill ha hjälp men inte får det och troliga anledningar till det...

Om du tänker dig en situation där du skulle behöva hjälp med att borsta tänderna, hur tror du att du skulle uppleva det?

Finns det något som personalen skulle kunna göra annorlunda för att du ska acceptera hjälp med tandborstning?

Om du tänker lite framåt, hur tänker du då angående att klara av att sköta tänderna själv (få hjälp med tandborstning)?

