
Oral health and institutionalised elderly

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Oral health and institutionalised elderly



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Abstract

Aim: The main aim of this thesis was to generate initiatives promoting good oral health for institutionalised elderly. It was therefore essential to investigate how their oral health status has changed over time, whether care professionals have adequate oral care knowledge and if the oral hygiene of the institutionalised elderly can be improved in the long-term by a new quality assurance system.

Methods: Several different methods were used, with both descriptive and analytical study designs. Factors relating to both residents and caregivers were investigated.

Clinical examinations of long-term care (LTC) residents from five LTC institutions were performed in 2004. Dental status, caries, periodontal disease, stomatitis and presence of prosthodontic restorations were registered and the results were compared with a similar study from 1988.

In 2005, a questionnaire-study was carried out among all Norwegian colleges educating care professionals working with basic care in LTC institutions. Quantity and quality of oral care training provided were assessed.

A new quality system aimed at improving and maintaining oral hygiene standards of the elderly in long-term care was implemented in a nursing home. This oral hygiene programme included 1) motivation and oral care training of the nursing staff, 2) production of picture-based oral care procedure cards, 3) distribution of adequate oral care equipment, 4) practical implementation of new routines and 5) assessment of results attained. The level of oral hygiene in the nursing home was assessed using the mucosal-plaque score (MPS) index. Overall evaluation was made before the start of the study, after 3 months and eventually after 6 years. During this time care staff's opinion about the use of electric toothbrushes on the care-dependent resident was investigated by a questionnaire-study.

Results: Several significant changes in the oral health status among the institutionalised elderly have occurred since 1988, the most important being a decrease

in the frequency of edentulism and an increase in the prevalence of oral diseases. Regarding the oral care training in the basic education of caregivers, variations between the different types of colleges were found. However, the majority of schools seem to provide information and training to cover basic requirements regarding oral care. Sustained improvements of LTC residents' oral hygiene were found 6 years after implementing the oral hygiene programme. Most of the caregivers preferred electric toothbrushes rather than manual ones. Many reported it made oral hygiene provision easier and less time-consuming, especially for residents without severe dementia.

Conclusion: The change in oral health of the institutionalised elderly constitutes a two-sided challenge, affecting both dental personnel and caregivers. The public dental service should be strengthened to handle the increased dental treatment need in this group. Lack of oral care training in the basic education of care professionals can not account for the inadequate oral hygiene in Norwegian LTC institutions. Putting resources into the implementation of a preventive oral hygiene programme is therefore more likely to lower the incidence of oral infections among LTC residents. For such a programme to be effective, training, mandatory routines, adequate equipment and support from dental personnel must be present. On-site staff training is important if unskilled as well as the professional caregivers are to attain adequate oral care knowledge and skills. The programme should also place responsibility at the individual level and reflect an institution-based philosophy with high oral hygiene priorities.

List of publications

The thesis is based on the following papers:

- I. Samson H, Strand GV, Haugejorden O. Change in oral health status among the institutionalized Norwegian elderly over a period of 16 years. *Acta Odontol Scand* 2008; 66:368-373.

- II. Samson H, Iversen MM, Strand GV. Oral care training in basic education of care professionals. Accepted for publication in *Gerodontology*.

- III. Samson H, Berven L, Strand GV. Long-term effect of a quality assurance system on oral hygiene in a nursing home. Submitted to *European Journal of Oral Science*.

- IV. Wolden H*, Strand GV, Gjellestad A. Caregivers' perceptions of electric versus manual toothbrushes for the institutionalised elderly. *Gerodontology* 2006; 23:106-110.

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PAPERS I – IV

APPENDICES

1. Introduction

1.1 Demography

Norway's population is estimated to rise from 4.7 million today to around 6.9 million in 2060. The proportion of people 67 years or older will continue to grow during this period, from today's 13% to approximately 23%. Furthermore, the proportion of people aged 80 years or older will grow from 5% to approximately 9% (1). The Norwegian population is among the oldest ones in the world. With a life expectancy of 78.2 years for men and 82.7 years for women, only 8 countries are above Norway (2). Still, the average Norwegian is estimated to live even 10 years longer within 2060 (1).

1.2 Oral health status

In Norway, as in other Western countries, the dental health of the population has improved during the last decades. The overall prevalence of both edentulism and caries has been decreasing since the 1970s (3-6). The Directorate of Health is collecting oral health data annually among children and adolescents, but no systematic surveillance is undertaken among adults and the elderly (7). In a study from 1993 Jokstad et al. showed that since 1980 a reduction in edentulism and caries had occurred also among the elderly in long-term care (LTC) institutions (8). However, there is a lack of recent studies on the prevalence of dental diseases among this group. Monitoring of changes in oral health by repeating systematic studies over time is important both for planning, organising and evaluating prevention strategies, education and dental services. When comparing studies, similarities regarding study methods and population characteristics are essential. Differences in age, gender, number of remaining teeth, general health, access to dental services, level of dependency and socioeconomic situation are among the factors that can cause discrepancies between results from different studies. Some recent Norwegian cross-sectional studies have investigated the oral health among elderly in LTC institutions (9-11). However,

comparisons of these studies have limited validity, as there are major disparities in the prevalence of edentulism and caries depending on the geographic region (10, 12).

1.3 Welfare services for the elderly

The major part of the Norwegian health care system is organised and financed by the public sector. The municipalities are responsible for nursing and care services, and standards of care are set out in the Municipal Health Services Act and in the Regulation of Quality of Care in Health and Social Services (13, 14). The services currently have more than 200 000 users, of whom approximately 41 000 live in nursing homes and the rest receive home care services in community care housing or in their own home (15).

The risk of illness or handicap increases with age. A rapid decline in physical or mental health frequently occurs after the age of 80 years (16). As 40% of the population die in nursing homes, the quality of care in LTC institutions is a matter of concern for most people, either personally or through family and friends (17). In Norway, 15% of people 80 years or older are living in nursing homes (18). During the last decades there has been a shift in the policy of the Government regarding the nursing and care services towards enabling older persons with care needs to stay at home as long as possible (19, 20). According to the OECD Health Project of 2005 the common policy direction of the OECD Social Policy Ministers of 1994 about “ageing in place”, have resulted in a considerable investment in home care services in most of the OECD-countries, including Norway (21). Since the 1980s, there has been an increase in the number of users of home care services while the ratio of LTC beds among the elderly has been reduced (22). As a consequence, nursing homes are now reserved for persons with severally impaired health status in need of 24-hour nursing care. The average nursing home resident is 85 years old, multi-morbid, functionally compromised, cognitively impaired and highly care-dependent (23-25). Following the increased burden of care in nursing homes, the caregiver-patient ratio has been criticised in the media (26-28) and been on the political agenda (20). Governmental

incentives have been introduced, and since 1995 the total number of man-years in nursing and care services has increased by 60% (29).

The proportion of this work being carried out by professional health care workers has also grown (30). In 2001, it was reported that half of the employees were registered nurses or auxiliary nurses. If persons with social work education were added, nearly two thirds of the man-years were carried out by these occupational groups. Approximately one third of the employees were unskilled workers (30).

As a result of the large expected increase in the proportion of elderly people, especially the oldest, care for the frail elderly has become a policy priority in many European countries (31). In Norway, nursing and health care for the elderly has been given priority ever since the two Lønning-committees (I and II) for priorities in health care published their recommendations in 1987 and 1997 (32, 33). In the National Health Plan for Norway (2007 – 2010) the Ministry of Health and Care Services suggests policy measures intended to result in better health services. Greater emphasis should be placed on preventive measures for at-risk groups, among them the elderly. Concerning oral health, a closer collaboration between the public dental health services and the municipal health services is recommended, to strengthen the efforts to prevent tooth decay and poor nutrition and to promote good dietary habits. The government also wants to strengthen the research and development associated with diseases and health status, living conditions and care services for the elderly, in order to be able to handle the increasing number of old people. Particular emphasis is to be put on research in proximity to patients/practices. Knowledge-based summaries of this shall provide the basis for general knowledge about the use of various prevention and treatment methods (34).

