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Geriatric oral health

Quality of life and oral care in Icelandic nursing homes

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Thesis for the degree of Philosophiae Doctor

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Ágrip

Bakgrunnur: Góð munnheilsa er mikilvæg fyrir alla aldurshópa og stuðlar að góðri almennri heilsu, vellíðan og lífsgæðum. Litlar upplýsingar eru fyrirliggjandi um munnheilsu íbúa á hjúkrunarheimilum og hvernig þeir upplifa eigin tannheilsu og tengd lífsgæði (Vísindagrein I og II). Eins er mikilvægt að viðhalda munnheilsu með reglulegri munnhirðu til að koma í veg fyrir þróun munnsjúkdóma, ekki síst hjá þeim sem eru orðnir hrumir og búa á stofnunum. Ekki eru fyrirliggjandi upplýsingar um hvernig staðið er að munnheilsuvernd á íslenskum hjúkrunarheimilum eða hver viðhorf eru meðal starfsfólk til munnheilbrigðisþjónustu í starfi sínu.

Markmið: Í fyrsta lagi, að skima munnheilsu íbúa á hjúkrunarheimilum og kanna sérstaklega hvernig fjöldi skemmdra, fylltra og tapaðra tanna og tegund tanngerva hefðu áhrif á munnheilsutengd lífsgæði og skoða tengsl milli munnheilsu og næringartengdra vandamála (Vísindagrein I og II). Í öðru lagi, að rannsaka viðhorf starfsfólks á þessum heimilum til munnheilsuverndar og bera niðurstöður saman milli fagstétta. Sérstaklega var skoðað hvort jákvætt og neikvætt viðhorf starfsfólks hefði mögulega tengsl við fagleg störf þeirra við munnheilsuvernd.

Aðferðir: Vísindagreinar I og II lýsa þversniðsrannsókn meðal íbúa ($N = 82$) á tveimur hjúkrunarheimilum á höfuðborgarsvæðinu, þar var munnheilsa þátttakenda skoðuð og skráð samkvæmt alþjóðlegum skoðunarstaðli (Oral Health Survey, OHS) og lagður fyrir lífsgæðakvarði (Oral Health Impact Profile, OHIP-49), sem mælir neikvæð áhrif munnkvilla á félagslega-, sálræna- og líkamlega virkni einstaklingsins og lífsgæði (Vísindagrein I). Jafnframt voru skoðuð tengsl milli munnheilsu íbúa, lífsgæða og næringartengdra vandamála með átta sértækum spurningum úr OHIP-49 lífsgæðakvarðanum (Vísindagrein II). Vísindagrein III lýsti þversniðsrannsókn meðal starfsfólks ($N = 200$) á tveimur hjúkrunarheimilum á höfuðborgarsvæðinu. Lagður var fyrir þýddur og staðfærður spurningarlisti *Viðhorf til munnheilsuverndar* (e. Nursing Dental Coping Belief Scale, DCBS) sem metur trú starfsfólks á því að þeir geti og búi yfir hæfni til að geta haft áhrif á framgöngu munnkvilla hjá sjúklingum í þeirra umsjá.

Niðurstöður: Vísindagreinar I og II sýna niðurstöður úr þversniðsrannsókn meðal íbúa á tveimur hjúkrunarheimilum. Alls luku 73 íbúar eða rúmlega 89% þátttöku í rannsókninni, meðalaldur var 86,8 ár ($\pm 5,7$) og aldurs spönn 73-100 ár. Tannlausir íbúar upplifðu neikvæðari áhrif eigin munnheilsu á almenna líðan og lífsgæði í samanburði við tennta íbúa. Fjöldi skemmdra, tapaðra og fylltra tanna var mikill (67,5%) og meðal tannátustuðull hár ($M = 25,7 \pm 3,3$), sem bendir til þess að útbreiðsla munnkvilla sé algeng í þessum hóp. Enn fremur var hlutfall ómeðhöndlaðra munnkvilla hátt hjá þátttakendum (67%) og reyndust íbúar með lengri búsetu á hjúkrunarheimili vera martækt oftast útsettir fyrir að vera með ómeðhöndlaða munnkvilla (Vísindagrein I). Meirihluti íbúa (59%) hafði einhverjar tennur en aðrir voru tannlausir, þeir íbúar sem höfðu búið lengur en ár á hjúkrunarheimili upplifðu martækt oftast skert bragðskyn ($p = 0,015$), breytt bragðskyn ($p = 0,029$) og erfiðleika við að tyggja mat ($p = 0,041$) en þeir sem búið höfðu þar skemur. Tannlausir íbúar skorðu hátt að meðaltali á kvarða sem mælir næringartengd vandamál

($M = 4,8 \pm 2,5$, min 0 – 8 max) og íbúar sem voru metnir með slæma munnheilsu DMFT-28), sem getur verið mikilvægur fyrirboði um aukna hættu á vannæringu (Vísindagrein II). Vísindagrein III, þátttaka í rannsókninni var 54,5% (109/200), meðalaldur var 38,5 ár ($\pm 15,8$) og aldurs spönn 18-70 ár. Starfsfólk með menntun í munnheilsuvernd skoraði marktækt lægra á spurningarlistanum *Viðhorf til munnheilsuverndar* en starfsfólk án hennar, sem bendir til þess að þeir sem hafi hlotið menntun í munnheilsuvernd séu með jákvæðara viðhorf til munnheilbrigðisþjónustu í starfi sínu. Algengast var að ófaglærðir starfsmenn sinnu daglegri munnhirðu íbúa en þeir voru ólíklegastir til að hafa menntun á því sviði. Samkvæmt niðurstöðum rannsóknarinnar stuðlar þekking á munnheilsuvernd að aukinni trú starfsfólks á að það hafi getu til að draga úr þróun munnkvilla meðal íbúa.

Ályktun: Álykta má að endurskoða þurfi munnheilsuvernd á hjúkrunarheimilum, til að tryggja að hún sé í samræmi við einstaklingsbundnar þarfir íbúa. Nauðsynlegt er að starfsfólk hafi sértæka menntun í munnheilsuvernd aldraðra og búi yfir skimunartæki í forvarnarskyni til að meta reglulega munnheilsu íbúa og framgang munnkvilla. Með samstilltri þverfræðilegri samvinnu heilbrigðisstétta og aðstoðarfólks í öldrunarhjúkrun með aðkomu hagsmunaaðila og stjórnvalda mætti endurskoða munnheilbrigðisþjónustu á þessum vettvangi og leita lausna til að draga úr sjúkdómsbyrði munnkvilla meðal íbúa.

Lykilorð: munnheilsa, munnheilsuvernd, lífsgæði, hjúkrunarheimili, öldrunarhjúkrun

Abstract

Background: Good oral health is fundamental for general health, wellbeing and quality of life for all age groups. Little information exists on the oral health of older adults living in Icelandic nursing homes and how they perceive their oral health and quality of life (Paper I, II). Further, regular oral hygiene is important for oral health promotion and preventing the development of oral diseases, especially for frail older adults living in long-term care. The literature contains little information on oral care in nursing homes and regarding oral health attitudes and beliefs among nursing home staff.

Aim: First, this work aimed to screen oral health among residents in Icelandic nursing homes and explore the association between the number of decayed, missing and filled teeth (DMFT), dental prostheses, oral health problems, nutrition problems and quality of life (Papers I, II). Second, it aimed to study oral health beliefs and attitudes to oral care among staff working in these same nursing homes and compare the results between professions, along with the association between positive and negative oral health beliefs and oral care (Paper III).

Methods: Papers I and II report a cross-sectional study of 82 residents living in two nursing homes. Their oral health was screened according to international standards using the Oral Health Survey (OHS) and Oral Health Impact Profile (OHIP-49) to collect data on residents' self-perceived oral health problems and their association with functional, physical, and social limitations and quality of life (Paper I). The self-perceived oral health problems and the association between oral health and nutrition problems were also studied using specific questions from the OHIP-49 (Paper II). Paper III was a cross-sectional study among nursing staff (N = 200) working in two nursing homes in Reykjavik and nearby municipalities. Data were collected using the Nursing Dental Coping Belief Scale (DCBS) to study their beliefs about being able to control oral health outcomes with oral care.

Results: In Papers I and II, a total of 73 residents (89%) completed the study. Their mean age was 86.8 years (± 5.7), ranging from 73 to 100 years. Edentate residents believed that their oral health negatively impacted their general wellbeing and quality of life compared with dentate residents. Both the number of DMFT (67.5%) and the mean DMFT index (25.7 ± 3.3) were high, indicating a high prevalence of oral diseases in this sample. The prevalence of untreated oral symptoms was high (67%), and these were significantly more common among residents who had dwelled longer in the nursing home (Paper I). Most (59%) residents had some teeth, whereas others were edentulous. Residents who had dwelled longer than a year in the nursing home significantly more often had less taste sensitivity ($p = 0.015$), changed taste perception ($p = 0.029$) and chewing difficulties ($p = 0.041$) compared to residents who had stayed in the nursing home for less time. Edentate residents frequently had nutrition-related problems ($M = 4.8 \pm 2.5$, range 0 to 8) and poor oral health, which can be an important predictor of malnutrition (Paper II).

In Paper III, a total of 109 employees (54.5%) participated in the study, with a mean age of 38.5 years (± 15.8), ranging from 18 to 70 years. Staff with oral health education scored lower on the DCBS than their peers with no oral health education, which indicates that oral health education resulted in positive oral health beliefs. Nevertheless, most nursing home

staff in this study had limited or no oral health education or practical training in oral care. The results show that oral health education may promote positive oral health beliefs and aid staff to believe that their oral care can reduce oral health problems among residents.

Conclusion: Oral care standards should be revised in nursing homes to guarantee oral care according to individualised needs. Staff must have specific oral health education and training. They need access to appropriate oral health assessment tools for regular screening to prevent the development of oral diseases and modify oral care plans when needed. To cope with oral care in nursing homes, authorities, politicians, health professionals, nursing staff and associates working in geriatric care could work together to create an oral care policy to lower the burden of oral diseases among residents.

Keywords: Oral health, oral care, nursing homes, quality of life, geriatric nursing

*Þessi ritgerð er tileinkuð forfeðrum mínum og formæðrum
sem kenndu mér að þolinmæði þrautir vinnur allar...*

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This work was carried out at the School of Health Sciences, Faculty of Odontology, at the University of Iceland. I am grateful to the School of Health Science for welcoming me as a PhD student, and I appreciate the support of Inga Þórsdóttir, Dean of School of Health Sciences and the Faculty of Odontology for letting me be a part of their research team. Thanks to the Research Fund of Hrafnista Nursing Homes [Rannsóknarsjóður Hrafnistu heimilanna] and The Public Health Fund [Lýðheilsusjóður], who both awarded the study a grant after it had begun.

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Preface

I began my career as a dental technician in 1994 at my own dental laboratory in Isafjordur. I continued my education and finished a master journeyman degree in 1997. The education for dental technicians later went through an academic shift, and I graduated with a BS degree from the School of Health Sciences at the University of Iceland. In 2001, I graduated from Skolen for Kliniske Tandteknikere at the University of Aarhus, Denmark, as a clinical dental technician. The profession is also recognised worldwide as denturist.

Many of my patients were older adults, often requesting services to replace their third or fourth set of complete dentures. They had much in common and were happy to share their stories of oral health experiences throughout life, why their oral health had deteriorated and how that had affected their quality of life, general health and wellbeing. Some of my older patients were in good health, lived independently at home or had some assistance to do so from social and health services in the municipally. Others had moved to a nursing home. However, their stories were different: nursing home residents sometimes complained about their dependency on others to use my service, mainly because of immobility or health issues. Further, they described how their health and ageing had affected their ability to perform daily oral hygiene. When asked why they did not seek assistance from nursing home staff to complete these tasks, the most common answer was, “I don’t want to bother the staff; they are always so busy.”

These stories were the seeds that started my journey researching oral health experiences and nursing home staff in a postgraduate Master of Public Health programme. The goal of my doctoral study was to add to the information missing from the literature about the clinical oral health of nursing home residents and investigate the association between their oral health and quality of life. Further, it aimed to study oral care protocols among nursing home staff in these same nursing homes and document their oral health beliefs that may be associated with oral care in these settings.

I hope that this study may contribute to knowledge about geriatric oral health and oral health care in nursing homes. Further, I hope that these findings will encourage health professionals, non-dental professionals and the dental team to join forces and set goals to lower the burden of oral diseases and improve the oral health quality of life and wellbeing of the geriatric population.

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List of abbreviations

AD	Alzheimer disease
CI	Confidence intervals
DCBS	Nursing Dental Coping Belief Scale
DIA	Dental service agreement between IHI and the Icelandic Dental association; reimbursement for dental service
DMFT	Decayed, missing and filled teeth; index to describe status of clinical oral health
EL	External locus of control, items on the DCBS
EU	European Union
FDI	World Dental Federation
GOHIG	Global Oral Health Interest Group
HRQoL	Health-related quality of life
ICF	International Classification of Functioning, Disability and Health
ICIDH	International Classification of Impairments, Disabilities and Handicaps
IHI	Icelandic Health Insurance
IL	Internal locus of control, items on the DCBS
MDS	InterRAI Minimum Data Set 2.0
NHA	Nursing Home Service Agreement
OR	Odds ratio
OHB	Oral Health Coping Belief, items on the DCBS
OHIP-49	Oral Health Impact Profile; 49 questions in seven domains
OHIP-49-NP	Oral Health Impact-49, version with eight specific questions measuring nutrition-related problems
OHQoL	Oral health quality of life
OHS	Oral Health Survey
PCA	Principal components analysis of Rasch residuals
QoL	Quality of life
RAI	Residents Assessment Instrument
SD	Standard deviation
SE	Self-efficacy, items on the DCBS
WHO	World Health Organization

Declaration of contribution

The study proposal, questionnaires and research aims were prepared by the doctoral candidate Aðalheiður Svana Sigurðardóttir. The doctoral candidate applied for ethical clearance from The Data Protection Authority (S-6034) and The Icelandic National Bioethics Committee, who approved the study protocol (VSN 12-207, 12-207-1) and prearranged cooperation from the nursing homes involved in the study.

The doctoral candidate performed clinical oral health data collection in the nursing homes under the supervision of Professor Inga B. Árnadóttir, who screened the clinical oral health of participants. The doctoral candidate also collected data using questionnaires from nursing home residents and employees and conducted structured interviews with residents if needed. The doctoral candidate developed the research questions in Papers I–III with guidance and feedback from her supervisors and doctoral committee, managed all data, and planned and performed statistical analysis with feedback and in cooperation with her supervisors Professor Alfons Ramel and Associate Professor Ólöf Guðný Geirsdóttir. The doctoral candidate handled drafting Papers I–III and clarifying the data. All authors contributed to interpreting the results, read and commented on the manuscripts and approved the final versions.