1.4 Oral health care

The responsibility for the oral health of persons receiving nursing and care services is regulated by law through the Dental Health Service Act and the Regulation of Quality

of Care in Health and Social Services (14, 35). The Norwegian Public Dental Services shall provide free, systematic and outreach care to certain groups of priority, *inter alia* elderly, chronically ill or disabled persons, living in institutions or receiving home nursing care. Institutionalised elderly are also entitled to receive necessary daily oral hygiene assistance to safeguard their oral health. The responsibility of this lies upon the municipality and the caregivers employed. Still, it has been revealed that the oral hygiene in several Norwegian nursing homes is far from optimal (36).

The professional groups providing basic care in Norwegian LTC facilities are registered nurses (sykepleiere), social educators (vernepleiere), auxiliary nurses (hjelpepleiere) and care workers (omsorgsarbeidere). The two former groups receive their training through university colleges, while the training of the two latter groups takes place in community colleges. The most frequent workplaces of registered nurses and auxiliary nurses are in the health and care services, such as hospitals and nursing homes. Additionally, auxiliary nurses often work in psychiatric institutions and with home-based care. Social educators and care workers, on the other hand, also work in nursing homes. However, they are more often employed by the health and social services, working in psychiatric institutions or with child care, drug-related care or rehabilitation care.

1.5 Barriers to oral care

Several studies from other countries have called attention to obstacles to the provision of oral care for the frail and care-dependent elderly. Both patient-related and caregiver-related barriers have been identified. Lack of patient cooperation due to cognitive impairments or reluctance to be inactivated is fairly common (37-39). Oral care is very often the last part of self-care a patient retains, and can be strongly related to the feeling of integrity. As the general health status declines, the need for oral care will at some point exceed the individual's functional capacity. A reduced mental or physical state, impaired vision or restricted dexterity can limit a person's ability to perform adequate oral care. Concerning barriers at the caregiver-level, lack of oral care

knowledge and practical skills are frequently reported (40-44). In many countries the average nursing home resident has become older and more care-dependent and the staff experiences an increased workload (31). In a busy day, other tasks seem more urgent and lack of time becomes an obstacle (37, 43, 45). Several studies have acknowledged that the residents would profit from the presence of effective routines and sufficient oral hygiene equipment (43, 46). Providing oral care can also be associated with feelings of intimacy or even disgust (37, 45, 47). Brushing other people's teeth implies crossing a psychological integrity zone, and such "intrusion" of the body can be experienced as emotionally complicated (37). If oral hygiene gets neglected in the first place, the accumulation of plaque, food debris and mucus in combination with bad odour, can serve as further impediments to the oral care provision.

1.6 Hypotheses

The general incentive behind the present thesis was to improve the quality of oral care for the institutionalised elderly. Three hypotheses were formulated, of which the first was that the oral health improvement that has occurred during the last decades is also evident among institutionalised elderly, visible as a reduction in loss of teeth. Investigating how oral health status has changed over time is essential when assessing the need for oral care assistance and professional treatment. It is also important when generating an understanding of which areas that need improvement.

Poor oral hygiene among LTC residents is a common problem worldwide (36, 48-51). As several studies from other countries have claimed that one of the main reasons is the caregivers' lack of oral care knowledge, the second hypothesis of the thesis was that the oral care training in the basic education of future Norwegian LTC professionals is inadequate.

It appears that elderly who reside in nursing homes because they are no longer able to look after themselves at home, also have low oral self-care abilities (52-54). This, in

combination with the shift in demography and dental status among the senior members of the population, makes it necessary to develop preventive oral hygiene programmes for this group. The third and last hypothesis was therefore that a new quality assurance system could improve the oral hygiene of LTC residents by improving staff-knowledge, implementing various routines, providing adequate equipment and continuously evaluating the results.

Hence, the thesis is in concordance with the global goals of the World Health Organization (WHO) for 2020; "...to strengthen systems and methods for oral health surveillance, to develop oral health programmes that will empower people to control determinants of health and to promote social responsibility and ethical practices of caregivers." (55).

2. Aims

The primary purpose of the present work was to generate initiatives promoting good oral health for institutionalised elderly by uncovering a scientific approach to how oral diseases can be prevented for this group.

Additionally, the specific aims were:

Study I

To assess whether or not the oral health status of institutionalised elderly in Bergen, Norway, has changed from 1988 to 2004.

Study II

To investigate the quantity and quality of oral care training in the basic education of future LTC professionals in Norway.

Study III

To develop an effective quality assurance system with sustained positive impact on the oral hygiene of elderly LTC residents.

Study IV

To assess how caregivers perceive the use of electric vs. manual toothbrushes for elderly in long-term care.

3. Material and methods

To assess and improve the oral health of institutionalised elderly residents, several different methods were used, with both descriptive and analytical study designs. Two surveys (Study I and II), one clinical intervention-study (Study III) and a questionnaire study with an after-only design (Study IV) were carried out in order to identify the extent of oral diseases and to reveal which areas that need improvement. Factors relating to both residents and caregivers were investigated.

3.1 Study design and population

3.1.1 Institutionalised residents (Study I and III)

Study I is a descriptive epidemiological sample-survey among institutionalised elderly in Bergen, Norway, based on two separate cross-sectional studies from 1988 (56) and 2004, respectively. The design is “quasi-longitudinal”, as the data comes from independent, but reasonably comparable samples.

In 1988, all 29 institutions for elderly in Bergen were stratified into three groups according to the number of residents. A random and proportional sample was drawn, consisting of five institutions with altogether 158 residents. Of these, 147 were examined, 22% men and 78% women, which gave a 93% participation rate. The mean age of the subjects was 83.9 years (range: 66 – 100). Reasons for non-participation were: “not present” (n = 7) and “refusal” (n = 4).

To secure comparability between the 1988 study and the present study, the same five nursing homes were chosen in 2004 as in 1988, which also gave approximately the same sample size. Out of 173 residents, 155 agreed to take part in the study (90% participation rate). Of the participants, 17% were men and 83% were women. The mean age was 86.5 years (range: 56 – 101). Reasons for non-participation in 2004 were “refusal” (n = 13), “illness” (n = 3), and “not present” (n = 2). To check the

representativeness of the participants, non-participants were asked about permission to use information regarding their age, sex and dental status (dentate/edentate). Information could be retrieved from 15 of the 18 non-participants. Of these were 33% men and 67% women. Their mean age was 88.9 years and 47% were edentate. Distribution of the non-participants, according to age, sex and edentulism were not shown to be significantly different from the participants. Table 1 gives the age and gender distribution of participants in 1988 and 2004.

Table 1. Age and gender distribution of participants in 1988 and 2004 in Bergen

| | 1988 (n = 147) | | | | 2004 (n = 155) | | | |
|--------|----------------|----------|-----------|------------|----------------|----------|-----------|------------|
| | Mean age | < 80 yrs | ≥ 80 yrs | Total | Mean age | < 80 yrs | ≥ 80 yrs | Total |
| Male | 82.4 | 10 | 23 | 33 (22%) | 83.0 | 6 | 21 | 27 (17%) |
| Female | 84.4 | 22 | 92 | 114 (78%) | 87.3 | 14 | 114 | 128 (83%) |
| Total | 83.9 | 32 (22%) | 115 (78%) | 147 (100%) | 86.5 | 20 (13%) | 135 (87%) | 155 (100%) |

Study III is an analytical intervention study among elderly residents in Norway's largest municipal nursing home. Repeated cross-sectional data were collected. Due to the lack of control group, the design was quasi-experimental, i.e. a one-group pre-test/post test design. Of the 100 residents in 2002, 6 refused to participate and 6 were edentate and without dentures, leaving 88 residents for the study (74 women and 14 men, 88% participation rate). Similarly, in 2008 there were 96 residents, 5 (or their guardians) refused to give informed consent and 3 were edentate and without dentures, leaving a study sample of 88 residents (69 women and 19 men, 92% participation rate). All residents, at the various times for data-collection, were invited to participate, and therefore constituted a convenience sample.