List of original papers

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

- I. Aðalheiður Svana Sigurðardóttir, Ólöf Guðný Geirsdóttir, Inga. B. Árnadóttir, Alfons Ramel. (2022). Munnkvillar aldraðra þögull faraldur á hjúkrunarheimilum, þörf fyrir breytingar á heilbrigðisþjónustu, accepted for publication in *Læknablaðið*, 108(5):19-26.
- II. Sigurdardottir A.S., Geirsdottir O.G., Ramel A., Arnadottir, I.B. (2022). Oral care, oral health, and associated nutrition related problems in Icelandic nursing home residents, accepted for publication in *Acta Scientific Nutritional Health*, 6(3): 38–45. <https://actascientific.com/ASNH/pdf/ASNH-06-1007.pdf>
- III. Sigurðardóttir, A.S., Geirsdóttir, O.G., Ramel, A., Árnadóttir, I.B. (2022). Cross-sectional study of oral health care service, oral health beliefs and oral health care education of caregivers in nursing homes accepted for publication in *Geriatric Nursing*, 43: 138–145. <https://doi.org/10.1016/j.gerinurse.2021.11.010>

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1 Introduction

Ageing is a normal part of the life cycle, with an age-related increase in the prevalence of chronic diseases, deterioration in physical and cognitive function, and disability. Many dependent older people living in nursing homes have less manual dexterity, cognitive decline and loss of vision that may result in poor oral hygiene and increase the risk of oral health problems. ¹ Oral health is linked to and an important factor in general health, ^{2,3} overall wellbeing, ⁴ and quality of life. ⁵

The burden of oral disease is estimated to affect 3.5 billion people worldwide. ^{6,7} Oral health problems are largely preventable and treatable during their initial stages. Nevertheless, oral diseases are a major public health problem and affect people throughout life, causing negative effects on their general health and wellbeing. ⁸

Older people now more often retain their teeth and have complex dental prostheses or implants that need daily oral care. The frailty of nursing home residents in Iceland has increased ^{9,10} and they need more specialised health care, ¹¹ including oral care to maintain oral health and avoid the progression of oral diseases. However, the impaired health of nursing home residents can make oral care challenging for the individual and the carer. ^{12,13}

Among the assistance that older people in nursing homes need, oral health is often overlooked, ^{14,15} and oral hygiene is often listed as missed care in these settings, ^{16,17} thus risking poor oral health. The lack of daily oral care in nursing homes has existed as a health problem for many years, resulting in poor oral health¹⁸ affecting the oral health quality of life.

This thesis addresses relevant questions regarding geriatric oral health in nursing homes and how quality of life can be affected by oral health problems and oral care in nursing homes, which are mutually critical issues to evaluate the need to reform health care in these settings.

2 Background

The literature review in this chapter is divided into three sections. It begins by reviewing the Icelandic public **HEALTHCARE SYSTEM** and indirect factors that may affect the delivery and utilisation of dental services among nursing home residents because clinical oral health recurs in both articles published on nursing home residents in this thesis (Paper I, II).

In the second section, the focus is on issues of geriatric **ORAL HEALTH** that may need special attention by nursing professionals to detect oral conditions that may negatively affect quality of life. Thereafter, the topic of **ORAL HEALTH CARE** is examined within the context of nursing home staff, focusing on enabling factors and barriers to oral care in nursing homes (Paper III).

The author has mainly focused on what is likely to support improvement in oral health care in Icelandic nursing homes. However, the evaluation of what is relevant in this review is based on the author's opinion, and the selection is not intended to ignore the research work of any scholars or imply that their work is less important in the field.

2.1 HEALTHCARE SYSTEM

The public healthcare system, policymakers and other stakeholders set standards in health care and health promotions and decide how to manage health among the population. Healthcare policy in Iceland is set in line with Health 2020, a European policy framework and strategy for the 21st century, which was originally published in 2012 by the World Health Organization (WHO).¹⁹ The parliament handles the policy planning, financing and government of the Icelandic healthcare system,²⁰ which serves approximately 369,000 inhabitants.²¹ The average life expectancy of Icelanders is 82.7 years and is slightly higher for women (84.5 years) than for men.²² The Ministry of Health is responsible for management and decisions concerning hospitals and nursing homes. Long-term care facilities such as hospitals and healthcare centres are financed on a fixed budget by the government, and municipalities finance social services.²³

The increased number of older adults has, among other things, inflated the burden on the healthcare system.²⁴ More older adults need round-the-clock nursing care in long-term care facilities¹⁰ that include room and board and assistance in daily living, psychosocial care, health care and medication care.²⁵ In the future, the increase in the age groups 80–89 years and 90+ years is expected to be twofold between 2020 and 2040. This will cause an additional need for nursing care.¹⁰ The need for more nursing capacity exists already as increased numbers of frail older people are waiting to be admitted to nursing homes.²⁶ The future challenge facing society is to cope with changes in health care needs in these settings.

Health care is mostly provided by public health services and largely financed by general or specific taxation collected by the central government and with a defined level of patient co-payments. However, the organisation and provision of home care for some groups, such as frail older adults and people with disabilities, is mostly the responsibility of local

authorities in Iceland.²⁷ The Icelandic healthcare system is relatively small compared to other Nordic and European countries. It is state-centred and publicly funded and offers universal coverage.²⁸ Mostly public expenditure (82%) covers health expenses in Iceland, and the rest is out-of-pocket payments by households.²⁰

2.1.1 Population in nursing homes

The definition of older adults varies between countries. In Iceland, older adults are defined by legislation as being 67 years of age and older.²⁷ Reaching this age is a milestone for those who plan to retire from work and apply for old-age pensions from public and private funds. Some older adults continue to work despite being entitled to old-age pensions, but this often depends on their general health and support from both formal and informal caregivers and society. The local authorities in each municipality offer home care services to older people aimed to enable them to live at home for as long as possible.²⁷ The result of ageing, frailty and multimorbidity often leads to admission to nursing homes.

Since 2008, the frail older individual or their spouse or social service have needed to apply for Nursing Home Pre-Admission Assessment. The admission criteria became stricter, and applicants are evaluated based on individual needs, i.e., social factors, physical and psychological condition, general health, and activities of daily living or self-care.²⁹ A retrospective comparative study by Hjaltadóttir et al.⁹ revealed that residents were older after the admission criteria became stricter; that the prevalence of Alzheimer disease (AD), ischemic heart disease and diabetes increased; and that the one-year survival rate decreased from 73.4% to 66.5%. The mean age in this group increased between 2017 and 2020, from 83.8 years to 84.7 years.¹⁰ Another study among nursing home residents that was completed after the change to stricter admission criteria showed a trend in reduced physical health, improved cognitive performance and greater involvement in social activities over 11 years.²⁵

2.1.2 Nursing homes and oral health standards

Local health authorities have a system of reimbursement to publicly and privately run nursing homes.³⁰ The Nursing Home Service Agreement (NHA) includes a fee schedule for nursing home health care according to law³¹ and sets basic standards for health care service.³⁰ According to the NHA, residents must have access to necessary health care on site and specialised health care elsewhere when needed. The health care is monitored and registered using the Residents Assessment Instrument (RAI)³⁰ InterRAI Minimum Data Set 2.0 (MDS), an assessment tool to collect information on health, function and resident ability to self-care to be used in health care plans. RAI has quality indicators that measure the quality of nursing care,³² and nine quality indicators are used to monitor the quality of care according to the NHA, but none of them measures oral health.³⁰ Soon after admission to a nursing home, clinical oral health should be assessed formally in a health evaluation on site and registered.³⁰ Furthermore, Icelandic doctors recommend including regular oral health assessment in health surveillance to promote the health of nursing home residents.³³ Nevertheless, geriatric health experts have determined that MDS is “totally inadequate

to protect the oral health of the institutionalised elderly as it fails to even address the issue of oral neglect.”³⁴

With the current assessment instrument possible inadequate to detect oral health problems, clinical oral care standards are also vague in Icelandic nursing home settings. The NHA only recommends that each nursing home sets its own standards in oral care but must guarantee access to dental services when residents need dental treatment. Furthermore, though recommendation exists in the NHA,³⁰ no further guidance is provided. Accordingly, no evidence-based oral care protocol is set in the NHA by Icelandic authorities. Consequently, oral health assessment, oral health screening and planning, execution and follow-up can vary both between nursing homes and within wards in a nursing home.

According to the Care Quality Commission, an independent regulator of health and social care in England, 52% of nursing homes inspected had no policy to promote and protect oral health, and 17% did not assess the oral health of residents at admission. Half of homes did not provide oral care training for staff, and 73% of residents’ care plans did not cover or only partly covered oral health.³⁵ Other countries have set guidelines or standards for oral care in nursing homes, including Europe, the USA and Australia.³⁶⁻³⁹

2.1.3 Oral health policy

In 2016, the World Dental Federation (FDI) redefined the oral health concept used by the WHO and other associations to include three key elements: disease and condition status and physiological and psychosocial function.⁴⁰ The *FDI Vision 2030: Delivering optimal oral health for all* challenges known inequalities in oral health and aims to lower the burden of oral disease worldwide and empower oral health care. The goal is to integrate oral care in health policies and settings to include individualised oral health care delivery. This global oral health approach suggests a revision of how public oral health promotion has been conducted to deliver better-quality oral care within the health system.⁴¹

The Global Oral Health Interest Group (GOHIG) belonging to the dental education community⁴² defined the context of global oral health as aiming for “*optimal oral health for all people and elimination of global health inequities through health promotion, disease prevention, and appropriate oral care approaches that consider common determinants and solutions and acknowledge oral health as part of overall health*”.⁴²

This definition moves away from treatment-oriented approaches and focuses on oral health prevention and promotion. Global oral health is distinct from dental public health, which is set to focus one single society on factors influencing local oral health. Latter mainly focuses on diagnosing a target or high-risk population’s oral health problems, finding their causes and effects, and planning interventions to prevent future oral diseases.⁴³

Oral health policies

The organisation of a dental service is affected by policies in each country and may have indirect effects on the use of the service. In the majority of European Union (EU) countries, dental health care operates mainly outside the healthcare system in the private sector.⁴⁴

Public coverage for dental care is more limited across the EU, on average 30%, and therefore is mostly financed by patients with out-of-pocket payments.²²

In the Nordic countries, oral health care has been an important part of the ideology of the Nordic Welfare State model. The organisation of dental care in Norway, Sweden, Denmark and Finland shares some similarities in operating both within the private and public sectors.⁴⁵ However, Iceland differs from other Nordic countries since all dentists are employed in the private sector. The other Nordic countries offer free dental care for children and adolescents in the Public Dental Service, and adults may partly be reimbursed based on the schemes of payment in each country.^{44,45} Public dental insurance and access to dental care play an important part for all population groups, regardless of socioeconomic status, gender, culture or ethnicity.

A recent study in the Nordic countries shows a high attendance to dental care ratio, implying knowledge of the importance of regular dental care. However, the same access to dental care is not guaranteed in rural areas. Authors have noted that older people and some disadvantaged social groups were most likely not to benefit from the healthcare system as it is currently organised.⁴⁶ Consequently, addressing social inequalities in oral health and dental care is important in the Nordic countries.⁴⁵

In Iceland, dentists in the private sector are paid for treatment based on their own fee schedule^{28,44} but may also provide dental care according to a dental service agreement (DIA) between the Icelandic Dental Association and the Icelandic Health Insurance (IHI). People may therefore be partly or fully covered according to their profile by the public IHI scheme.

Today, IHI somewhat reimburses the costs of dental care for people 67 years of age and older and disability pensioners and covers almost all the costs of dental services for people 18 years of age and younger.²⁸ Since 2018, residents in nursing homes have been fully reimbursed according to profile and price regulations set in the DIA by the IHI.⁴⁷ However, additional charges not included in the DIA are paid out of pocket by the patient according to the dentist fee schedule. No other dental care insurance scheme is available in Iceland for the public, so people aged 19–66 years other than disability pensioners pay in full their own dental care expenditures. More than two thirds of co-payments for health care by private households in Iceland are for pharmaceuticals and dental care.²⁰

Oral diseases are often overlooked, neglected globally and rarely seen as a priority in health policy.⁴⁸ The Icelandic Public Health Policy set in 2010 aimed to increase the proportion of dentate people 65 years and older with at least 20 functional tooth units in occlusion to 50%.⁴⁹ No specific oral health objectives are set for the geriatric population in the current public health policies, valid to 2030. However, a plan has been set to increase public dental reimbursement and set an upper limit on dental care expenditure for children and pensioners.¹⁹

The study *Health and wellbeing of Icelanders*⁵⁰ has been repeated regularly by the Directorate of Health since 2007 and reports data on the prevalence of edentulousness and the frequency of individuals aged 65–74 years with at least 20 remaining natural teeth.⁵⁰

No data are regularly collected on the oral health of people aged 75 and older. Authorities recommend that healthcare institutions have formal quality control and compliances at hand to improve safety and quality of health care services.⁵¹ The Directorate of Health published an evidence-based preventive strategy called *Clinical guidelines on the prevention of dental caries in Iceland*⁵² in 2005 intended for all individuals working on preventing dental caries in the population.

Historically, public dentists operated in Iceland in public schools from 1922⁵³ to 2000,⁵⁴ but their service was suspended for various reasons, not to be discussed here. However, a Dental Clinic is open to the public during the academic year from August to April at the Faculty of Odontology of the University of Iceland.

The Dental Clinic is used to train dental students in general dentistry, and inpatients are charged considerably lower for dental treatments than in the private sector. That may explain why the majority 86.6% of inpatients represent the population aged between 19 and 66 years not covered by the DIA and why fewer belong to groups covered by DIA.⁵⁵ This public Dental Clinic is intended for dental education, and the selection of inpatients is based on the clinical training needs of its students. Consequently, only 55% of inpatients (n = 140) undergo dental treatments within 4 years.⁵⁶

In 2016, approximately 8% of the general population in Iceland reported unmet dental care needs, but the gap was fourfold (15%) in the lowest income quintile compared to the highest (3%). The need for unmet dental care is far greater among people in the low-income groups in Iceland than in any other Nordic country.²⁰

The evidence presented in this section suggests that oral care policy for people in long-term care is overlooked in our healthcare system and nursing homes themselves are responsible to form and comply with their own oral healthcare policy. A lack of standards in oral care delivery and regulation of oral care may introduce oral health care inequalities to residents in publicly funded nursing homes.

2.2 ORAL HEALTH

Clinical oral health information describes the epidemiology of oral diseases in populations and the need for dental treatment. It is used to advise about the best oral care practices and to inform about risk factors for oral health problems.⁵⁷ Health professionals and associates must recognise common oral health problems and symptoms affecting the geriatric population and their associated factors.

The definition of oral health has changed over the years and is multidimensional rather than disease-specific.