3.1.2 Educational institutions for caregivers (Study II)

A cross-sectional census survey was performed among the colleges educating LTC-professionals in Norway. The Norwegian Universities and Colleges Admission Service (NUCAS) provided lists of all institutions offering basic education programmes for at least one of the four groups of LTC professionals (registered nurses, social educators, auxiliary nurses and care workers) in 2004/05. All 270 schools were invited to participate in the study. Of the 203 respondents (75% response rate), 15 (7 %) did not include oral care in their educational programme. These were excluded from the subsequent analyses, leaving 188 schools as final participants. The data were collected between September and December 2004.

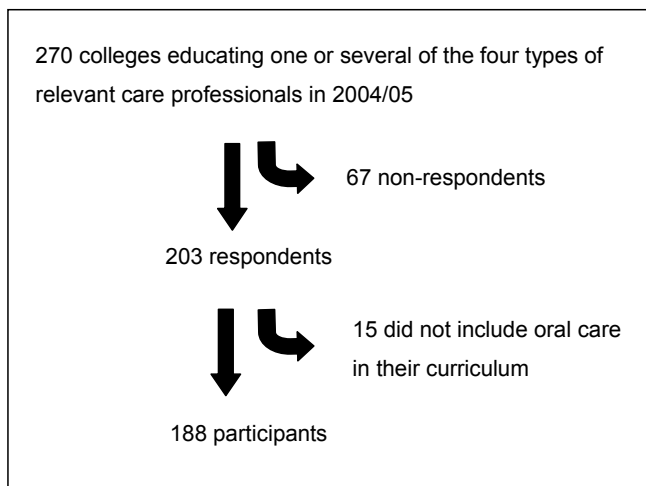


Figure 1. Flow chart showing the population of colleges, respondents, exclusions and participants.

3.1.3 Caregivers (Study IV)

A questionnaire study with an after-only design was undertaken among the caregivers working in Norway's largest municipal nursing home. All 150 caregivers providing basic care in the long-term wards were invited to participate in the study. A total of 119 caregivers agreed to take part by completing a self-administered questionnaire (79% response rate).

3.2 Intervention

3.2.1 Institutionalised residents (Study III)

The following quality system was introduced for the nursing home in 2002:

1. *Teaching/motivation of the nursing staff.* Both theory and practice of oral and dental care were imparted by dentists, dental hygienist and competent nursing staff during a 4-hour course. Group work based on discussions of actual cases was an essential part of the tuition. Written information concerning oral care was distributed to all wards.
2. *Production of picture-based procedure cards (oral care cards).* Six different research-based procedure cards were produced, depicting simple, practical procedures and relevant appliances that should cover all needs (natural dentition, partial dentures, full dentures, palliative care). They are intended to serve as guidelines, to calibrate and be binding on the nursing staff. The cards can be downloaded without cost from the internet (57). A plastic-coated card, selected according to the specific needs, is visibly, but discreetly attached to the bathroom wall of each resident, and constitutes an individually adapted treatment plan. The name of the resident and individual comments is written on it with indelible ink. This can, however, be removed with an alcohol swab, so that the card may be reused (Appendix I).

3. *Distribution of adequate appliances.* As a standard, an electric toothbrush mounted on the bathroom wall, interdental brush, toothpaste and fluoride tablets were made available to all with remaining teeth. Residents with complete or partial dentures were issued with a special denture brush and liquid soap. All were given suitable dental mugs for storage of these appliances on which a motivating message was found. Additional appliances were procured as needed.
4. *Implementation of new routines in the ward.* For each ward, an “oral care contact” person was appointed who had a direct contact with the dental team of the nursing home. Written working instructions regarding the responsibility and duties of the “oral care contact” were produced. The appointed “oral care contacts” were responsible for notifying dental personnel of newly arrived residents, so that these could be expeditiously examined and issued with appropriate dental appliances and oral care cards. Similarly, they would report if a resident had specific oral problems (mucosal ulcers, fractured or cracked dentures, abscesses, pain, difficulties in chewing etc). Finally, the “oral care contacts” would be responsible for teaching the routines to newly or temporarily employed staff as well as for the supply of dental appliances.

3.2.2 Caregivers (Study IV)

As part of the oral hygiene programme in Study III, electric toothbrushes (Braun Oral-B Ultra AP 800 TX®), with a two minute timer, were installed in the bathrooms of all dentate residents, supplementing their manual toothbrushes. The caregivers underwent a full day’s training programme in preventive oral care, including demonstration of electric toothbrushing procedures.

3.3 Measurements and procedures

3.3.1 Clinical examinations (Study I and III)

Clinical examinations were performed to assess the oral health status of institutionalised elderly in Bergen and to assess whether a new quality assurance system could improve the oral hygiene in this population.

Study I was performed using the same examination procedures and evaluation criteria as in the 1988-study. A set procedure was followed for the clinical examinations, with the participants lying in bed or sitting in a chair. The instruments used were a plain mouth mirror, a blunt explorer, a periodontal probe and an adjustable head-torch. Prior to the study, the examiner had been calibrated with a dentist with extensive clinical experience, who also supervised examinations at regular intervals.

Clinical parameters recorded were tooth loss, caries and periodontal, mucosal and prosthodontic status (Appendix II). Dental status was recorded for each tooth, based on the Method of Assessing Dental Caries as recommended by the WHO (58). However, for comparative purposes, some modifications were made (Appendix III). The DMFT (decayed-missing-filled teeth) score included only remaining functional teeth and missing teeth. Root remnants and other non-functional teeth that were indicated for extraction due to periodontal disease or for prosthodontic reasons, were excluded. The same was the case with implants and third molars (unless a first or second molar was missing). Periodontal treatment needs were recorded using CPITN (Community Periodontal Index of Treatment Needs). Oral mucosa was inspected for denture stomatitis according to Budtz-Jørgensen & Bertram's recommendations (59).

A test-retest was performed on a randomly drawn sample of 10 dentate elderly nursing home residents. The subjects were selected from a different nursing home than the ones included in the study, but they were considered to be representative for the study participants. Reliability of the DMFT index was assessed at tooth level.

In Study III, the effect of the oral hygiene programme was revealed by recording the level of oral hygiene at baseline in 2002, 3 months after the intervention and finally after 6 years, in 2008. In addition, the effect was monitored regularly by dental hygienists who reported the results to the ward administration, as a means towards improvement. The recordings were carried out on residents who were bedridden or sitting on a chair. A headlight and dental mirror were used for the examination.

The level of oral hygiene was assessed using the mucosal-plaque score (MPS) index. Recordings were performed as follows: the degree of plaque on teeth and denture was recorded by means of a *plaque* score (PS) using a four point Likert-type scale: no easily visible plaque [1], small amounts of hardly visible plaque [2], moderate amounts of plaque [3] and abundant amounts of confluent plaque [4]. The condition of the mucosa, *mucosal score* (MS), was also recorded using a four point Likert-type scale: normal mucosa [1], mild inflammation [2], moderate inflammation [3] and severe inflammation [4]. When in doubt whether to record 1 or 2, or 2 or 3 the lowest value was chosen. When in doubt whether to record 3 or 4, the highest value was chosen. A pictorial manual has been produced with clinical photos illustrating the criteria (60). The sum of PS and MS constitutes the MPS. Accordingly, the lowest possible score is 2 and the highest 8. A score of 2 – 4 depicts a good/ acceptable state, a score of 5 – 8 depicts a gradually deteriorating, unacceptable state.

Finally, information was gathered from the matron regarding her/his opinion as to the reasons why specific residents did not attain an acceptable MPS and whether residents were diagnosed with dementia or not.

The MPS recordings and evaluations from 2002 through 2008 were conducted in the same manner. All scores before 2008 were recorded by one evaluator. With regard to the recordings made in 2008, in order to obtain an objective evaluation, an unbiased qualified person with previous experience from comparable assessments made at the request of a government department, recorded the MPS. At this time, the first evaluator and the latter independently scored 10 randomly selected residents to test

whether the inter-reliability between them was acceptable so that the “before – after” results could be compared meaningfully.

3.3.2 Questionnaires (Study II and IV)

The self-administered questionnaires used in Study II and IV were constructed for this purpose, but had been pilot tested by multidisciplinary teams. Content- and face-validity were assessed and the questionnaires were adjusted accordingly before use.

School questionnaire (Study II)

The questionnaires were administered by post with reply envelopes, which were addressed, pre-stamped and coded. Upon receipt of the replies, the codes were noted on a separate form. Hence, the anonymity of the participants was safeguarded, and a reminder letter could be sent to the non-respondents. In the accompanying letter, participating institutions were informed about the purpose of the study and that participation was voluntary. Confidentiality and anonymity were guaranteed. Return of the questionnaire was considered consent.

The questionnaire consisted of 15 items regarding the amount of oral care training, scope of oral care in teaching literature, coverage of oral care aspects through practical training, formalisation of oral care training in the curriculum, whether students’ knowledge and competence were evaluated, teachers’ professional education, whether oral care was considered important and whether the oral care training was considered adequate. The two last questions were assessed by 5-point Likert-type scales, with response options ranging from “strongly agree” to “strongly disagree”. These scales were later recoded into 3-point Likert-type scales for analytical purposes (Appendix IV).

Caregiver questionnaire (Study IV)

Fifteen months after the electric toothbrushes had been installed in 2002, a self-administered questionnaire was distributed to the caregivers by the head nurses of each ward. The responses were to be placed in a sealed container in the administration's office within two weeks. The questionnaire contained 7 questions (five multiple-choice and two open-ended) regarding the extent of use, ease of use, time consumed and the general opinions of the residents and staff (Appendix V).

3.4 Statistical analyses

The data were computerised and proof-read. Statistical analyses were performed using SPSS®, versions 11.0, 14.0 and 15.0, (SPSS, Chicago, IL, USA) (Table 2). Variables were described by calculating frequency distributions, means/standard deviations for normally distributed variables or median/range for skewed distributed variables. Kolmogorov-Smirnov test was used to test normality of distributions. To assess the statistical significance of association between pairs of variables cross-tabulations with chi-square test/Fisher's exact test were used for discrete variables. The Mann-Whitney U-test or the two-sample t-test was applied to compare continuous variables and the sign test to investigate paired observations. One-way ANOVA was used to detect between-group differences for continuous variables, followed by multiple pair-wise analysis with Tuckey's post hoc test. The Pearson's rank correlation coefficient (r) was used to assess correlation between two continuous variables, i.e. the strength and direction of the relationship between these. The significance level was set at 5% for Study I, II, and III, and at 1% for Study IV, which describes the probability of making a type I error, i.e. rejecting a true null-hypothesis. In Study II pair-wise multiple comparisons were performed when overall tests had detected between-group differences. The significance level was then adjusted according to Bonferroni's method of correction.

Statistical comparisons were conducted between genders and age groups in Study I, but the small number of males and participants less than 80 years of age made it difficult to obtain statistical significance of observed differences (i.e. insufficient power).

In Study I, the crude rates of edentulism in the two cohorts were adjusted according to age and gender by the method of direct standardisation (61). Information regarding the 1988 cohort was gathered from published tables, because the original data files had been deleted (56). Using tables instead of data files limited the data analysis.

Intra-examiner reliability of the DMFT registrations and inter-examiner reliability of the MPS registrations were expressed in terms of Cohen's kappa.

Table 2. Statistical tests used in Study I – IV

| Statistical methods used | Study I | Study II | Study III | Study IV |
|--|---------|----------|-----------|----------|
| Chi-square test | + | + | | |
| Fisher's exact test | | + | | |
| Cohen's kappa | + | | + | |
| Kolmogorov-Smirnov test | + | | | |
| Mann-Whitney U-test | + | | | |
| Sign-test | | | | + |
| One-way ANOVA | | | + | |
| Tuckey's post hoc test | | | + | |
| Two-sample t-test | | | + | |
| Pearson's rank correlation coefficient | | | + | |

3.5 Ethical issues

The informed consent process is important in research, but may be difficult to obtain from demented participants. However, it has been shown that people with very mild and mild dementia are able to understand most of the informed consent information, if it is tailored to their ability (62). The participants of Study I were informed about the aims and methods of the study, and the information was made very simple, yet concise. It was very important to respect the autonomy of each participant. Some residents with severe dementia had reduced communication skills. In these cases, the slightest signs of disapproval, including nonverbal signs, against a clinical examination or study participation were respected. There was minimal risk of discomfort, harm, strain or negative side-effects. The examination was part of the routine annual screening assessment carried out by the public dental service, and any treatment need detected was referred to the responsible dentist. Hence, each participant derived a personal advantage from the clinical registration, and the benefit of the study is considerable for this group of patients and exceeds the possible inconvenience.

3.6 Ethical approval

Participants in Study I – IV could not be recognised on individual level, only group level, and for participants in Study II, even only on national level. In all four studies participants were informed about the purpose of study and that participation was voluntary. Confidentiality and anonymity were guaranteed. In Study I and III, participants or their next of kin/guardian signed a written consent/approval of their participation. The National Committee for Research Ethics in Norway (REK Vest) has approved the study design and data collection of Study I and III. Study II and IV did not include any personal data, and did therefore not require ethical approval.

4. Summary of results

4.1 Institutionalised residents (Study I and III)

Study I revealed that edentulism was less prevalent in 2004 (43%) than in 1988 (71%) (crude percentages), and the average number of teeth among the dentate participants had increased from 10.7 to 14.6. The proportion of subjects with decayed teeth increased from 55% in 1988 to 72% in 2004, and the mean DMFT increased from 19.4 to 23.2. The frequency of subjects with periodontal pockets of 4 mm or more increased from 43% to 65% during the 16 year period. More participants had crowns or bridges and fewer had partial dentures. Edentulous residents with missing dentures were more frequent in 2004, mainly for the upper jaw. Among the denture-wearing subjects, stomatitis was more common in 2004 than in 1988; however, a decrease in the degree of severity was evident.