*“Oral health is multi-faceted and 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 and disease of the craniofacial complex head, face, and oral cavity.”*⁴⁰

To promote oral health, oral health goals focus on integrating individualised oral health care into general health care⁴¹ and making the service assessable for all.^{41,46} Moreover, to

prevent oral diseases and improve general health and wellbeing, collaboration is needed between oral health professionals and other health care personnel to deliver proper oral health care.^{3,41}

2.2.1 Geriatric population

Organising dental services requires an understanding of a given population's characteristics, including nursing home residents. Dental vulnerability varies across the lifespan and is related to individual factors and social support.⁵⁸ Ageing is a complex physiological multisystem decline, resulting in an increased prevalence of common diseases that contribute to frailty and increased vulnerability.⁵⁹ Though general health has improved and life expectancy has increased in most societies in recent decades,²⁴ oral health can advance frailty and frailty can negatively affect oral health.⁶⁰ Accordingly, the deterioration of general health is associated with functional impairment, increased frailty and dependency.⁶¹ Consequently, an increased need for care is associated with a decline in oral health.²

Older people have diverse sociodemographic backgrounds and health and oral health issues at admission to nursing homes. Oral health is closely related to oral health behaviour, personal oral health perspectives, socioeconomic factors, perceived need, and use of and access to dental care. In this population, the majority (75%) of residents have untreated oral health problems at admission.⁶² Providing oral care is a complex task in a nursing home environment and depends on the nursing home organisation, staff, residents, and oral care protocols or actions.¹³

Figure 1 (page 8) shows the concept of a life course approach to dental vulnerability.⁵⁸ This model is applicable to most populations because the dental care pathway is different in groups concerning dental service and oral care. For example, Figure 1 shows that *Population 1*, representing the majority of people, is born and vulnerable for a while at the beginning of life. They manage to thrive with support from the environment until old age when health begins to decline. This group remains functional most of their life but may experience pre-dependency or early, mid or late dependency linked with increased frailty. Dependency is in line with dental service and oral care need, depending on oral health maintenance and access to care, which evolves into the need for prevention plans, including self-care plans. Later during mid dependency, the focus is on keeping oral health and quality of life, if possible, until late dependency, which focuses on palliative approaches in dental service and oral care. *Population 2* represents people who are vulnerable throughout life, i.e., may have chronic health conditions or disabilities and need special dental services and oral care. *Population 3* represents people who have ideal dental support and care pathway utilisation and maintain their oral health throughout life in a functional state, pain-free and with an acceptable appearance.⁵⁸

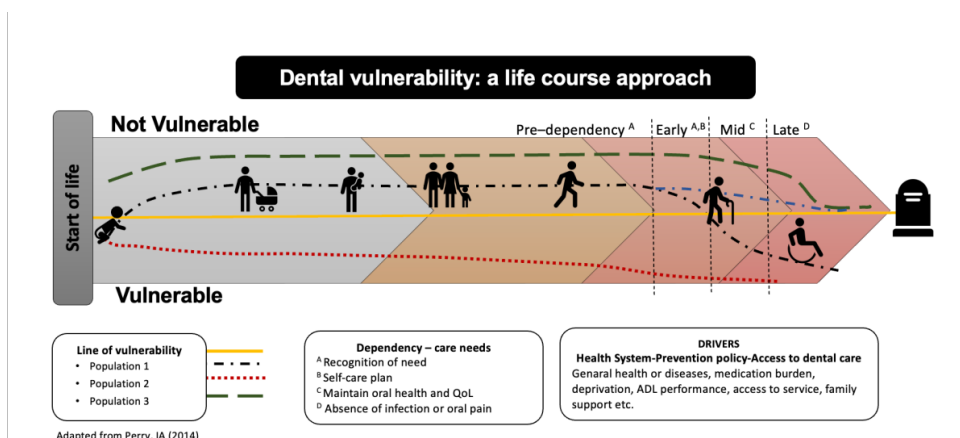


Figure 1 The concept of dental vulnerability using a life course approach.

Integrating oral care guidelines into nursing homes is a complicated and challenging task. The care system is divided into units with poor communication and interprofessional infrastructure, such as a lack of interprofessional training, poor referral practices and a lack of a national information system for patients' data for different health professionals.⁶³ Further, existing guidelines are not always adequately implemented, i.e., residents are not screened or monitored as expected, and oral care providers have limited resources to facilitate access to dental services.⁶² Despite these inadequacies, notably, interventions and organisational changes at nursing homes have shown positive oral hygiene outcomes and fewer oral symptoms among nursing home residents.^{64,65}

2.2.2 Quality of life

Quality of life (QoL) is a multidimensional concept and includes physical, psychosocial and environmental domains. Health-related quality of life (HRQoL) is a satisfactory measure to assess the impact of health conditions and treatment and is associated with the person's perspective of what is important for their wellbeing. The more negative the impact, the greater the effects on QoL.⁶⁶ Benyamini et al.⁶⁷ found that self-rated health and oral health measurements of older people have shown to be independent contributors to life satisfaction. For practice, they recommended that health care providers ask older people during routine assessment how they perceive their oral health. They also suggested recommending them to continue dental health behaviours, including regular oral hygiene and visiting a dental practitioner. Environmental quality of life is not a health-related measure of impact but may feature economic resources, community stability or the ability to interact socially. These QoL domains may be mediated in older adults with chronic health problems and cognitive impairment if their health limitations require reliance on personal assistance and care.⁶⁸ Participants living in nursing homes in Iceland revealed that feeling secure in the nursing home was the most important aspect that contributed to their QoL.⁶⁹

Another concept closely related to QoL and general health focuses on oral health quality of life (OHQoL). Oral diseases may play a major role in a person's life and affect social

functions and interactions.⁷⁰ The concept is defined as “a multidimensional construct that reflects (among other things) people’s comfort when eating, sleeping and engaging in social interactions; their self-esteem; and their satisfaction with respect to their oral health”.⁷⁰ Importantly, a decline in general health is a predominant factor associated with oral health² in nursing homes, where the majority of residents have poor OHQoL⁷¹⁻⁷⁵ and a high need for dental services.^{72,76-78}

A reasonable approach to tackle oral care issues in nursing homes and the community could be adapting existing all-inclusive dental care programmes into health care for older people. Such programmes mandate dental examination to be performed within a certain time after enrolment to community home services or admission to nursing homes. Further, they develop minimal standards that can facilitate the delivery of dental examinations to support the oral health of residents and general health outcomes and QoL.⁷⁹ A systematic review by Wong et al.⁸⁰ investigated the association between oral health and associated factors among older people in long-term care and OHQoL. It explored individual non-modifiable (age, gender, dementia, etc.), modifiable (health, oral health, nutrition, dental visits, etc.) and environmental factors (oral care-related support, financial, insurance, oral care practice) in long-term care. It concluded based on available studies that no good agreement exists on how much these factors affect OHQoL. Therefore, the authors recommended clinical trials on modifiable factors among those who live in institutions.⁷²

2.2.3 Oral health and older people

Global improvement in oral health has resulted in a lower prevalence of dental caries in many areas of the world.⁸¹ Accordingly, more older people are dentate,⁸² and fewer are completely edentulous and use dental prostheses.^{45,46} The worldwide population growth and better tooth retention have increased the burden of oral diseases and the need for oral care.⁸¹ A recent Icelandic study described residents in nursing homes with an average age of 84.4 years and the majority (63%) being women. Around 29% were diagnosed with AD or dementia, 36% had cognitive issues other than AD, and only one third were without cognitive problems.³²

Dentate and edentate older people living in care homes have been found more likely to live with one or more oral health impacts (dental caries, dry mouth, or pain or problems with oral health) than similar samples living in the community.⁸³ A study by Czwikla et al.⁸⁴ opposed that finding, showing that home care recipients scored significantly higher in categories measuring problems with tissues and gums, dental pain and oral cleanliness than their peers living in nursing homes. Accordingly, oral care is poor in both nursing home residents and community-dwelling older people, and oral care assistance is urgently needed.

Oral hygiene, assessment and use of dental services

To maintain a healthy and caries-free oral cavity, attention should be paid to appropriate dietary intake and oral cleanliness. Consuming less sugar, limiting the frequency of sugar intake and guaranteeing normal salvia flow are recommended to prevent the progression of dental decay.⁵² Furthermore, good regular oral hygiene twice a day, using oral floss and

toothbrushing, removes dental plaque. Fluoride in toothpaste prevents the decalcification of tooth enamel that can cause dental decay. Older adults are recommended to regularly brush the oral cavity and use high-sodium fluoride toothpaste (2,800–5,000 ppm) for optimal oral hygiene and caries protection. Further, if mechanical toothbrushing is not achievable for dependent older people, some bactericidal, fungicidal and virus-killing chemical solutions such as chlorhexidine can be used for oral care to maintain a low plaque score.⁸⁵ To complete oral hygiene for nursing home residents, access to adequate equipment or supplies must be guaranteed.^{86,87}

People who regularly brush their teeth are likely to continue the behaviour while they can and if they are motivated. A study by Barbe et al.⁶⁴ showed that 81% of nursing home residents could clean their teeth by themselves, including 100% of residents without dementia and 73% of those with dementia. Additionally, those who could brush their own teeth showed better oral health than those who needed oral care from staff.

Nitschke et al.⁸⁸ explored the use of dental services in old age and noted a trend toward use less often as age increased, although the need for these services increased. Janssens et al.⁸⁹ studied the oral health of nursing home residents with a mean age of 83.9 years (N = 1,226) in Belgium with limited access to dental care due to higher care dependency, using a mobile dental unit. They found that oral health among this group was poorer compared to the general, less dependent nursing home residents, and the need for dental service was high.⁸⁹

In 2017, the use of dental services among Icelanders 67 years and older revealed that 54% used dental services at least once a year.⁴⁷ Dental care non-attendance of older adults living in nursing homes over five years was more than 40% in Germany⁸⁸ and Iceland.⁹⁰ Mobility limitations and anxiety related to the discomfort of dental treatments have been speculated to be related to a low frequency of dental care access. Additionally, dentists have limited enthusiasm to bring dental services to institutionalised older people.⁹¹ However, it should not be overlooked that dentists and associated dental professionals play a major role in motivating older adults to maintain and improve their oral health, especially those who have less ability to self-care.⁹² Thus, for functionally dependent older people, dental services on site would be more appropriate.⁸⁰

Oral symptoms and nutrition-related problems

The mouth is an integral part of the body. The oral cavity is one of the first parts of the aero-digestive tract and plays a key role in protecting the individual and nutrition intake.⁹³ Saliva is a natural preservative factor in the oral cavity and helps in cleaning the mouth; thus, a lack of buffering capacity increases the risk of dental caries.^{52,94,95} For functional dependent older adults, changes in physical strength can affect chewing and swallowing muscles, and decreased physiologic reserve or neuromuscular disorders may risk the development of dysphagia.^{93,96} In ageing, pathophysiologic changes of the sensory system can lead to a loss of taste and smell perception, diminish food enjoyment, reduce salivary output, and affect chewing efficiency and swallowing function.⁹³ Smell and taste identification can also be influenced by age, comorbidities and the number of medications used.⁹⁷

According to a Swedish study among frail older people, most residents (63%) had malnutrition, and a further 17% were at risk of undernutrition.⁹⁸ Importantly, continuous regular oral care has been successful in maintaining the nutritional status of frail older people.⁹⁹ However, detecting signs of malnutrition seems to be problematic for nurses. A Finnish study discovered that nurses were unable to detect undernutrition of older people in their care; of the 57% diagnosed, they detected 15%. The authors recommended nutrition education for nursing staff because this is a significant problem.¹⁰⁰

Older people are often multimorbid and treated with medications that risk polypharmacy. This is an etiologic factor for dry mouth,¹⁰¹⁻¹⁰³ which causes difficulties while eating, swallowing and speaking.^{4,104} Consequently, dry mouth is likely to affect dietary intake and eating habits, which can contribute to the development of malnutrition.^{4,105,106} Several studies have indicated a higher risk for malnutrition if oral health is poor in older people.^{107,108} This may relate to the oral hard tissue condition, i.e., the number of natural teeth, edentulism and denture use, or soft tissue condition, including hyposalivation,¹⁰⁹ cracked or dry lips, or oral candidiasis.^{109,110} Further, a vitamin B deficiency may cause common oral symptoms i.e., cracked lips, angular cheilitis or cracks in the corner of the mouth, inflammation of the mucosa lining and tongue, or sore throat.⁹⁵

Masticatory function is important for food intake and metabolism. Fewer occluding teeth or failed dental rehabilitation can alter chewing efficiency and metabolism.¹¹⁰ For dentate individuals in nursing homes, the number of teeth, functional occluding pairs and chewing efficiency are important for acceptable OHQoL.¹¹¹

OHQoL has become a well-recognised patient-centred parameter that is useful to investigate the impact of oral health outcomes, such as tooth loss and oral diseases, on people's lives.¹¹² The loss of teeth, deterioration of motor skills and chewing difficulties have all been linked to malnutrition, sarcopenia and frailty.^{96,113,114}

Nomura et al.¹¹⁵ reported that people with fewer than 15 natural teeth were unlikely to consume ordinary food. Residents with oral symptoms often need more assistance during mealtimes. They tend to eat too little, eat food of pureed or liquid consistency,^{4,116} and use protein supplements and energy-rich meals.⁴ A longitudinal study among 70- to 80-year-old Japanese people showed a significant decline in the intake of various nutrients (protein, sodium, potassium, calcium, vitamin A, vitamin E), meat and vegetables among older adults with impaired dentition.¹¹⁶

Other factors such as dementia and neuropsychological and mobility problems may add to the risk of malnutrition.¹⁰⁷ The consequences of being multimorbid and frail have been reported to affect older people with oral diseases negatively,¹¹⁷ including the burden of oral symptoms associated with negative subjective oral health perceptions.^{4,110}

Dental biofilm, swallowing difficulties and aspiration pneumonia

Importantly, an increased number of retained teeth correlates with salivary bacterial count and dental biofilm⁸² that tends to increase with age.⁷⁸ Regular oral hygiene is powerful to clean the oral cavity⁵² and lower the incidence rate of oral diseases.⁸ For frail older people, this may be an overwhelming task, hazarding the accumulation of plaque and an upsurge

in the risk of dental decay and periodontal diseases.^{81,118,119} Special attention should be given to root caries in older adults because gingiva recession occurs in ageing and the root becomes exposed to dental plaque.⁵² Moreover, oral biofilm combined with swallowing problems may expose aspirated pathogens to the lower respiratory tract.¹²⁰ A recent meta-analysis in adults over 60 years of age showed that swallowing problems were associated with a two times higher risk of aspiration pneumonia and malnutrition and a 2.7 times greater risk of mortality.¹²¹ A systematic review of oral health and dental care for institutionalised older people found evidence that effective oral hygiene could prevent pneumonia.⁸

People with dementia are around four times more susceptible to swallowing problems, which have been associated with dependency and poor oral health.¹²¹ Oral health assessment in nursing homes has shown an unsurprisingly high prevalence of untreated dental decay (70%–72.8%)^{72,76} and periodontitis (75.6%–87%).^{77,78} Poor oral health has been related to a higher mortality rate (28.5%) than good oral health in nursing homes (15%).¹⁰⁴

Chronic oral diseases – the edentulous patient

Dental diseases can advance tooth loss that may eventually result in edentulousness, which has adverse effects on general health^{3,122} and involves a greater risk of systemic diseases.^{122,123} Da Mata et al.¹²⁴ assessed OHQoL in a cohort of Irish individuals over 60 years of age and found no significant association between general health and subjective oral health. However, they observed that objective oral health, denture wear and the patient's expectations may play a role in this association.

Chewing problems are common with dentures, but mandibular implant treatment can improve masticatory performance among denture-wearers.¹²⁵ Bakker et al.¹²⁶ found no association between edentulism, oral health problems and malnutrition, but a link existed between malnutrition and OHQoL. Felton¹²³ found a relationship between being edentulous and reduced dietary intake, obesity and pneumonia-related hospitalisations. OHQoL among denture-wearers was significantly affected by the denture condition, need for treatment and chewing efficiency.¹¹¹

In denture-wearers, using dentures for 24 hours a day increases denture biofilm, tongue plaque, gum inflammation and *Candida albicans*. If the individual also has a swallowing problem, their risk for serious pneumonia is 2.3-fold.¹²⁷ Protheses such as dentures are linked to mucosal lesions including ulcers, angular cheilitis and denture stomatitis.¹²⁸ The latter is usually caused by *Candida* growth in the oral cavity and on dentures, which may be reduced with improved oral and denture hygiene. This is noteworthy since infrequent cleaning of dentures is associated with pneumonia incidence.¹²⁹ Further, unmet denture treatment need seems to contribute to mortality¹³⁰ and predict cardiovascular disease mortality.¹²³

Taken together, these oral health-related studies indicate a relationship between oral health, comorbidly and frailty, malnutrition and general health. Further, regular oral care is fundamental to preventing the progression of oral bacteria and oral diseases. The use of

dental services may be a major barrier for dependent older people that may negatively affect their oral health and wellbeing.

2.3 ORAL HEALTH CARE

Nursing care faces the challenge of providing comprehensive care to frail older people to maintain their general health. Oral health care should be included to maintain residents' wellbeing, general health^{3,8,131} and QoL.^{80,89}

During the 1990s, the concept of oral care was defined in the *Illustrated dictionary of dentistry* as “the total of dental diagnostic, preventive, and restorative services provided to meet the needs of a patient”.¹³² The term oral care is used in this thesis in line with Coker et al.'s¹³¹ concept analysis of oral hygiene care: “Oral hygiene care involves approaches informed by knowing the patient, inspecting the oral cavity, removing plaque, cleansing the oral tissues, decontaminating the oral cavity, using fluoride products and maintaining oral tissue moisture.” Further, the oral carer needs to have awareness, knowledge and accurate beliefs about oral health and oral care and the necessary competencies to manage and perform oral care.¹³¹ Collectively, these studies outline how critical the role of oral health care is for the oral care worker and outline the role of the oral care assignment.

2.3.1 Importance of geriatric oral care

Coping with oral care in nursing homes is ideal when the organisational structure includes oral care as integral when planning residents' health care and combines need assessments, execution plans, quality control and monitoring the delivery.^{133,134}

Further, oral hygiene practices should be carried out according to evidence-based guidelines and standards and fulfil individualised oral care needs. Hilton et al. summarised existing guidelines for standards in oral care for older people. The result was that oral hygiene should be performed twice daily for dentate individuals,^{87,135} using a toothbrush and high-fluoride toothpaste. Dentures should be cleaned at least daily using a tooth- or denture brush and mild soap or water and soaked in cleaning solution overnight.⁸⁷ Other guidelines recommend the same approach for denture-wearers and dentate individuals (brushing twice daily) but using abrasion-free cleaning products.¹³⁵ The aim is to prevent oral diseases and microbial infection, disrupt the accumulation of oral plaque, reduce the risk of caries and periodontal diseases, and aid functional and psychosocial wellbeing.¹³¹

To prevent the progression of oral diseases, oral care has become more pertinent in nursing homes. Nevertheless, oral hygiene has been repeatedly reported as poor^{89,136} in these settings. Oral care activities vary greatly and seldom meet recommended standards.¹³⁴ This disregard could be explained by different care cultures, which can affect the prioritisation and integration of oral care into general care practices⁶³ and daily routines.¹³⁷ Additional factors may be a lack of public support for oral health promotion in long-term care, lack of oral care guidelines and poor understanding in these settings of the connection between oral care, oral diseases and general health.^{3,8,12,133}

Oral hygiene engagement

Nursing home staff today face older people who retain more teeth throughout life¹³⁸ and have complex restorations, prostheses⁶⁴ and implants supporting fixed or removable dentures.⁹² Accordingly, the oral hygiene task becomes especially challenging. The frailty of residents can be an obstacle to oral care for both the individual and the carer.¹² Further, cognitive decline and resistance to oral care are considered barriers to oral care. In Icelandic nursing home residents, neuropsychological symptoms and behaviour problems are frequent. Up to 90% of individuals with dementia show behavioural problems, including resistance to care.³²

Furthermore, nursing home personnel feel that a heavy workload,¹³⁹ personal job dissatisfaction or burnout, and a lack of staff can play a role in the risk of leaving oral care undone.¹⁷ The complex interactions between the oral care of nursing home residents and enabling factors and barriers^{12,63,133,137,140,141} need constant review to improve oral health outcomes and OHQoL in long-term care.

The largest proportion of employees in nursing homes in Iceland are care assistants (63%),¹⁰ followed by licensed practical nurses (18%)¹⁴² and registered nurses (12%)¹⁰. The number of qualified nursing professionals working in nursing homes has decreased, especially in smaller nursing facilities.¹⁰ The roles and responsibilities are different between these groups, but registered nurses oversee nursing care and administration of medication, whereas their associates perform most of the nursing care.¹⁴² Registered nurses and licensed practical nurses are registered health professionals at the Directorate of Health, and care assistants are allied non-professionals. Registered health professionals in Iceland work according to specific legislation concerning their health education and Act 34/2012 on health professionals.¹⁴³

Limited public information is available in Iceland to identify the core competencies expected of staff in nursing care. Though oral health education is a major part of the curriculum for dental professions, limited information exists about the topic among other professions and associates.¹⁴⁴ The topic of oral health is linked to formal nursing courses within the programmes of registered nurses and licensed practical nurses, but this information cannot be quantified or described and needs to be further studied; it will not be discussed here.

In contrast, high schools in Norway have mandatory oral health education for auxiliary nurse programmes.¹⁴⁵ Sweden set legislation in 1999 that regulated dental care for dependent older adults and included free oral care assessment at their residence and access to nursing home personnel trained in oral care.¹⁴⁶ Older people living in Denmark with health issues are offered a special oral health programme with the support of local municipalities. Most participants in that programme live in nursing homes.¹⁴⁷ Nurses in Finland are generally aware of people's oral health in their care, but they need continuing education in oral care. Additionally, they are uncertain in their oral care management, but registering oral care plans in information systems has helped improve oral care and oral self-care by residents.¹⁴⁸

Oral health knowledge is an essential prerequisite for health-related behaviours and attitudes.¹³⁸ Studies have shown an association between increased knowledge and attitudes and better oral care.¹⁴⁹ The healthcare system must guarantee that nursing home staff have appropriate resources, support, knowledge and skills to cope with the issues concerning geriatric oral care.¹³⁹

The studies presented thus far provide evidence that oral care education in Iceland is not well-defined for other professions than dental health professionals. Moreover, support seems lacking within the educational system to guarantee basic education or practical training for nursing home staff in Iceland.

Oral health education and training

Another concern is the absence of required oral health training^{12,150,151} and practical competencies^{12,87,152} in caregivers in a nursing home setting. Health education is based on learner activities and the relationship between cognitive understanding of factual knowledge, beliefs and behaviour, and the development of certain skills. The relationship between these domains is complex, self-motivated, and personal and can therefore result in conflict and not be rational. Though the majority (93%) of staff agreed that oral hygiene was important for residents, 36% felt that oral care was an unpleasant task and most (59%) had negative attitudes to oral care. This indicates a lack of self-efficacy and little belief in being able to accomplish goals.¹⁵³

Research shows that oral health education programmes for nursing home staff can increase oral health knowledge^{3,154}, improve attitude to oral care^{3,65} and improve oral cleanliness of residents.¹⁵⁵ However, the literature shows insufficient evidence of the effect of oral health education¹⁵⁶ and oral care practices on residents' oral health outcomes.^{140,156} Further, improving oral hygiene among nursing home residents is not easy. Even though well-trained nurses carry out oral care, half of dentate residents and one third of denture-wearers still had an unacceptable oral hygiene status.¹⁵²

Though results show insufficient evidence of the effect of oral health education on oral health, training can influence oral care competencies among nursing staff and improved oral and denture hygiene.¹⁵⁷ It is also effective on oral hygiene if dental nurses perform professional oral cleaning in nursing homes, and considering this alternative for oral care in nursing is recommended.⁶⁴ Further, other interventions that focus on regular, weekly support by dental hygienists, theoretical lectures and hands-on training improved oral hygiene in an intervention group. Having monthly professional oral care combined with individual oral care instruction led to improved oral hygiene among participants.¹⁴⁹ Interventions have shown that nursing staff became more aware of their own limitations in oral care and valued the contact with professional dental services.¹⁵⁸

2.3.2 Oral health attitudes

Oral care delivery may be affected by personal beliefs on which tasks must be completed¹⁴¹ or are indispensable. Therefore, recognising barriers to oral care,¹⁵⁹ both organisational and personal, is important. Oral health knowledge, oral health attitude and perceived

behaviour control are predictors of intention to improve oral health behaviours.¹⁶⁰ For nursing personnel, it is important to have good role models, self-confidence in being able to accomplish specific oral care tasks and a belief in being able to overcome hindrances to performing the tasks.¹⁶¹

People with positive oral care attitudes are more likely to reflect good oral health knowledge,¹⁶² value their own oral health¹⁶⁰ and be motivated to prioritise oral care during their routine work in the nursing home.^{146,162,163} Caregivers trained in practical oral care have positive attitudes to oral care, compared to those who had no training,¹⁶⁴ and the majority of nursing home staff prefer hands-on training on site.¹³⁹ Oral care intervention improved oral health beliefs, i.e., knowledge, attitudes, responsibility and oral awareness.¹⁴⁹ On the other hand, negative oral health beliefs¹⁶⁵ and low priority given to oral care can hinder oral health promotion and ultimately reduce the quality of care.^{163,166,167}

The role of staff should not be underestimated in nursing homes. They must understand the connection between oral health, general health and QoL.^{3,65} Moreover, they must possess the clinical skills to screen and detect oral symptoms⁴ and be able to work according to evidence-based oral care plans based on residents' needs.¹³⁶ Finally, oral screening should be regularly performed and the oral care plan adjusted when needed.¹⁶⁸

2.4 Summary

This brief review of **healthcare systems**, health policy, the DIA and the NHA gives practical information concerning oral health policy for the population of older people. Population growth will increase the need for health care for frail people around the clock, both in nursing homes and in the community. Further, the burden of oral care in these settings will continue to rise.

This literature review gives an overview of common oral diseases that may affect the **oral health** of older people. It explains how frailty can contribute to oral health problems and addresses known risk factors, enabling factors and barriers to **oral health care** in nursing homes and similar settings. It also reveals the importance of oral care for frail older people and regular oral hygiene to reduce the development of oral diseases. Further, it shows that interventions, oral health education and practical training aimed at nursing home staff may empower them in their oral hygiene practice for older people. Though research has not confirmed that regular oral care can improve oral health, it may improve oral cleanliness among nursing home residents, reduce the progression of oral diseases and contribute to their better OHQoL.

2.4.1 Theoretical approach

Health and oral health models

In 1948, the WHO defined a health concept including not only physical health but also social and psychological wellbeing.¹⁶⁹ In the 1990s, the International Classification of Impairments, Disabilities and Handicaps (ICIDH) was formed by the WHO, integrating biomedical and social models into the biopsychosocial approach.^{170,171} The ICIDH framework advanced in 2001 into the International Classification of Functioning, Disability and Health (ICF). The ICF framework is used to categorise health and health-related domains and elicit and record information to describe the consequences of diseases on health, focusing on function and disability.¹⁷² The ICF provides a conceptual basis and explains interactions between contextual factors involving environmental and personal factors, components of function and disabilities (body function and structure, activities, participation), and health conditions. It covers the entire lifespan. However, the framework does not cover socioeconomic or cultural factors.¹⁷³ The ICF model can be used to understand the association of different components affecting health.

The theoretical model of the Oral Health Impact Profile (OHIP-49) used in this study originated from Locker.^{174,175} His conceptual model was constructed according to the ICIDH to measure oral health, encompassing both behaviour and social consequences of oral conditions.¹⁷⁶ However, the Locker model did not integrate environmental or individual factors that may play important roles in oral health.¹⁷¹ Still, the OHIP-49 measures multidimensional adverse effects of an individual's oral condition on OHQoL¹⁷⁴ that cause a reduced ability and limitation of performance of certain activities within a range considered to be normal.¹⁷⁰ Today, the oral health model includes driving elements determining oral health and moderating factors affecting self-perceived oral health and overall health and wellbeing.⁴⁰ The FDI recommends using individual OHQoL measures, clinical assessment and behaviour indicators to evaluate oral health care needs to plan oral health services. Further, national Oral Health Survey (OHS) and OHQoL findings can profile the oral health impact on daily life and be used to estimate cost-effectiveness, oral care, treatment or interventions and to plan oral health strategies.⁷⁰

Quality of life

HRQoL and OHQoL measures in health sciences assess the subjective impact of diseases on individuals' general wellbeing and capabilities to live to the fullest. This perception can have legitimately dissimilar meanings for different people. The main domains of HRQoL in research are physical, psychological, function, social and health-related perceptions.¹⁷⁷ Many studies use a generic QoL questionnaire for older adults to broadly study patients' perceptions of their general health state, whereas others investigate specific conditions.⁶⁶ Specific HRQoL usually aims at particular diseases and their related QoL, such as depression or osteoporosis.¹⁷⁷

General HRQoL instruments include the Short Form-36^{177,178} and the Icelandic Quality of Life Scale. The latter includes domains on health, finances, intercommunications, stress, pain, self-control, sleep and wellbeing. Older people in Iceland perceive that good health,

finances that support their usual lifestyle and being able to live with their spouse to the end of life (including in a nursing home) contribute the most to QoL.¹⁷⁹ Results from both generic and specific HRQoL questionnaires may lead to modifications and improvement in health care, improve symptom relief, predict prognosis or help detect problems long after treatment is completed.¹⁸⁰

A recent systematic review of QoL research in medicine and health sciences concluded that most studies had conceptual and methodological limitations. However, it is important to understand the QoL concept in research to be able to improve care, rehabilitation and symptom relief. Despite the debate on the meaning of the QoL concept, the review authors noted the holistic approach of the WHO definition: “An individual’s perception of their position in the life in the context of the culture in which they live and in relation to their goals, expectations, standards and concerns”.^{180,181} This definition recognises the multidimensional nature of QoL and includes physical and psychological domains as well as the level of independence, social relationships, environment and spiritual beliefs.¹⁸¹

Dental coping beliefs and oral care behaviour

Multiple theories and models of behavioural change exist to help understand people’s behaviour. The Nursing Dental Coping Belief Scale (DCBS) uses three models of cognitive psychology to explore people’s perceptions of health and understand health-related behaviour.¹⁸² Two models explain self-control using the Bandura self-efficacy¹⁸³ and Rotter’s locus of control¹⁸⁴ theories, and the third is Meichenbaum cognitive-behavioural modification.¹⁸⁵ These models explain behaviour, i.e., self-efficacy or mastery, which refers to one’s own competency and capability to succeed in accomplishing a goal and is related to motivation and action. Locus of control is categorised as internal and external; internal represents the ability to control situations and act accordingly, and external describes dependency on others. Meichenbaum’s theory identifies faulty beliefs or misunderstandings to change and restructure behaviour. The DCBS measures oral health belief, self-efficacy and locus of control to measure oral health care priorities.¹⁸³⁻¹⁸⁶

2.4.2 Rationale

Objective and scientific value of the research

Though oral health of residents in nursing homes and oral health care in these settings has received considerable critical attention in European and Nordic countries, it is not well documented in Iceland.