In Study III, a change in the residents' dental status was observed during the study period. In 2008, 36 residents (41%) had their own teeth only, 31 (35%) had a combination of own teeth and dentures, and 21 (24%) had complete denture only. Comparable figures in 2002 were 36%, 29% and 35%, respectively. Before the quality system was implemented only 36% of the residents had an acceptable score (i.e. 4 or lower). Six years later the comparable proportion was 70%. An overall analysis by the one-way ANOVA suggested a statistically significant difference of oral hygiene between the three groups ($p < 0.001$). Further analysis with Tuckey's post hoc tests revealed that a statistically significant improvement in oral hygiene had occurred after 3 months ($p < 0.001$), which was still significant after 6 years ($p < 0.001$). In response to the question of why some individual residents in 2008 exhibited poor oral hygiene, the nurses stated that 8 (9%) were dying or very sick, 4 (5%) were aggressively demented and 14 (16%) were mentally alert persons who were not followed up because they cleaned their teeth themselves. A two-sample t-test showed that oral hygiene was associated with dental status in 2008. Residents with remaining teeth had a significantly higher mean MPS than the ones wearing only complete dentures ($p < 0.001$). Cognitively impairment was also found to be of importance, in that residents

with a manifest diagnosis of dementia had significantly better oral hygiene than the ones with uncertain cognitive impairment ($p = 0.049$). The results also indicated a positive correlation between the degree of mucosal inflammation (M score) and the amount of plaque (P score) ($r = 0.54$, $p < 0.001$).

4.2 Schools educating caregivers (Study II)

Of all the 203 responding schools, 188 (93%) included oral care in their educational programmes, hence constituting the participants. Both theoretical lectures and practical training were offered by 94% of them. Concerning the amount of training, 67% and 58% of the participants reported allocating two hours or more on lectures and practical training, respectively. Training in various aspects of oral care was assessed, both in school and in practice placement. Toothbrushing was carried out in the majority of schools, in both arenas. Practical exercises in denture cleaning were provided by one third in school, but two thirds reported this type of training in practice placement. Training in special mouth care was frequently performed in school (81%), but somewhat less common in practice placement (65%). The most frequently used textbooks among the colleges educating registered nurses, social workers and auxiliary nurses had a fairly high scope of oral care. Few schools (26%) reported having a formal description of the oral care training programme in their curricula, but the majority (86%) evaluated their students' oral care knowledge by some sort of exam. Most schools (88%) used registered nurses to teach oral health care. Dentists or dental hygienists were used for this assignment by 31% of the schools.

4.3 Caregivers (Study IV)

Of the respondents, 78% replied that they always or frequently used an electric toothbrush. With regard to brushing times, 44% of the respondents reported that they spent less time on oral care procedures with an electric toothbrush than with a manual

one. Equal amount of time for both types of toothbrushes was reported by 53%. Only 3% reported spending more time with an electric toothbrush than with a manual one. Oral care procedures were considered easier with this device by 63% of the respondents, 22% registered no change and 15% found it more difficult. If residents suffering from dementia were considered separately, 45% found the procedures easier when using electric toothbrushes, 24% registered no difference and 31% found it more difficult.

5. Discussion

The following section considers methodological issues of the present thesis and the main findings of the constituting papers.

5.1 Methodological issues

5.1.1 Reliability

Reliability refers to the stability or consistency of information, i.e. the extent to which similar information is obtained when a measurement is performed more than once (63). To ensure that the methods used in the studies had a high degree of consistency, several approaches were used. A test-retest method was carried out and analysed with kappa statistics for some of the categorical variables measured. In order to assess the level of intra-examiner reliability in Study I, a random sample of 10 subjects was examined twice, two weeks apart. The kappa value for the test-retest DMFT registration was 0.89 at the single tooth level, which is considered to be “almost perfect” repeatability (64). In Study III, no intra-examiner reliability testing was carried out, but a high value could be expected as both examiners were dental health workers with extensive clinical experience. Furthermore, both examiners related their findings to a written and illustrated leaflet of criteria throughout the whole evaluation. A test of the inter-examiner agreement for the evaluators gave a kappa value of 0.61 for the MPS, which is considered “substantial” repeatability (64). Furthermore, in all the studies, data were re-checked after data entry. The self-administered questionnaires used in Study II and IV were constructed for this study and had not been previously used. Reliability testing of the questionnaires was not performed, due to limited time and financial resources in Study II and the guarantee of full anonymity in Study IV. This lack of reliability-testing makes the psychometric properties of the questionnaires unknown. Study II involved two Likert-like items, a scale generally used to measure the study subjects’ qualities such as knowledge or attitudes. However, even though it

is the most widely used scale in survey research, it is still known to show fairly poor reproducibility (65).

5.1.2 Validity

Internal validity is concerned with the question of whether a true measure is obtained for the study subjects, i.e. are the methods used adequate to answer the research questions. External validity relates to the generalisability of the findings to some wider population, either the study population or an even broader population (65). When designing studies, the demands for internal and external validity often compete. In general, surveys are often strongest on external validity, while experimental studies are stronger on internal validity.

Internal validity

Statistical validity

Estimation of differences between groups requires a sufficient sample size. If the sample size is too small the risk of not finding significant differences, i.e. committing a type II error increases.

In Study I the sample size in 1988 had been based on the results of a preceding pilot and the demand for precision (56). In 2004, the same five nursing homes as in 1988 were included, which gave approximately the same sample size, i.e. initially 173 study-subjects invited. This was considered acceptable, as the expected change in edentulism from 1988 to 2004 (approximately 17%) (8, 56) still gave an adequate power of 80% with $n > 132$. Edentulism was selected as parameter for the sample size calculation, as it can be considered a crucial oral health measure.

In Study II, the main problem in the data material was the small number of the social educator schools ($n = 9$). This made it difficult to reach a significant level when testing

for differences between the different subgroups. As this was a census study, greater test power could only be achieved by increasing the significance level above 5%. However, this was not done, as it would increase the risk of a type I error.

Methods and measurements used (Study I and III)

In order to standardise the conditions in Study I, the criteria set for field surveys by the WHO were adhered to, and caries experience and periodontal disease were assessed according to the DMFT and CPITN index, respectively (58). An optimal method for registration of dental caries, filled teeth, missing teeth due to caries and periodontal disease would also include radiographs, a mobile dental unit, optimal cleaning and drying of teeth, adequate lighting and patients' dental records. Since the data from the clinical examination in Study I was collected under field conditions, i.e. in the residents' private rooms, with the participants sitting in a chair or lying in bed, an underestimation of the reported prevalence might have occurred. However, most of the participants had a reduced dentition with some spacing, facilitating the detection of approximal caries and dental fillings. According to the WHO, it is not recommended to use radiographic information in field surveys because of the impracticability of using the equipment in all situations. Even in populations with high prevalence of disease, the underestimation will only be around 10-15% (58). However, the presence of study limitations, which make the estimates uncertain, are unlikely to have biased the observed changes in oral health status, since the same procedures and evaluation criteria were used both in 1988 and 2004.

To avoid the instrumentation effect that might result from a shift in the observer's standards over time, the observer was calibrated with an experienced clinician who supervised examinations at regular intervals.

The most favourable study design for a clinical study is the randomised controlled trial. In Study III, no control group was applied. It is then difficult to know whether the results are really due to the intervention, or to some other confounding factors. When

assessing the long-term outcomes of an oral hygiene intervention in an LTC institution, some difficulties concerning the use of control group arise. A separate ward in the same nursing home could not be used as control. Knowledge diffusion would be difficult to hinder due to the caregivers daily social interaction and some staff rotation in between wards. The use of a different nursing home as a control group could and should have been used for the 3 months registrations. However, being valid as a control implies the absence of internal and external factors affecting the oral hygiene, and imposing this on a nursing home for an extended time period raises serious ethical issues.

Indices

The DMFT index is widely used, but has fairly poor validity as a measure of dental caries experience, especially in older adults. It is highly dependent on the observer's diagnostic and treatment criteria, which often varies between different clinicians. Additionally, a change in treatment criteria and treatment options has occurred over time (66). The index is insensitive to revised fillings, but becomes inflated by fillings placed and teeth missing for reasons other than caries. As the index represents prevalence of the disease and its consequences (treatment experience), it will easily become saturated in populations with a high caries experience, such as institutionalised elderly in Norway. This will confound detection of changes over time.