The purpose of this study was to explore and describe prevalence of oral diseases among residents in Icelandic nursing homes and identify oral health symptoms affecting their QoL. It also aimed to study self-reported oral health care and oral care perspectives among staff, which may affect the quality of oral care.

The goal was to produce information that can be used to estimate the prevalence of oral diseases among residents in nursing homes and their association with QoL, as well as to produce information on and describe attitudes to oral care and oral care management by staff and identify potential barriers to oral care in these settings.

The novel results of this study will add to the missing literature concerning the oral health of nursing home residents and oral health care in these settings. The findings may help to advance the management of oral health care based on individualised needs in nursing homes and be used to decide future policy to develop oral care competencies among nursing home staff. The goal of this study was to provide scientific evidence to be used to improve oral care of older Icelanders living in nursing homes.

3 Aims

3.1 General aim

The overall aim of this doctoral thesis was to investigate the clinical oral health of nursing home residents and self-perceived negative effects of oral health on their OHQoL, as well as to explore self-reported oral health care and nursing dental coping beliefs among oral care providers to explore factors affecting oral care activities and beliefs that might be associated with the quality of oral care.

3.1.1 Specific aims

1. To inspect the clinical oral health of nursing home residents and explore factors that contribute to self-perceived OHQoL (Paper I).
2. To examine the associations between the clinical oral health of nursing home residents and nutrition-related problems to identify oral health risk factors (Paper II).
3. To describe the self-perceived nursing dental coping beliefs among care assistants, licensed practical nurses and registered nurses working in nursing homes and identify their daily oral care activities (Paper III).

4 Materials and methods

This thesis is the result of an observational study published in three papers (Papers I–III), based on a descriptive cross-sectional design.

4.1 Design and methodological approach

The study design used was a descriptive observational cross-sectional analysis, which is practical for population-based surveys and to assess the prevalence of diseases in clinical samples. Study I examined the clinical oral health and OHQoL of residents living in two nursing homes in the Reykjavík area (Paper I). Study II examined the associations between the clinical oral health of residents and self-reported nutrition problems (Paper II). Study III examined the oral healthcare and oral health beliefs of health personnel working in the same settings at the same time (Paper III). The methodological approaches for Papers I–III are summarised in Table 1.

Table 1. Summary of methodology of studies in Papers I–III included in the thesis.

Study	Sample	Design	Data Analysis	Outcome
I	Convenience sampling (N = 82) Residents	Observational cross-sectional Clinical examination OHS ^a , OHIP-49 ^b Semi-structured interviews	Descriptive, frequencies, percentages, means, standard deviations, logistic regression	Oral health assessment Quality of life assessment
II	Convenience sampling (N = 82) Residents	Observational cross-sectional Clinical examination, OHS ^a OHIP-NP ^c	Descriptive, frequencies, percentages, means, standard deviations, bivariate, multiple logistic regression	Oral health assessment Quality of life and nutrition problem assessment
III	Convenience sampling (N = 200) RN, ^e LPN, ^f CA ^g	Observational cross-sectional DCBS ^d	Descriptive, frequencies, percentages, means, standard deviations, univariate, logistic regression	Psychometric testing nursing coping belief Oral care activities and materials

Note: ^a Oral Health Survey, ^b Oral Health Impact Profile, ^c Oral Health Impact Profile – Nutrition problems, ^d Dental Coping Belief Scale, ^e Registered nurses, ^f Licensed practical nurses, ^g Care assistants.

4.2 Study population

Initially, four (26.7%; n = 4/15) of the largest nursing homes in Reykjavík and nearby municipalities were invited to take part in this study. These homes occupy 32.9% (n = 471) of the nursing capability in the area.^{187,188} Two nursing homes agreed to be involved in the study. Both are run by the same organisation, with identical structures, inputs and services. Data were collected from residents and staff in nursing home A from May to June 2013 and in nursing home B during the same months in 2018.

After data collection in nursing home A in 2013, it was decided by the doctoral committee to repeat data collection in nursing home B in order to increase statistical power and representativeness of the available data, which was done in 2018.

Data collection at both time points was done by identical study staff and the inclusion criteria were also the same. Comparisons between the data from the two different time points show no significant difference in mean age of residents, although a significantly higher number of residents aged 90 years and older lived in nursing home B (for more details see Table 5, page 31). A comparison of staff working in nursing home A and B showed predominant similarities, although there was a higher proportion of nurses being involved in the study at nursing home B (for detailed information see Table 14, page 48). After consideration and advice by the chief statistician of the Icelandic Heart Association, it was decided to combine the two data sets for the calculations represented here in the thesis as well as in the corresponding three scientific papers.

The participants in the study were nursing home residents living in the two nursing homes (Papers I, II) and the nursing home personnel working in the same wards caring for the residents (Paper III). No risk was involved for participants in the study.

Nursing home residents

The participants in the study in Papers I and II were 82 Icelandic nursing home residents who lived in two nursing homes. The head nurses in each nursing home identified residents fitting the inclusion criteria of being residents in the nursing home, being 67 years of age or older, and having the cognitive ability to give full and written consent to participate and take part in the clinical oral health examination of the study.

During the study, four people withdrew their participation, and five questionnaires were excluded since the residents did not attend the clinical oral health examination of the study. A total of 73 residents finished both parts of the data collection.

Nursing home personnel

This sample consisted of health personnel caring for the residents taking part in the clinical oral health part of the study. According to the nursing home management, a total of 200 nursing home personnel were eligible to take part in the study.

In Paper III, eligible participants were found by the head of nursing on each floor in the nursing homes, who also introduced the research on site, distributed the questionnaires and arranged the returning protocol in cooperation with the researchers. Some nursing home staff may not have been able to understand the Icelandic questionnaire and therefore were unable to take part.

Involvement was self-selective, voluntary and anonymous by returning the self-administrated questionnaire. Participants also gave informed consent for participation in the study. A total of 109 employees answered the DCBS used in this study, including registered nurses, licensed practical nurses and care assistants.

Instruments

The following section describes the measuring instruments used for data collection in the studies in Papers I–III. The results from the clinical oral health examination of nursing home residents and QoL questionnaire were used in Papers I and II and a questionnaire in Paper III. Basic information about instruments used in Papers I–III are listed in Table 2.

Oral Health Survey

The OHS can be used in epidemiological studies to measure the prevalence and severity of oral diseases among groups within the population to assess the need and requirement for dental services, as well as to explore how an existing oral health service is managing with the current need for care or the nature and extent of curative, preventive and restorative service needed.¹⁸⁹

The OHS instrument was used to document data from the clinical oral health screening used in Paper I and II. Data included the number of natural teeth, status of permanent dentition and sociodemographic information. Further information regarding variables and coding for statistical analysis is in Table 4 (page 28).

Oral Health Impact Profile-49

OHQoL was assessed using the OHIP-49 questionnaire. The OHIP-49 measures the impact of oral health on functional, physical, psychological and social wellbeing. The instrument has 49 statements formed as questions divided into seven conceptual domains according to Locker's model of oral health.¹⁷⁶ They are (1) *Functional limitation*, (2) *Physical pain*, (3) *Psychological discomfort*, (4) *Physical disability*, (5) *Psychological disability*, (6) *Social disability* and (7) *Handicap*.¹⁷⁴

Each construct has 5–9 statements (see Table 2) measured on a 5-point Likert scale. For data entry, the scale ranges from 0 (“Never”) to 4 (“Very often”), where the lowest possible total score is 0 and the highest is 196 for denture-wearers and 184 for non-denture-wearers since three questions (numbers 17, 18 and 30) are only meant for denture-wearers and not calculated in the total score for dentate individuals.¹⁷⁴ Instructions to respondents included orientation to the desired recall period (last 3 months), as recommended by the author. Scoring higher than 0 on the OHIP-49 indicates that the person is experiencing negative oral health effects in one or multiple QoL domains.¹⁷⁴

Questions about sociodemographic details (gender, marital status, education, last housing before moving to nursing home), frequency of oral hygiene and use of dental care were added to the study questionnaire (Table 2, page 24). Some questions were reused from OHS to cross-check the consistency of responses (subjective oral health, general health).

The OHIP-49 has been used globally in full or shorter versions.¹⁸⁸ The instrument can be used to identify groups that place a high priority on their own oral health or treatment need and inform about the burden of clinical oral diseases and the effectiveness of reducing that burden within the health service.^{174,176}

All QoL scales were tested for internal construct reliability analysis (N = 73) using Cronbach's alpha. The OHIP-49 had a high Cronbach's alpha ($\alpha = 0.94$), and subscales had a moderate to high Cronbach's alpha:¹⁹⁰ *Functional limitations* ($\alpha = 0.73$), *Physical*

pain ($\alpha = 0.68$), *Psychological discomfort* ($\alpha = 0.80$), *Physical disability* ($\alpha = 0.84$), *Psychological disability* ($\alpha = 0.77$), *Social disability* ($\alpha = 0.76$) and *Handicap* ($\alpha = 0.76$).

Internal construct reliability analysis was tested for 39 questions (N = 1217) by Slade¹⁹¹ and showed a high Cronbach's alpha ($\alpha = 0.94$) for the shorter version OHIP-14 or set of 14 questions ($\alpha = 0.88$).¹⁹¹ The OHIP-5 English version has shown good construct validity in confirmatory analysis and satisfactory reliability with Cronbach's alpha ($\alpha = 0.75$).¹⁹²

Table 2. List of instruments used in Paper I–III showing number of questions.

Paper	Instrument	Domains or single questions	Number of questions
I	^a OHS	General information, dentition status and treatment need, oral mucosa condition, prosthetic status and need, and notes	12
I	^b OHIP-49	Functional limitation*	8–9
		Physical pain*	8–9
		Psychological discomfort	5
		Physical disability*	8–9
		Psychological disability	6
		Social disability	5
		Handicap	6
I	Single questions	Sociodemographic background	5
		Self-reported oral hygiene, use of equipment and oral treatments	9
		Last visit to a dental office and type of dental treatment	2
II	OHS	General information, dentition status and treatment need, oral mucosa condition, prosthetic status and need, and notes	12
II	^c OHIP-49	Functional limitation (Q1, Q6, Q8)	3
	Nutrition	Physical pain (Q15)	1
		Physical disability (Q26, Q28, Q29, Q32)	4
III	^d DCBSc	Internal locus of control	7
		External locus of control	7
		Self-efficacy	7
		Oral health beliefs	7
III	Single questions	Sociodemographic background	10
		Oral health opinions	7
		Equipment and material used for oral healthcare	10
		Total	152

Notes: ^a Oral Health Survey (WHO), ^b Oral Health Impact Profile-49, ^c OHIP-49 Nutrition Problems, ^d Dental Coping Belief Scale, *one question in the domain is only intended for denture-wearers.

OHIP-49-Nutrition Problems

In Paper II, the OHS was used to describe the clinical oral health and prosthetic status of residents. Eight questions in three domains were selected from the OHIP-49 (Table 3) to measure associations between oral health and nutrition-related problems: the OHIP-49-

Nutrition Problems (OHIP-49 NP). These nutrition-related answers were dichotomized into “yes” (experiencing the problem) or “no” (showing no problem). The summary score of these possible nutrition-related problems had a potential range from 0 to 8, describing the severity of the problems (0 = no problem; 8 = severe problem).

Table 3. List of OHIP-49 questions used to measure nutrition-related problems.

Item	OHIP-49 Questions
1 ^a	Do you have difficulties chewing any foods because of problems with your teeth, mouth or dentures?
6 ^a	Do you have experienced changes in taste perception because of problems with your teeth, mouth or dentures?
8 ^a	Do you have difficulties with your digestion because of problems with your teeth, mouth or dentures?
15 ^b	Are you not able to eat because of problems with your teeth, mouth or dentures?
26 ^c	Do you have less taste perception because of problems with your teeth, mouth or dentures?
28 ^c	Do you avoid food because of problems with your teeth, mouth or dentures?
29 ^c	Are you unsatisfied with food because of problems with your teeth, mouth or dentures?
32 ^c	Do you have to stop eating because of problems with your teeth, mouth or dentures?

Notes: ^aFunctional limitation, ^bPhysical pain, ^cPhysical disability.

Internal reliability analysis was tested with Cronbach’s alpha for the eight specified OHIP-49 questions (N = 73), and the result showed high reliability ($\alpha = 0.84$). Findings from OHIP-49-NP questions can be used to investigate and identify oral health nutrition-related problems and be used for practice to adjust food variety to inhibit the development of malnutrition due to oral health problems.

Nursing Dental Coping Belief Scale

Multiple studies have used the DCBS^{166,186,193} in similar settings, including the Nordic countries. With written permission from the corresponding author, the questionnaire was translated into Icelandic, then piloted and tested.

The DCBS concept is based on theories and models of behaviour psychology. The questionnaire has 28 statements measured on a 5-point Likert scale ranging from 1 (“Strongly disagree”) to 5 (“Strongly agree”). Total scores range from 28 to 140.

The DCBS is divided equally into four dimensions:¹⁸⁶ (1) *Oral Health Coping Belief* (OHB) rationalises personal conviction of being able to influence health behaviours, (2) *Self-Efficacy* (SE) determines whether coping behaviour will aid in a favourable oral health outcome; (3) *Internal Locus of Control* (IL) describes opinions on being able to control events and (4) *External Locus of Control* (EL) clarifies whether a person believes that events or success are based on fate, luck or elements out of their control. Reverse coding was used for two themes (OHB, EL), as proposed by the authors. A low score characterises a positive dental coping belief, showing strong conviction in the person’s own abilities and

competencies to influence oral health behaviours, whereas a high score shows the opposite.
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Single questions collect sociodemographic information from participants, and open- and closed-ended questions collect data on self-reported oral hygiene nursing behaviour and oral care and attitudes. Findings using the DCBS can be used to make necessary improvements within the organisation, mutually benefiting the dependent residents and the health care personnel.

The DCBS was translated into Icelandic and back-translated into English by a native-speaking researcher fluent in both languages, who worked as a Professor in the Faculty of Odontology at the University of Iceland. The scale was tested by health care personnel before the final version. Cronbach's analysis ($n = 109$) was used to test the internal reliability of the DCBS Icelandic version. The alpha level was found to be $\alpha = 0.78$, and based on standardized items $\alpha = 0.79$, which indicates an adequate level of inter-item reliability. The results showed a high Cronbach's alpha on IL ($\alpha = 0.72$) but considerably lower on OHB ($\alpha = 0.54$), SE ($\alpha = 0.42$) and EL ($\alpha = 0.55$).

Similar results have been reported in the literature. The Spanish translation and validation of the DCBS ($N = 69$) showed a low to moderate Cronbach's alpha (DCBS $\alpha = 0.64$, OHB $\alpha = 0.67$, SE $\alpha = 0.50$, IL $\alpha = 0.56$ and EL $\alpha = 0.46$).¹⁹⁴

A recent study ($N = 2,167$) used the DCBS to study oral health care beliefs among care personnel working with older people, following up oral care education.¹⁹⁵ The authors attempted to improve the Cronbach's alpha (α) by excluding the lowest-value items. This had no effect for any of the four dimensions (OHB $\alpha = 0.54$, SE $\alpha = 0.44$, IL $\alpha = 0.57$ and EL $\alpha = 0.64$),¹⁹⁵

4.3 Data collection

Nursing home residents

Oral health examination

The schedule and execution of manual work to examine the oral health of the residents were prepared in cooperation with head nurses in each nursing home. The location of the examination room in nursing home A was decided in cooperation with head nurses, who also introduced the research team at the sites. Examinations in nursing home B were performed in the residents' private room in their reclinable bed.

The clinical oral health examinations in the nursing homes were conducted by a dentist, with assistance from a denturist who recorded the general information of the residents and the results of the examination of the oral mucosa, dentition, prosthetic status and whether oral treatment was needed. To confirm the clinical examination, the record-keeping denturist read aloud the results from the first screening while the dentist confirmed the results during a second screening.

The FDI dentition notation was used to record permanent dentition, and the clinical status of each tooth in both jaws was estimated and recorded with the OHS instrument. The examination room in nursing home A was equipped with a reclinable chair and movable Luxor light (bulb with blue-white colour spectrum). During oral examination in both settings, the dentist used Exam Vision™ with light and 2.8x magnifying loupes, simple mouth mirrors (Kerr™), disposable brushes (3M ESPE™), personal protection wear (mask, gloves, etc.), plastic cups, paper bowls, gauze and disinfection (Micro 10+™ Unident). Durohpat™ 2200 ppm was applied to dental caries when needed.

OHIP-49

Participants answered the OHIP-49 by themselves or had a visit from the research team who read the questionnaire aloud and assisted residents with completing it. The interviews were conducted in the residents' private rooms away from disturbance and lasted approximately 30–60 minutes, sometimes with a 5–10-minute break.

During the study, four people withdrew their participation, and five questionnaires were excluded since the residents did not undergo the clinical oral health examination according to OHS to fulfil the inclusion criteria of the study. A total of 73 residents finished both parts of the study.

Nursing home personnel

Nursing Dental Coping Belief Scale

The study was formally introduced to managers and head nurses in each nursing home. The head nurses introduced the study to nursing staff at staff meetings, found potential participants and distributed the printed questionnaires. The returning protocol was arranged in cooperation with the researchers. The identified participants completed the study and filled out the questionnaire in writing during one shift in the nursing home and returned their responses on site in a sealed box.

4.4 Data analysis

Statistical analysis in studies I–III was performed with SPSS® version 27.0 (Armonk, NY, USA, IBM Corp®). All variables in studies I–III were examined for normality using the Kolmogorov–Smirnov test and data were presented as descriptive data using frequency, percentage, ratio, range, mean and standard deviation (SD). The level of significance was set at $p < 0.05$ in all studies.

Papers I and II

A summary of variables and coding for studies in Papers I and II is shown in Table 4.

Table 4. Variables in studies and coding.

Variables	Coding and categories
Dentition ^a	(1 = decayed, 2 = filled tooth with decay, 3 = filled, 4 = missing, 5 = fissure sealant, 6 = bridge abutment, 7 = crown, 8 = veneer, 9 = implant or 9 = trauma) to calculate mean number of present permanent dentition.
Oral mucosa	(0 = normal, 1 = abscess, 2 = ulceration, 3 = candidiasis, 4 = oral tumour, 5 = other conditions).
Periodontium	(0 = healthy, 1 = bleeding, 2 = calculus) and coded as bivariate variable (1 = normal, 2 = abnormal).
Prosthetic status	(0 = no prosthesis, 1 = bridge, 2 = more than one bridge, 3 = partial denture, 4 = both bridges and partial dentures, 5 = full removable denture).
Types of prosthesis	(1 = dentition and fixed prosthesis, 2 = dentition and removable partial dentures, 3 = complete dentures) or complete dentures (1 = no, 2 = yes).
Need for service: dental care	(1 = no, 2 = yes), need for new prosthetic (0 = no, 1 = yes, 3-7 = types of prosthesis needed).
Sociodemographic and oral and general health	
Gender	(1 = male, 2 = female),
Date and year of birth	years and categories (1 = <80 years, 2 = 80–89 years, 3 = 90 years of age and older).
Last residency before moving to nursing homes	(1 = Reykjavik, 2 = town, 3 = village, 4 = rural) and length of residency at the nursing home: (1 = <1 year, 2 = ≥1 year), dental visit (1 = <1 year, 2 = ≥1 year).
Education	(1 = compulsory education, 2 = college secondary education, 3 = vocational education).
Marital status	(1 = married or with a spouse, 2 = widow(er), 3 = spouse living elsewhere, 4 = unmarried).
Subjective general health and oral health	(1 = good, 2 = moderate, 3 = bad).
Decayed, missing and filled teeth (DMFT)	Number of DMFT according to OHS.
OHIP-49-NP	

Note: ^aAll variables recorded in the OHS were coded according to clinical status of permanent teeth.

Variables in the OHS instrument describe the clinical oral health status of each resident. The DMFT measure is a summation of decayed teeth (DT), missing teeth (MT) and filled teeth (FT).¹⁹⁶ The index counts the number of existing teeth and their status¹⁸⁹ and records both past and current disease but cannot verify the cause of missing teeth.

In the current study, 28 out of 32 teeth are recorded for each participant. The total DMFT score counts the affected teeth in the dentition. DMFT 0 represents an individual with all 28 counted teeth healthy, and DMFT 8 describes an individual with 20 healthy teeth and 8 DMFT. The DMFT value was coded into three groups: 1 = DMFT ≤23, 2 = DMFT 24–27 and 3 = DMFT 28.

OHIP-49 and OHIP-49-NP

The OHIP is a self-rating patient-centred index with 49 questions that cover seven domains: (1) *Functional limitation*, (2) *Physical pain*, (3) *Physical disability*, (4) *Psychological discomfort*, (5) *Social disability*, (6) *Psychological disability* and (7) *Handicap*. Each domain is summed for the total score. The total OHIP-49, mean score and

SD were calculated for each domain, along with the counts and percentages of responses to each question.

In Paper I, descriptive data were calculated for sociodemographic and DMFT variables. Both total and mean scores were calculated for OHIP-49 and each subscale. An independent samples t-test or Chi-square test were used to compare groups. Multiple linear regression models (SPSS general linear model; univariate) adjusted for gender and age were used to compare OHIP-49 mean scores between groups and calculate associations with clinical variables (DMFT, prosthetic status) and QoL.

In Paper II, eight questions from OHIP-49 were selected to explore the connection between clinical oral health (OHS, DMFT) and nutrition-related conditions deriving from three domains (Functional limitation, Physical pain and Physical disability; Table 3). All questions have the same response categories (“Very often”, “Fairly often”, “Occasionally”, “Hardly ever” and “Never”). These nutrition-related answers were dichotomized into “yes” (experiencing the problem) or “no” (showing no problem).

For statistical analysis in Paper II, differences between groups and subgroups at baseline were calculated using independent samples t-tests for normally distributed variables or the Mann–Whitney U test for variables not normally distributed. The Chi-square test was used for categorical variables. Associations between oral care, oral health, length of residency at the nursing home and nutrition-related problems in the OHIP-49-NP were investigated using logistic regression models adjusted for gender and age and reported as odds ratio (OR) with 95% confidence intervals (CIs). Further information can be seen in Paper I and II.

Nursing Dental Coping Beliefs

Nursing DCBS ideology is based on theories and models of behavioural psychology and has four dimensions, each with seven questions. This was a focus in Paper III.

1. External locus of control: the belief that one’s success is based on fate or luck.
2. Internal locus of control: the belief that one’s success is based on their own abilities.
3. Self-efficacy: the belief one’s competence will aid in a favourable outcome.
4. Oral health beliefs: personal convictions that influence health behaviours.

Other open- and closed-ended questions about sociodemographic data, age, gender, level of education, self-reported frequency of oral care and use of treatments, and attitudes toward oral care and oral health of residents were used in the study (disagree, unsure or agree).

The level of education was (a) care assistants, with primary compulsory education; (b) licensed practical nurses, with secondary education at a college level; or (c) registered nurses, with tertiary education from universities. The level of work experience was grouped into <1, 1–6, 7–12 and >12 years. Questions regarding oral health education (theoretical, lectures) and training (hands-on) were grouped into yes or no.

Statistics were calculated as descriptive data as mean, SD, frequency and percentages. Groups were compared using Chi-square tests for categorical variables or independent samples t-test for continuous variables. Multiple linear regression models (general linear model; univariate in SPSS) were constructed to investigate the relationships between education, training in oral hygiene and work experience in years, with DCBS measures (dependent variables). Further information can be seen in Paper III.

4.5 Approvals

Before commencing the study, ethical clearance was sought from The Data Protection Authority (S-6034) and The Icelandic National Bioethics Committee, who approved the study protocol (VSN 12-207, 12-207-1).

5 Results

5.1 Paper I

This section is a revised version of the text “Munnkvillar aldraðra á hjúkrunarheimilum, þörf fyrir breytingar heilbrigðisþjónustu”, accepted for publication in *Læknablaðið*. This study aimed to inspect clinical oral health among residents living in Icelandic nursing homes and explore factors that contribute to self-perceived OHQoL.

A total of 82 residents participated in this study. Nine withdrew their participation or did not participate in the clinical oral health examination, leaving a total of 73 residents. All participants represented the most functional residents in these settings and without dementia.

The characteristics of nursing home residents were identical in studies I and II (Papers I, II), and the majority were women (62%). The mean age of nursing home residents was 86.8 (\pm 5.8) years, identical in men and women. The summary statistics and sociodemographic information of participants are shown in Table 5, which has previously been submitted to *Læknablaðið* to be published.

Table 5. Sociodemographic information of participants in the study (N = 73).

		Home				Total		<i>p</i> -value ^a
		Nursing home A		Nursing home B				
		Count	(%)	Count	(%)			
Gender	Men	13	(34.2)	15	(42.9)	28	(38.4)	0.576
	Women	25	(65.8)	20	(57.1)	45	(61.6)	
	Total	38	(100.0)	35	(100.0)	73	(100.0)	
Age group	80–89	23	(60.5)	14	(40.0)	37	(50.7)	0.027 ^b
	>90	10	(26.3)	18	(51.4)	28	(38.4)	
	Total	38	(100.0)	35	(100.0)	73	(100.0)	
Residence^c	Capital	26	(70.3)	29	(82.9)	55	(76.4)	0.338
	Town	9	(24.3)	4	(11.4)	13	(18.1)	
	Village	0	(0.0)	1	(2.9)	1	(1.4)	
	Rural	2	(5.4)	1	(2.9)	3	(4.2)	
	Total	37	(100.0)	35	(100.0)	72	(100.0)	
Education	Compulsory	24	(68.6)	18	(51.4)	42	(60.0)	0.019 ^a
	College Secondary	11	(31.4)	10	(28.6)	21	(30.0)	
	Vocational	0	(0.0)	7	(20.0)	7	(10.0)	
	Total	35	(100.0)	35	(100.0)	70	(100.0)	
Marital status	Unmarried	2	(5.4)	2	(5.7)	4	(5.6)	0.028 ^a
	Married	2	(5.4)	2	(5.7)	4	(5.6)	
	Widow/er	27	(73.0)	23	(65.7)	50	(69.4)	
	Divorced	6	(16.2)	1	(2.9)	7	(9.7)	
	Married ^d	0	(0.0)	7	(20.0)	7	(9.7)	
	Total	37	(100.0)	35	(100.0)	72	(100.0)	

Notes: ^a Chi-square test significant $p < 0.05$. ^b Two-sided test significant difference in column proportion between homes, ^c Place of residency before admission to nursing home, ^d Spouse living elsewhere.

As can be seen from the table, the residents in both nursing homes shared similar characteristics in general, except for education and the oldest age category.

5.1.1.1 Clinical oral health and prosthodontic status

The first set of analyses examined the status of clinical oral health (N = 73). The DMFT index was from 12 to 28, with DMFT 12 representing the best dentate individual, who had 16 remaining natural teeth. The clinical oral health examination showed that the DMFT index was high in this sample ($M = 25.7$; $SD \pm 3.3$) indicating that a high prevalence of oral diseases existed among the residents ($M =$ men: 25.5 ± 3.9 , $n = 28$; women: 25.8 ± 2.9 , $n = 45$). The majority of residents had lost their natural teeth, and the mean total proportion of retained teeth was 32.5% (men: 30.9%; women: 33.4%). The mean number of teeth for men was 8.7 ± 9.9 , and for women it was 9.4 ± 9.2 .

Table 6 presents an overview of clinical variables. The prevalence of missed teeth was high in this study, and the reason for the lack of teeth was not investigated. Nearly 3% of teeth had dental caries (untreated).

Table 6. Total number of teeth assessed in oral health survey (N = 73).

Clinical status of teeth	Maxilla		Mandible		Total	
	n	Percent	n	Percent	n	Percent
Sound teeth	35	3.4%	157	15.4%	192	9.4%
With dental decay	5	0.5%	13	1.3%	18	0.9%
Filled with decay	16	1.6%	14	1.4%	30	1.5%
Filled	135	13.2%	145	14.2%	280	13.7%
Missing due to dental caries	3	0.3%	6	0.6%	9	0.4%
Missing teeth*	723	70.7%	646	63.2%	1369	67.0%
Abutment, crown, etc.	104	10.2%	40	39%	144	7.0%
Trauma	1	0.1%	1	0.1%	2	0.1%
Total	1022	100%	1022	100%	2044	100%

Note: *Missing due to unidentified reasons.

Additionally, prosthodontic rehabilitation was examined among participants to describe the types and frequency of removable partial dentures, complete dentures, fixed crowns and bridges. In total, 44 participants (60.3%) had a complete denture in the upper jaw (maxilla), around one third (31.5%, $n = 23$) had both their own teeth and fixed dental crowns or bridges, but relatively few had fixed prostheses and removable dentures in both jaws (8.2%; $n = 6$).

Figure 2 presents an overview of the main clinical characteristics of retained and missing teeth in both jaws in the sample (N = 73). The majority of sound teeth were in the mandible, and most dental rehabilitation including abutments (dental crowns, inlays, onlays and fixed dental bridges) was in the upper jaw.