The CPITN index used to measure periodontal disease has several limitations regarding validity (67). The measurement of pocket depths rather than gingival recession, alveolar bone loss and intensity of inflammation will tend to cause the severity of disease to be underestimated. Even though the CPITN index has been criticised (68) and revised, it was chosen in the present study to allow comparison with the results from 1988. In Study III, the MPS index used as an oral hygiene measure, has previously been validated as a reliable measure for the assessment of oral hygiene in groups of elderly (69) and has been used before in other studies (11, 36).

Response error

Response error arises from incorrectly completed questionnaires, and may have biased the results in the two questionnaire studies. Some respondents might lack the knowledge needed to answer the questions, remember incorrectly (recall bias) or questionnaire items might be misunderstood. Finally, prestige bias is considered to be one of the most common and pervasive sources of bias affecting the validity of self-report data (70). Respondents tend, consciously or unconsciously, to reply what they think is the most desired or socially accepted answer. Since both misunderstandings and prestige bias might represent a systematic error, several actions were taken to minimise these sources of error. The questionnaire-studies were an interdisciplinary collaboration, and the survey items were piloted on the different occupational groups to avoid misunderstandings across the professions. Confidentiality was assured to minimise social desirability.

External validity

Non-response error

The participation rates in all four studies were fairly high, ranging from 70% to 90%, which is considered acceptable to good (71). Lower response rate in studies where there is no direct contact with the sampling unit, is common. The fairly high response rates observed in Study II and IV are therefore probably due to several response-enhancement strategies. Participants received clear and appropriate information, the questionnaires were short, with simple questions pertaining largely to easily ascertained facts, reply envelopes were addressed and pre-stamped, anonymity was assured and the initial non-responders received a reminder. Still, the potential bias caused by those not participating, is of course of concern. High response error can occur along with a high response rate, if the difference between the responders and the non-responders are big.

Testing for significant differences regarding mean age, distribution of sex and edentulism between participants and non-participants was done in Study I. T-test, Fisher's exact test and Chi-square test, respectively, were used. No significant difference was found at the 5% level. The observer's subjective opinion was that the physical and mental state of the non-participants seemed poorer than that of the study participants, and it is known that poor general health may impact on oral health (72). Many of the non-participants also conveyed a negative attitude towards oral health. It has been shown in another Norwegian study that unhealthy individuals often attend population-based surveys to a lesser degree than healthy individuals (73). This could contribute to a small overestimation of the reported number of teeth and an underestimation of the prevalence of oral diseases.

In Study II both the responses and the response rates varied among the four groups of schools in each question. However, a check for non-response bias by the direct standardisation method showed that the mean value of the deviances was 1% (range: 0 – 4), indicating that the overall estimates were reasonable reliable.

Information is lacking about the non-respondents of the other studies. The magnitude and direction of the potential selection bias is therefore difficult to assess. Conclusions from the results should therefore be drawn with some caution.

Generalisability

Representativeness of survey samples is essential when estimating prevalence of various characteristics of the population being studied. The age and gender distribution in Study I is characteristic of nursing home populations, and is in concordance with several other studies (11, 48, 74, 75). Still, the generalisation potential of Study I is limited. The participants reflect the variety of characteristics of institutionalised elderly in Bergen, Norway, and the findings are only valid for the population in this area. Because the number of residents per institution was expected to affect the residents' oral hygiene, a stratification procedure was undertaken to ensure inclusion

of all sizes of institutions. Socioeconomic status could also have been used as stratification variable, since it is related to oral health (76). The sample in the present study consists of institutions in high socioeconomic areas, but the intake of residents is not dependent of the applicant's area affiliation. However, it is likely that most people apply to an institution close to their own home. Despite these limitations, it is likely that the reasons behind the observed changes have occurred elsewhere as well. Thus, a similar shift in oral health can be expected for other populations alike.

The results of Study II can be generalised to the Norwegian educational institutions for care professionals working in LTC institutions, but not for schools in other countries. The samples in Study III and IV were convenience samples, not randomised. These studies were initiated by a request from the nursing home itself. The possible effect of this apparent motivation among the leadership should not be disregarded. However, the results of these studies are not meant to be representative for other residents or care staff in Norway nor in other countries, but are simply exploratory in nature. Nevertheless, they could form a basis for further research. Another threat to the external validity in clinical studies is the possible reactive effect of the experimental arrangement, the so called "Hawthorne phenomenon" (77). A short-term experimental effect might occur because the subjects are aware of being observed. However, this has probably not affected the observed results in study III, since measurements were carried out as late as six years after the intervention.

5.2 Comments on the main findings

5.2.1 Edentulism and prevalence of oral disease

Study I assessed the oral health status of institutionalised elderly to detect whether there had been any shifts in oral health status during the last decades. Several distinct changes were observed. The principal findings were a decline in the frequency of edentulism, an increase in the mean number of functional teeth, but also an increase in the prevalence of caries and periodontal diseases. The figures are not representative on

a nation-wide level. However, they do show that the WHO's oral health goal to reduce edentulism by 25% by the year 2000, was not only achieved, but exceeded, for this study population (78). The decline in the rate of edentulous elderly observed during the last two decades has been shown by several other studies, and is probably attributable to multiple factors (8, 79, 80). The increase in the population's socioeconomic status, educational level, and dental awareness during the second half of the last century is believed to have played a part (79, 81). There has also been a continuous rise in the use of dental services and a change in treatment philosophy from a predominately curative to a predominately preventive profile (66, 82). The elderly in the 2004 cohort have also benefited from the use of fluoride toothpaste for a longer period of their life than members of previous cohorts. Gerodontological units have been established at universities, teaching dental health personnel to be more aware of the needs of the elderly. Furthermore, dental infections could be controlled by antibiotics since the 1940s. Hence, restorative dentistry became a more common treatment alternative to tooth extractions.

The proportion of subjects with caries in 2004 was found to be 72%. This may seem very high, but are consistent with similar studies from Denmark (77%), Sweden (70%), and Australia (72%) (83-85). The substantial increase in both the prevalence of caries and periodontal disease since 1988 could be associated with a multitude of factors. The average LTC resident is older and probably more physically and mentally impaired than before. This will affect the ability to perform or receive oral care, reduce host defence mechanisms, and increase the prevalence of multi-medication therapies with accompanying hypo-salivation. It has also been suggested that the increased number of retained teeth may be an explanatory factor (86).

Even though several studies indicate that the oral hygiene among institutionalised elderly residents has undergone some improvement during the last years (11, 36, 80) it seems insufficient; the range of individual risk factors for oral diseases on resident level has grown substantially more than the improvement in oral hygiene.

5.2.2 Oral health

According to the WHO “Oral health implies being free from chronic mouth and facial pain, oropharyngeal cancer, oral sores, birth defects such as cleft lip and palate, periodontal disease, tooth decay and tooth loss, and other diseases and disorders that affect the oral cavity.” (87). This definition is limited, as oral health means more than the absence of disease. Oral health has a broader meaning, which parallels the WHO’s definition of health from 1948 saying that “Health is a complete state of physical, mental and social well-being.” (88). This means that oral health also includes quality of life. Oral health is therefore affected by many aspects, some in the context of being risk factors for oral diseases, others because they are related to a person’s expectations and perception of quality of life. When assessing whether an improvement of oral health has occurred in a population, the individuals’ opinions of their oral health are therefore of consequence (89).

It is well established that edentulism can have a profound effect on the quality of life, and that number of teeth are related to chewing ability and nutritional status (90-96). Previous studies have shown that Norwegian adults find it relatively difficult to cope with the loss of teeth and receiving dentures (97, 98). When older people are retaining their teeth longer than ever before, it therefore appears as a clear improvement of the oral health status, at least for the healthy and homebound elderly. However, the situation is somewhat more complex for the frail and care-dependent, as the presence of teeth also makes an individual subject to dental infections. New research has pointed to the associations between chronic oral infections and systemic conditions, such as heart and lung diseases, stroke, and poor diabetic control (99-103). Elderly immunocompromised individuals are at greater risk of general morbidity and mortality due to such diseases (104). It is therefore natural to question whether the observed change in oral health status is for the better – for everyone.

The complete loss of natural teeth has for some time been a key indicator of a population’s oral health status. As edentulism is declining, even among the oldest, other measures of oral health becomes more important. Following the definitions of

Käyser (105), both the WHO and numerous studies have referred to the presence of at least 20 teeth when measuring satisfactory oral health (106-108). However, the sole presence of teeth says nothing of their state of health. According to Locker, the traditional clinical indicators such as DMFT or CPITN express the extent of current disease or the damage to oral tissues from past disease but reveal nothing about the function of the oral cavity or the person (109). As a consequence, without information on the individuals' perceived oral health, it is difficult to conclude whether the decline in edentulism and the incline in oral disease observed in Study I constitute improvement or deterioration of the oral health status of institutionalised elderly persons. Nevertheless, oral health, in the meaning of being free from disease, is not a self-generating matter. It requires conscious and repeated efforts, including daily oral hygiene routines. Since the institutionalised elderly are frail and highly care-dependent, the responsibility for this must inevitably be placed with the caregivers. Hence, if the increasing number of teeth among the elderly shall represent an improvement of their oral health, prevention strategies, such as effective oral hygiene regimens, must be implemented without further delay.

5.2.3 Oral care knowledge

A great number of studies have claimed that professional caregivers' lack of oral care knowledge is one of the reasons for poor oral hygiene among the LTC residents (40-44, 110-112). In Study II, the quality and quantity of oral care training in the basic education of future Norwegian care professionals were examined.

The results indicated more extensive oral care training in Norway than in some other countries. A recent study from Ireland found that less than half of the registered nurses had received both theoretical and clinical training in oral care during their basic education (113). In the UK, Longhurst noted that even though all of the nursing schools provided oral care training, many of the training programmes seemed to be inadequate. Only 15% allocated more than two hours to theory (114). This was lower than reported for all four types of schools in our study.

Improving the oral health of the elderly care-dependent by education and continuous training of caregivers has been recommended by the WHO (115). The education should not only focus on developing practical skills, but also ensure that caregivers have a clear understanding of the relationship between oral health, general health and quality of life. When evaluating the teaching literature used by the Norwegian schools, it was noticed that only three mentioned that poor oral hygiene increases the risk of general diseases with a possible fatal outcome. Without this knowledge, the caregivers might assign lower priority to oral care, as other tasks appear more important and possibly more visible if left unattended. It is therefore essential that the educational training programmes are aimed at establishing attitudes based on a fundamental understanding of the rationale behind the procedure.

In Study II an attempt was made to assess whether caregivers in LTC institutions receive adequate oral care knowledge and skills through their basic education. In this context the question of what “adequate” comprise emerges. The author’s opinion is that if caregivers have sufficient knowledge and practical skills which enable them to brush other peoples’ teeth and prosthesis we would come a long way. In addition, they are expected to have basic knowledge about the importance of oral hygiene regarding oral health, general health and quality of life, how to perform an oral health assessment and special mouth care for very ill people, how fluoride and clorhexidine can be used in oral disease prevention and how the detrimental effect from hyposalivation on teeth and gums can be prevented. The results indicate that the majority of relevant educational institutions include most of these issues in their training programmes, either through literature and textbooks, theoretical lectures or practical training.

When assessing the findings from Study II, it is essential to consider the fact that the 15 excluded schools were also educating relevant personnel (care workers and auxiliary nurses). Hence, the results are only valid for the educational institutions which are offering some kind of oral care training. Among these schools differences regarding type and extent of oral care training offered were observed. Although not optimal, the basic education of registered nurses, social educators and auxiliary nurses appears sufficient in terms of allocated time. Some care worker schools seem to fall

short. Despite the possible need for a more systematic approach and standardisation regarding oral health care issues in these educational programmes, the majority of schools appear to provide information and training to cover basic requirements regarding oral care. It is therefore possible that reasons for poor oral care in nursing homes also must be sought elsewhere.

Some studies have shown that the level of oral care knowledge among caregivers is not necessarily related to the provision of adequate oral hygiene. De Visschere found that only the management of the institutions and the degree of dependency of the residents were risk factors of poor oral hygiene (48). No significant correlation between cleaner prostheses and a higher level of oral care knowledge among the caregivers could be shown. In a recent study by Reed et al. it was noted that other barriers to oral care provision may persist despite an improvement of the caregivers' knowledge and skills (116).

According to McGuire, caregivers frequently rely on ineffective routines (117). Furthermore, management often fall short on organising on-site training, fails to support the development of new routines and does not motivate staff to prioritise and take on personal responsibility for the provision of oral care. It is also reported that oral care is frequently performed by unqualified care staff, and absence of routine procedures for in-service staff training may then result in poor dental and denture hygiene for the care-dependent residents (118). Even if such in-service training exists, the high staff turn-over frequently found in nursing homes will inhibit its effectiveness (119).

Several studies have reported that caregivers perceive lack of time as a barrier to oral care provision (37, 41). As the average LTC resident has become older, more demented and with a more compromised general health, it was not surprising that a Norwegian study from 2001 noted that the burden of care has increased since 1992 in nursing homes as well as in other residential care units (28). The Norwegian government has formulated a target of 9% increase in man-years in LTC services by the year 2009, based on the 2004 level (29). The level of care staff must obviously be

adequate, but it is also important to increase the efficiency of the workforce situation. Achieving appropriate staffing level is obviously essential, but not necessarily sufficient to ensure high quality care. A Norwegian study from 2004 did not find any support for the claim that an increase in the number of caregivers employed resulted in better care for the residents in LTC institutions (26). Other factors such as a good working environment, a clear professional management profile, possibilities for skills development and mutual counselling among colleagues were more important for the quality of care supplied in the institution. The quality assurance system tested in Study III fulfils many of these requirements, which might be part of the reason for the successful results of the programme. The caregivers become more motivated to prioritise oral hygiene in a hectic and demanding work situation.

5.2.4 Oral hygiene programmes

Daily oral health care for those living in nursing facilities is meant to be performed by the nursing staff, but the reported situations have generally been unsatisfactory (49, 54, 120, 121). After the introduction of a simple quality assurance system in Study III, a significant long-term improvement of dental and oral hygiene was achieved. The system entails a measurable assessment of the level of oral hygiene, and is a practical and appropriate instrument for a continuous follow-up of oral care in such institutions.

Some improvement of the oral hygiene due to external factors in the relevant time period is expected. An improvement in the oral hygiene among institutionalised elderly residents during the last decades has also been found in a recent Swedish study (80). The results from two Norwegian nationwide studies indicate that the proportion of institutionalised elderly with an acceptable hygiene level increased from approximately 50% to 60% between 1996 and 2004 (11, 36). If employing the samples from these studies as comparison groups, it appears as if some improvement of the oral hygiene between 2002 and 2008 could be due to social changes in the relevant time period. However, as the proportion of residents with an acceptable oral hygiene

increased from 36% at baseline to 75% after 3 months, social changes and external factors cannot account for the main improvement observed.

Several advantages following the oral care cards are recognized. They supply information on how the care of the individual resident should be carried out, both to new and temporary staff. The fact that they are picture-based may be of particular use for non-native speakers. Furthermore, the cards fulfil the information duty of the dental staff towards the nursing home, and the nurses cannot claim ignorance.