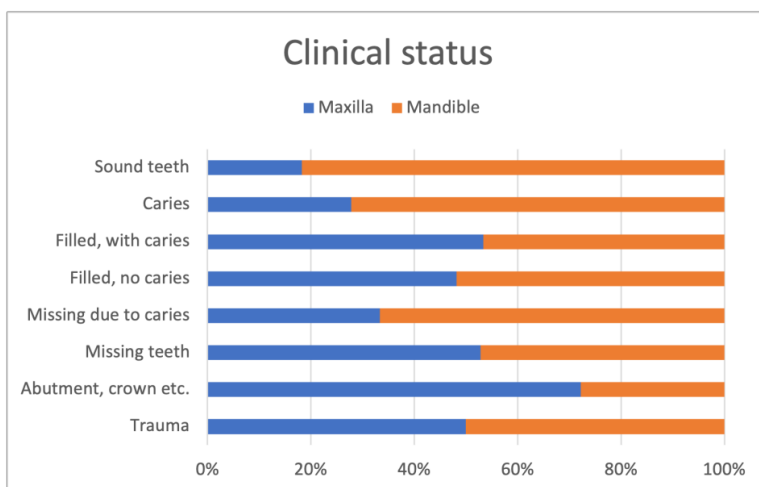


Figure 2. Total status in maxilla and mandible in OHS assessment.

Figure 2 shows that special observation is needed in general to perform the necessary “five-surface” oral care approach (clean occlusal, buccal, lingual and interproximal surfaces) to prevent oral diseases. Most of the present teeth were in the mandible and most dental prostheses were in the maxilla.

Further analysis of dental status and dental prostheses is shown in Table 7, which has previously been submitted for publication in *Læknablaðið*. Among all residents (N = 73), most were edentulous and used complete dentures. Removable prosthetics were the most common dental rehabilitation (68.5%; n = 50).

Table 7. Number of residents with own teeth, fixed prostheses, partial dentures, and complete dentures.

Oral health	Male			Female			Total	
	n	% ^a	% ^b	n	% ^a	% ^b	n	%
Own teeth, fixed prosthesis	8	(28.6)	(11.0)	15	(33,3)	(20.5)	23	(31.5)
Own teeth and removable prosthesis ^c	8	(28.6)	(11.0)	12	(26.7)	(16.4)	20	(27.4)
Complete dentures	12	(42.9)	(16.4)	18	(40.0)	(24.7)	30	(41.1)
Total	28	(100)	(38.4)	45	(100)	(61.6)	73	(100)

Notes: ^a Two-sided proportion test between columns, ^b Percentage of total, ^c Having complete or partial dentures in one jaw opposite their own natural teeth with or without partial dentures.

The purpose of the clinical oral health evaluation was to investigate the prevalence of oral diseases among residents in nursing homes. Overall results from the clinical oral health assessment show that the most common dental rehabilitation was complete dentures and removable dentures supported by natural teeth.

Oral hygiene and dental visit

Information on clinical status (dentures and removable partial dentures) and the dentate with removable partials gives an overview of the oral care approach needed in these settings, i.e., the five-surface oral cleaning approach for own teeth and regular dental visits. Self-reported information on previous utilisation of dental services, that is the last visit to the dental clinic (n = 71), showed that most participants visited a dental clinic within the last year (38%; n = 27), followed by the last 1–5 years (29.6%; n = 21) then more than 6 years ago (32.4%; n = 23).

Figure 3 shows the self-reported frequency of oral hygiene practices by residents and their described frequency of oral hygiene delivery by staff. Most residents (59%, 26/44) cleaned their teeth and dentures once daily. The majority responded that no assistance was provided with oral hygiene (dentures: 76%, 38/50 vs. teeth: 85%, 17/20).

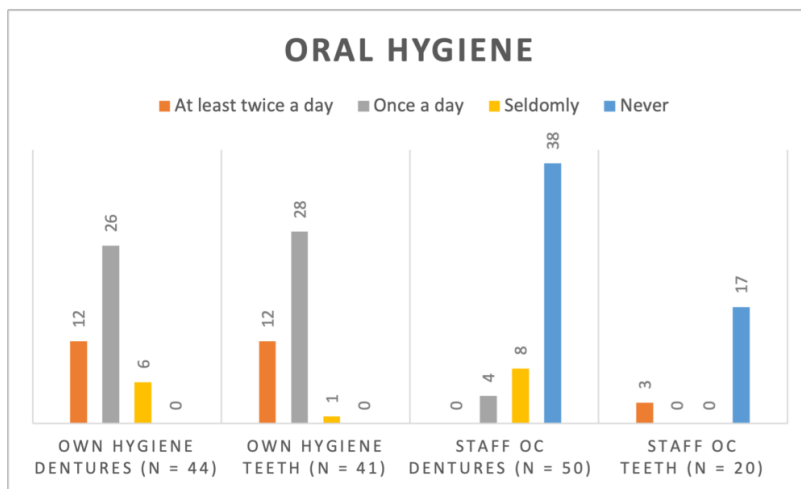


Figure 3. Oral hygiene practice reported by residents.

These results support that the prevalence of oral diseases is high in nursing homes and that a high need exists for specialised dental services. Further, the results verify that residents have complex clinical oral health and various types of dental prostheses that will need different oral care approaches by nursing personnel.

The result from the OHS data is that the majority of residents needed dental services (67.1%; n = 49) such as specialised oral cleaning (calculus removal), dental treatment (decay, broken teeth, gingivitis or periodontitis), or dental rehabilitation (crowns, dentures, removable dentures, and other work).

The majority of respondents (88.6%, 62/70) rated their oral health as either good or neither good nor poor, and relatively few rated their oral health as very poor (11.4%). This outcome goes against the professional dental assessment that the residents needed dental treatment to improve their oral health.

5.1.1.2 Quality of life and oral health-related problems

We analysed the associations between QoL scales and prevalence of oral health symptoms according to the length of stay from admission (less than a year or longer). Table 8 illustrates the breakdown of OHIP-49 and subscale scores and the selected oral health variables that might be affected by the length of stay in a nursing home. The data in the table has previously been submitted and accepted for publication in *Læknablaðið*.

The results show that residents who were admitted within a year had favourable mean scores on all QoL scales, except for *Psychological disability*, when compared to residents who had stayed longer than a year in the nursing home. No significant differences were found between length of stay and QoL, but this was near significant for the index measuring *Functional limitation*.

Table 8. Oral health and quality of life related to the length of stay of resident in the nursing home (N = 60).

Scale	Length of stay	N	M	±	SD	(%)	p-value ^a
OHIP-49	<1 year	27	33.3	±	20.3		0.159
	1 year or more	33	40.6	±	19.6		
Functional limitation	<1 year	27	9.0	±	5.8		0.056
	1 year or more	33	11.6	±	5.7		
Physical pain	<1 year	27	5.4	±	4.6		0.507
	1 year or more	33	6.1	±	3.8		
Psychological discomfort	<1 year	27	5.4	±	4.2		0.499
	1 year or more	33	4.8	±	3.6		
Physical disability	<1 year	27	7.7	±	6.2		0.061
	1 year or more	33	10.8	±	6.2		
Psychological disability	<1 year	27	2.1	±	2.6		0.513
	1 year or more	33	2.5	±	2.5		
Social disability	<1 year	27	0.9	±	1.4		0.158
	1 year or more	33	1.6	±	2.3		
Handicap	<1 year	27	2.7	±	2.6		0.471
	1 year or more	33	3.3	±	3.3		
Oral health							p-value ^b
DMFT 28 ^c	<1 year	27				(48.1)	0.148
	1 year or more	33				(66.7)	
Dry mouth (very often)	<1 year	27				(74.1)	0.881
	1 year or more	33				(75.8)	
Oral mucosa (normal)	<1 year	27				(81.5)	0.768
	1 year or more	33				(84.4)	

Notes: ^a t-test, ^b Chi-squared test,

^c Total number of decayed, missing or filled teeth = 28 teeth.

Continued, next page.

Table 8. Continued. Oral health and quality of life related to the length of stay of resident in the nursing home (N = 60).

Oral health	Length of stay	N	M	± SD	(%)	p-value ^b
Need for dental service	<1 year	27			(51.9)	0.028
	1 year or more	33			(78.8)	
Dental visit	<1 year	27			(48.0)	0.113
	1 year or more	33			(68.8)	
Wearing complete dentures	<1 year	27			(29.6)	0.087
	1 year or more	33			(51.5)	
Oral health (good)	<1 year	27			(50.0)	0.221
	1 year or more	33			(40.6)	

Notes: ^a t-test, ^b Chi-squared test,

^c Total number of decayed, missing or filled teeth = 28 teeth.

Analysis of oral health variables (dry mouth, oral mucosa, dental visit, etc.) revealed a statistically significant difference between the need for dental service and how long participants had lived in the nursing home. The longer residents had lived in the nursing home (1 year or more), the need for dental treatment increased.

Data in the next two tables has previously been submitted to *Læknablaðið*. Table 9 (see, page 37) compares the estimated mean scores of the OHIP and its subscales in three groups based on their DMFT status, controlled for age and gender. The reference group was the highest DMFT category. The mean scores were significantly different between DMFT groups on the OHIP-49 and two QoL subscales.

These results corroborate that the resident with the worst oral health in the study experienced *Functional limitation*: poorer taste, sense and metabolism and difficulties with pronouncing words. Further, they experienced *Physical disability*: their speech was unclear and they were misunderstood, they sensed less flavour of food, avoided or could not eat certain food, experienced interrupted meals because of oral health and had an unsatisfactory diet. Additionally, the OHQoL index *Physical pain* was close to significantly different.

Table 9. Comparison of mean scores^o on quality of life scales and subscales by number of decayed, missing and filled teeth (N = 73).

Quality of life scales	DMFT groups	M	±	SD	p-value
OHIP-49	<23 (n = 20) ^a	26.5	±	4.4	0.014
	24–27 (n = 12) ^b	34.7	±	5.7	0.425
	28 (n = 41) ^c	39.8	±	3.1	ref. #
Functional limitation	<23 ^a	7.0	±	1.2	0.002
	24–27 ^b	9.4	±	1.6	0.185
	28 ^c	11.8	±	0.9	ref.
Physical pain	<23 ^a	4.2	±	0.9	0.078
	24–27 ^b	5.7	±	1.2	0.711
	28 ^c	6.2	±	0.6	ref.
Psychological discomfort	<23 ^a	5.4	±	0.8	0.359
	24–27 ^b	5.8	±	1.1	0.278
	28 ^c	4.4	±	0.6	ref.
Physical disability	<23 ^a	4.8	±	1.3	0.000
	24–27 ^b	8.2	±	1.7	0.191
	28 ^c	10.7	±	0.9	ref.
Psychological disability	<23 ^a	2.1	±	0.6	0.551
	24–27 ^b	2.1	±	0.8	0.635
	28 ^c	2.5	±	0.4	ref.
Social disability	<23 ^a	1.0	±	0.4	0.727
	24–27 ^b	1.5	±	0.5	0.595
	28 ^c	1.2	±	0.3	ref.
Handicap	<23 ^a	2.0	±	0.6	0.172
	24–27 ^b	2.0	±	0.8	0.291
	28 ^c	3.0	±	0.5	ref.

Notes: ^oGroups defined by DMFT status and mean score compared to reference group with no teeth, controlled for gender and age,

^a DMFT <23: Residents with 12–23 decayed, missed or filled teeth (5–16 healthy teeth),

^b DMFT 24–27: Residents with 24–27 decayed, missed or filled teeth (1–4 healthy teeth),

^c DMFT 28: Residents with 28 decayed, missed or filled teeth (0 healthy teeth),

#ref: Reference group.

We analysed the mean scores of dentate and edentate participants on the OHIP-49 and subscales. Table 10 has been submitted to *Læknablaðið*. Individuals using complete dentures had mean scores significantly higher on the same OHQoL compared to people with the highest DMFT index (Table 9) i.e., *Functional limitation* and *Physical disability*, which has been previously described. Complete denture-wearers scored significantly higher on the subscale *Handicap*: they sensed that their edentulousness had an impact on their general health, wellbeing and social engagement and were less satisfied with life than dentate residents.

Dentate individuals with prostheses scored significantly higher on the subscale *Psychological discomfort*, showing they were more often self-conscious because of oral health problems; their oral symptoms made them feel miserable, they felt uncomfortable about their appearance and they were often more tense because of oral problems than were people using complete dentures.

Table 10. Comparison of mean scores on quality of life and subscales^o between dentate (n = 43) and complete denture-wearers (n = 30).

Quality of life domains	Clinical oral health	M	±	SD	p-value
OHIP – 49	Dentate with prosthesis ^a	31.9	±	3.1	0.083
	Complete dentures ^b	40.2	±	3.6	
Functional limitation	Dentate with prosthesis ^a	8.7	±	0.9	0.011
	Complete dentures ^b	12.1	±	1.0	
Physical pain	Dentate with prosthesis ^a	4.9	±	0.6	0.118
	Complete dentures ^b	6.5	±	0.7	
Psychological discomfort	Dentate with prosthesis ^a	5.7	±	0.6	0.022
	Complete dentures ^b	3.7	±	0.7	
Physical disability	Dentate with prosthesis ^a	6.8	±	0.9	0,002
	Complete dentures ^b	11.3	±	1.1	
Psychological disability	Dentate with prosthesis ^a	2.4	±	0.4	0.744
	Complete dentures ^b	2.2	±	0.5	
Social disability	Dentate with prosthesis ^a	1.4	±	0.3	0.303
	Complete dentures ^b	0.9	±	0.3	
Handicap	Dentate with prosthesis ^a	2.0	±	0.4	0,027
	Complete dentures ^b	3.5	±	0.5	

Note: ^o Groups defined by teeth and prosthesis status, mean scores compared to reference group being edentulous using complete dentures, controlled for gender and age

^a Residents with own teeth, fixed prosthesis (dental crown, bridge) and/or removable partial dentures.

^b Residents having no teeth, using dentures in both jaws.

The first set of analyses aimed to investigate the association between clinical oral health and QoL (Table 9). These results indicate that a high DMFT-28 or being edentulous and using complete dentures contributed to poorer chewing ability, affected nutrition intake and ability to communicate. Moreover, edentulousness had an impact on general health, and resulted in being less satisfied with life. In contrast, dentate individuals with prostheses or with DMFT<23 experienced less restriction of QoL but a greater effect on psychological wellbeing than participants using complete dentures.

5.2 Paper II

This section is a revised version of the text “Oral care, oral health and associated nutrition related problems in Icelandic nursing home residents”, published in *Acta Scientific Nutritional Health*.¹⁹⁷

This study aimed to examine the associations between the clinical oral health of nursing home residents (N = 82) and nutrition-related problems to identify oral health risk factors. A total of 73 residents took part in both parts of the study, completed the clinical oral health examination and returned the OHIP-49 questionnaire. The characteristics of the participants can be seen in Table 11, which was previously published in *Acta Scientifica Nutritional Health* ¹⁹⁷

Participants shared similar characteristics, except for education: men had finished more than compulsory education. Over half had a DMFT index of 28, and the mean DMFT was around 26; nonetheless, 42% rated their oral health as being good. The majority of participants (67%) needed dental therapy, and a similar proportion had been at a dental clinic more than a year ago. More than 40% had complete dentures, and the mean number of nutrition-related problems was high (4.8 ± 2.5).