Residents with any remaining teeth had a significantly higher mean MPS, than those who had only dentures in 2008. This is in concordance with previous studies (11, 36). It was therefore uplifting to see that a significant long-term improvement of the residents' oral hygiene occurred, despite the increased proportion of dentate residents throughout the study period.

The results from the present and previous reports show that even when oral hygiene programmes or initiatives succeed in major improvements among most residents, there will always be some who do not reach acceptable levels of oral hygiene (112, 122-124). Experience has indicated that it may be hard to improve these results, the reason being the general situation in nursing homes. To the question of why some residents exhibited poor oral hygiene, the nurses gave three reasons: some residents were dying or very sick, some were aggressively demented and others cleaned their teeth themselves. Surprisingly, the results showed that the oral hygiene of the demented residents was better than for the mentally alert ones, a finding in contrast to previous studies (125, 126). One plausible reason could be that mentally alert residents in the present study were less likely to receive help with oral hygiene than the demented ones because caregivers trusted them to manage this task alone. The nurses maintained that it was a question of human integrity and respect, and refusing to allow especially the mentally alert residents to clean their own teeth would be degrading and humiliating. Unwillingness from residents to receive help with oral care has also been noted by other studies (37, 127). However, there should be room for some improvement here and nursing staff should be encouraged to provide assistance also for those. This study

shows that if patients need to be in a nursing home because they are unable to care for themselves, this also applies to their oral care.

After implementation of this quality assurance system, dental personnel can use the MPS as objective expressions of the level of oral hygiene of the individual patient, the ward or the entire nursing home. Thus the institutions can be notified if a defined standard is not attained, and also specifically which residents do not have satisfactory oral hygiene. However, the MPS must be interpreted with caution. For instance, some nursing homes gather the most compromised residents in one ward, thus making it more difficult to attain a satisfactory average score. In addition, it is easier to achieve a satisfactory MPS if the residents have only prostheses.

Efficient aids are important factors in raising the quality of daily oral care. Electric toothbrushes are more effective than manual ones (128), are easy to manipulate for nurses and residents alike and have a small head which is well adapted to the available space. A recently published study from Australia reported a request for improved cleaning aids such as electric toothbrushes amongst nursing staff in various care facilities (39). Several of the caregivers reported that the oral care situation felt less intimate than when using a traditional brush. This may boost the caregivers' motivation in performing oral care. However, there is always a risk that a new device such as the electric toothbrush versus the manual brush will enjoy a novelty effect. In the present study, the evaluation was postponed for more than one year after installation to avoid this kind of bias.

When introducing electric toothbrushes to the elderly, some difficulties are likely to occur at first. Both the staff and the residents have to become accustomed to a different way of brushing teeth. Several comments clearly show that negative feedback was most evident in the initial stages. On the other hand, the use of electric toothbrushes is more likely to be successful with non-demented residents. To introduce electric toothbrushes for demented persons requires a great deal of patience. The noise and vibration from the toothbrush might cause anxiety and stress. Success will depend upon the demented person's degree of mental capacity and perception of the device.

The electric toothbrush must therefore be demonstrated gently, with simple and clear information, and the procedure repeated several times.

Based on the findings of this study, electric toothbrushes can be recommended for the dentate elderly. However, out of respect for a person's autonomy, one must accept that it is sometimes impossible to use this device. In order to remedy this, electric toothbrushes should be introduced for the elderly before or in the early stages of dementia. As they then will become more familiar with their use, such problems will hopefully become less apparent in future generations of institutionalised elderly.

The quality assurance system was developed as an instrument to improve and maintain the oral hygiene in nursing homes. It is not known if the observed improvements are caused by motivational factors, the development of systematic care procedures and information material, or the fact that the nurses are aware that their work with oral health care is measured in relation to a defined standard. However, oral health developments indicate that more people will retain their teeth in the future. Procedures for oral care in institutions and the implementation of these will therefore be of considerable importance.

5.2.5 Concluding remarks

The present thesis has revealed short-comings in the current situation. A concurrent increase in dentate individuals and oral diseases among institutionalised elderly demonstrate the demand for preventive oral health care. The change in oral health status is a major challenge to both nursing and dental care services. Oral care training in the basic education of care professionals does not necessarily result in high standards of oral care in LTC institutions. However, it may be seen as an essential foundation together with an array of other factors. Oral care for care-dependent LTC residents must become a natural and integral part of the daily personal hygiene regime, equivalent to other personal hygiene care. Cleaning the teeth and mouth is one of the primary needs of daily care for most people. In order to achieve the same for the frail

elderly, continuing efforts to improve care staffs' attitudes, allocating responsibility to an individual level and establishing effective and mandatory oral care routines is of great importance.

5.3 Implications and future studies

It seems unavoidable that the ageing of the population will have economic consequences. Since the Norwegian institutionalised elderly receive free dental care from the Public Dental Health Services, oral diseases and treatment thereof will place a direct economic burden on the society. The nursing and care sector is the largest item of costs in most Norwegian municipalities, and constitute already more than one third of the total running expenditures on the national level (129). Poor oral hygiene in frail elderly, with subsequent excessive amount of oral bacteria, increases the risk of systemic diseases. With their higher rate of morbidity and mortality, this may result in major health care costs for the society. Hence, oral hygiene programmes improving the oral health among this group have obvious economic advantages.

The frail elderly living in institutions have limited abilities to influence their own situation, and are vulnerable to inadequate oral health care provision. Continual monitoring of their oral health status is therefore important to ensure that they receive the standards of care they are entitled to. This thesis presents trend data of oral health for institutionalised elderly together with an effective method for preventing oral diseases. It should be useful for health care providers and policymakers when planning appropriate nursing care and oral health services, designing policy options and choosing intervention strategies aimed at improving the oral health for this population.

The studies of the present thesis have revealed a need for further investigations of several aspects. Lack of oral care knowledge, lack of cooperation from demented residents and lack of priorities are reported to be among the most frequent barriers to oral care provision in nursing homes (37-44). Future studies should therefore explore how these barriers may be reduced or eliminated. The provision of oral care and

treatment to demented individuals can be very difficult. This indicates a present need for evidence-based treatment/intervention methods that are effective, ethical and useful in different health care settings. The Marte Meo Method is a video-based educational programme that can be used to enhance communication and interaction between for example caregivers and demented patients (130). It is a tool that provides practical information to carers about handling daily interaction difficulties with demented patients, such as the provision of oral care. Investigating whether staff-training that improves knowledge of dementia-focused behaviour and communication strategies result in higher standards of oral hygiene compared to purely procedure-based training programmes or programmes focused on changing attitudes and priorities is therefore crucial.

6. Conclusions

- Several distinct changes in the oral health status of the institutionalised elderly have occurred during the last two decades in Bergen. The observed changes include a decrease in edentulism and an increase in the average number of teeth. Furthermore, the prevalence of oral diseases like caries, periodontitis and stomatitis has increased.
- The need for dental treatment and effective prevention strategies for this group were greater in 2004 than in 1988.
- The quantity and quality of oral care training in the basic education of caregivers varies between the different types of schools in 2004/2005, but the majority of schools provided information and training to cover basic requirements regarding oral care.
- Lack of oral care training in the basic education of care professionals can not account for the inadequate oral hygiene in Norwegian LTC institutions.
- The oral hygiene of institutionalised elderly can be improved long-term by implementing a quality assurance system.
- Many caregivers prefer electric toothbrushes before manual ones, and perceive that they make oral care provision easier and less time-consuming, especially for residents without severe dementia.
- Electric toothbrushes may represent a motivating factor that can result in an improved oral hygiene level of care dependent residents.

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