Table 11. Characteristics of the participants and oral symptoms.

Variable	Men			Women			p-value*
	Mean	(n = 28)	SD	Mean	(n = 45)	SD	
Age (years)	86.6	±	5.7	86.9	±	5.9	0.817
Smoking (yes)		17.9%			8.9%		0.257
Basic school education		50.0%			82.2%		0.004
Widowed/alone/not		92.9%			95.6%		0.622
Length of residence more		50.0%			44.4%		0.644
Good self-rated oral health		39.3%			46.7%		0.176
DMFT index	25.5	±	3.9	25.8	±	2.9	0.765
DMFT index = 28		57.1%			55.6%		0.929
OHIP-49	34.4	±	20	36.3	±	19.9	0.691
Frequent dry mouth		60.7%			66.7%		0.606
Needing oral therapy		67.9%			66.7%		0.916
Last dentist visit >1 year ago		64.3%			64.4%		0.989
Complete dentures		42.9%			40.0%		0.809
No help with oral hygiene		66.7%			79.5%		0.410
Nutrition-related problems	4.6	±	2.7	5.0	±	2.3	0.579

*p-value based on Chi-square test for categorical variables, independent samples t-test for normally distributed continuous variables and Mann-Whitney U test for not normally distributed continuous variables.

5.2.1.1 *Quality of life, oral symptoms and nutrition problems*

Logistic regression analysis was used to test the associations between length of residency from admission, oral care variables and nutrition-related problems, adjusted for gender and age. The data in the following two tables were previously published in *Acta Scientifica Nutritional Health*. ¹⁹⁷

Table 12 (see page 41) shows that in this age- and gender-corrected analysis, length of residency in the nursing home was related to changes in taste perception, less taste and

difficulties chewing. However, no significant relationships could be observed between participants' need for dental therapy, their last visit to the dentist and nutrition-related problems.

We also analysed nutrition-related problems, oral health and DMFT status of residents using logistic regression. The analysis was adjusted for age and gender. DMFT 12–23 was set as the reference group (best oral health).

Table 13 on page 42, shows a significant association between DMFT-28 index and chewing difficulties, avoiding certain foods, being unsatisfied with food and being unable to eat.

The same nutrition problems were more frequently observed in complete denture-wearers, except for digestion difficulties. A significant association existed between being a denture-wearer and having to stop eating during mealtimes. Further, a significant association was found between frequent dry mouth and stopping eating and being unsatisfied with food. However, no significant association was found between participants with a higher DMFT index or complete denture-wearers and taste perception.

This cross-sectional study showed that oral health was poor among residents in Icelandic nursing homes and that a great need exists for improved oral care. The findings are significant in at least two major respects. A score of DMFT-28 and being edentulous and using complete dentures was associated with nutrition-related problems, mostly related to mastication and restricted diet.

Denture-wearers and individuals who frequently had dry mouth reported that their oral health was causing them to stop eating during mealtimes. The frequency of nutrition-related problems related to malnutrition was high, and poor oral health was significantly associated with oral health problems and length of residence.

Table 12. Associations* between length of stay, oral care and nutrition-related problems.

Variable	Outcome	OR	95% CI	p-value	
Length of stay more than 1 year	Change in taste perception	3.19	1.13	9.01	0.029
	Difficulties chewing	2.82	1.04	7.64	0.041
	Less taste perception	3.57	1.28	9.99	0.015
	Difficulties in digestion	2.61	0.98	6.96	0.056
	Avoid food	1.38	0.49	3.87	0.543
	Stop eating	2.09	0.79	5.48	0.135
	Unsatisfied with food	2.36	0.88	6.38	0.089
	Not able to eat	0.67	0.23	1.97	0.466
	Needing oral therapy	Change in taste perception	2.21	0.79	6.21
Difficulties chewing		2.26	0.82	6.19	0.114
Less taste perception		0.86	0.31	2.41	0.774
Difficulties in digestion		1.97	0.71	5.49	0.195
Avoid food		1.39	0.48	4.03	0.543
Stop eating		1.04	0.38	2.82	0.941
Unsatisfied with food		2.33	0.84	6.43	0.103
Not able to eat		1.04	0.33	3.23	0.948
Last visit to dentist more than 1 year ago		Change in taste perception	1.09	0.38	3.09
	Difficulties chewing	1.35	0.49	3.70	0.556
	Less taste perception	1.24	0.45	3.42	0.682
	Difficulties in digestion	1.18	0.44	3.18	0.750
	Avoid food	0.86	0.29	2.56	0.786
	Stop eating	1.56	0.57	4.27	0.392
	Unsatisfied with food	1.16	0.42	3.20	0.778
	Not able to eat	1.16	0.42	3.20	0.778

*Analysis based on logistic regression adjusted for gender and age.

Table 13. Associations* between oral health and nutrition-related problems.

Variable	Outcome	OR	95%CI	p-value	
DMFT 24-27 ** DMFT 28 ***	Change in taste perception	1.68	0.37	7.69	0.507
		2.07	0.67	6.41	0.207
	Difficulties chewing	1.43	0.34	6.14	0.626
		5.25	1.64	16.82	0.005
	Less taste perception	1.69	0.38	7.58	0.492
		1.79	0.59	5.42	0.303
	Difficulties in digestion	3.14	0.67	14.67	0.145
		3.31	1.00	10.96	0.050
	Avoid food	4.59	0.92	22.80	0.063
		9.00	2.56	31.76	<0.001
	Stop eating	2.02	0.43	9.44	0.371
		3.06	0.93	10.06	0.065
	Unsatisfied with food	3.13	0.68	14.38	0.142
		4.32	1.37	13.64	0.013
Not able to eat	3.13	0.68	14.38	0.142	
	4.32	1.37	13.64	0.013	
Having complete dentures	Change in taste perception	1.42	0.52	3.89	0.498
	Difficulties chewing	3.89	1.32	11.50	0.014
	Less taste perception	1.52	0.56	4.10	0.410
	Difficulties in digestion	1.23	0.48	3.16	0.670
	Avoid food	6.61	1.72	25.34	0.006
	Stop eating	4.62	1.68	12.72	0.003
	Unsatisfied with food	5.46	1.74	17.16	0.004
	Not able to eat	5.46	1.74	17.16	0.004
		1.34	0.48	3.72	0.576
		1.06	0.39	2.87	0.912
Having a frequent dry mouth	Difficulties chewing	1.61	0.59	4.40	0.349
	Less taste perception	1.12	0.42	2.98	0.824
	Difficulties in digestion	2.04	0.71	5.81	0.184
	Avoid food	3.65	1.23	10.78	0.019
	Stop eating	3.15	1.14	8.75	0.028
	Unsatisfied. with food	2.79	0.96	8.16	0.061
	Not able to eat				

*Analysis based on logistic regression adjusted for gender and age. ** As compared to DMFT 12-23 teeth.

5.3 Paper III

This section is a revised version of the text “Cross-sectional study of oral health care service, oral health beliefs and oral health care education of caregivers in nursing homes”. Partial results of the presented work have been published in *Geriatric Nursing*.¹⁹⁸ This study aimed to describe self-perceived nursing dental coping beliefs among staff in nursing homes and identify their daily oral care activities.

Employees from two nursing homes were the sample in this study (N = 200). The study response rate was 54.5% (n = 109). Participants were aged from 18 to 70 years, and the majority were female (94.4%). The mean age was 38.5 ± 15.8 years, and male participants (29.7 ± 8.1 years) were significantly younger on average ($p < 0.05$) compared to female participants (39.1 ± 15.9). The data in Table 14 presents an overview of the characteristics of the participants from each nursing home and was previously published in *Geriatric Nursing*.¹⁹⁸

Table 14. Sociodemographic of care assistants, practical nurses and registered nurses.

Variable		Nursing home A		Nursing home B		Total		p-value*
		n=52	(%)	n=57	(%)	N=109	(%)	
Gender (n = 107)	Male	1	(1.9)	5	(9.1)	6	(5.6)	0.107
	Female	51	(98.9)	50	(90.9)	101	(94.4)	
Age group (n = 105)	≤25 years	21	(41.2)	13	(24.1)	34	(32.4)	0.122
	26–35 years	6	(11.8)	12	(22.2)	18	(17.1)	
	36–45 years	5	(9.8)	10	(18.5)	15	(14.3)	
	46–55 years	9	(17.6)	5	(9.3)	14	(13.3)	
	≥56 years	10	(19.6)	14	(25.9)	24	(22.9)	
Education (n = 106)	Care assistant	13	(25.5)	11	(20.0)	24	(22.6)	0.003*
	LP nurse ^a	36	(70.6)	28	(50.9)	64	(60.4)	
	R nurse ^b	2	(3.9)	16	(29.1)	18	(17.0)	
Work experience (n = 107)	<1 year	7	(13.5)	9	(16.4)	16	(15.0)	0.447
	1–6 years	25	(48.1)	22	(40.0)	47	(43.9)	
	7–12 years	3	(5.8)	8	(14.5)	11	(10.3)	
	>12 years	17	(32.7)	16	(29.1)	33	(30.8)	
Oral care service (n = 109)	Yes	49	(45.0)	50	(45.9)	99	(90.8)	0.239
	No	3	(2.8)	7	(6.4)	10	(9.2)	
Oral care training Practical (n = 105)	= Yes	26	(49.1)	27	(50.9)	53	(50.5)	0.766
	= No	24	(46.2)	28	(53.8)	52	(49.5)	
Theoretical (n = 107)	= Yes	17	(43.6)	22	(56.4)	39	(36.4)	0.523
	= No	34	(50.0)	34	(50.0)	68	(52.3)	

* Based on Chi-squared statistics, ^a Licensed practical nurse, ^b Registered nurse.

A significantly higher proportion of registered nurses worked in nursing home A. Otherwise, participants shared similar characteristics, and distribution was identical

between the nursing homes in gender, age, work experience, oral care delivery and oral care training. Though most participants (91%) provided oral care, only around half had received practical oral care training, and only 36% had received theoretical oral care training.

5.3.1.1 Oral health education and practice among nursing home personnel

A summary of oral care delivery, education in practical oral hygiene and theoretical oral health, and attitudes to oral care among care assistants, licensed practical nurses and registered nurses is shown in Table 15, which was previously published in *Geriatric Nursing*.¹⁹⁸ This table shows that all care assistants and most licensed practical nurses delivered oral care (Table 14), but one third of care assistants and just over half of licensed practical nurses had formal oral health education and practical training.

Table 15. Oral health education, oral health practice and beliefs among care assistants, practical nurses and registered nurses.

		Care assistants		Practical nurses		Registered nurses		<i>p</i> -value*
		<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	
Oral care provider	Yes	24	(100.0)	60	(93.8)	13	(72.2)	0.004*
	No	0	(0.0)	4	(6.2)	5	(27.8)	
Theoretical or practical oral health education	Yes	8	(33.3)	34	(54.0)	15	(83.3)	0.006*
	No	16	(66.7)	29	(46.0)	3	(16.7)	
All residents in my care want assistance with oral hygiene.	Agree	14	(58.3)	30	(46.9)	10	(55.6)	0.087
	Unsure	4	(16.7)	18	(28.1)	0	(0.0)	
	Disagree	6	(25.0)	16	(25.0)	8	(44.4)	
Oral care might be left out if staff are short-handed.	Agree	12	(50.0)	38	(59.4)	13	(72.2)	0.294
	Unsure	2	(8.3)	11	(17.2)	2	(11.1)	
	Disagree	10	(41.7)	15	(23.4)	3	(16.7)	
I dislike cleaning teeth/prostheses of the residents.	Agree	0	(0.0)	7	(10.9)	3	(17.6)	0.110
	Unsure	1	(4.2)	8	(12.5)	0	(0.0)	
	Disagree	23	(95.8)	49	(76.6)	14	(82.4)	
Oral health service is lacking in the nursing home.	Agree	8	(34.8)	31	(48.4)	13	(76.5)	0.071
	Unsure	10	(43.5)	18	(28.2)	1	(5.9)	
	Disagree	5	(21.7)	15	(23.4)	3	(17.6)	
Overall, the oral health of residents is acceptable.	Agree	2	(8.7)	13	(20.6)	9	(52.9)	0.007*
	Unsure	11	(47.8)	23	(36.5)	1	(5.9)	
	Disagree	10	(43.5)	27	(42.9)	7	(41.2)	
Nursing dental coping belief		69 ± 7		64 ± 10		58 ± 13		0.001*
Total score all items								

*Based on Chi-squared statistics, $p < 0.05$.

These results are significantly different from registered nurses, who are most often educated in oral health issues but less likely to deliver oral care. Further, though not statistically significant, registered nurses agreed more often than other groups that oral care

might be left out if staff were short-handed 72.2% and that oral health service was lacking in the nursing homes 76.5%. However, there was statistically significant difference in opinion of overall oral health being acceptable: fewer care assistants (9%) and licensed practical nurses (21%) agreed than registered nurses (52%). Further, registered nurses had significantly lower mean scores on the DCBS than other groups.

A single question asked whether participants had watched the educational film published by the Public Health Office intended for nursing staff on how to perform oral care for vulnerable groups, including older adults. Table 16 shows that less than one third had seen the educational film, and no significant difference was between educational groups.

Table 16. Frequency of watching film on practical oral care for vulnerable groups (N = 104).

		Care assistants		Practical nurses		Registered nurses		Total	
		n	(%)	n	(%)	n	(%)	n	(%)
Seen educational material from Public Health Office?	Yes	6	26.1	15	23.8	6	33.3	27	26.0
	No	17	73.9	48	76.2	12	66.7	77	74.0
	Total	23	100	63	100	18	100	104	100

An analysis showed that nursing home personnel with oral health education scored lower on the DCBS (62.1 ± 11.5 vs. 66.1 ± 9.5) and on the self-efficacy subscale (15.3 ± 3.1 vs. 17.0 ± 2.8) compared to those with no formal oral care education. No other subscales were significantly different.

We analysed the relationships of work experience, education and oral hygiene training with the DCBS and subscale scores (oral health coping belief, self-efficacy, internal locus of control and external locus of control) using general linear models. The data, shown in Table 17, on next page have been previously published in *Geriatric Nursing*.¹⁹⁸

Table 17. Multiple linear regression models on the relationships of education, work experience and oral hygiene training with DCBS scores.

Dependent variable	Parameter	B	95% CI		p-value
Oral health coping belief	Intercept	14.032	11.475	16.590	<0.001
	Care assistant ^a	3.095	0.646	5.544	0.014
	Practical nurse ^a	3.242	1.219	5.265	0.002
	<1 year of work ^b	0.259	-2.202	2.721	0.835
	1–6 years of work ^b	-0.514	-2.350	1.321	0.579
	7–12 years of work ^b	-0.126	-2.894	2.643	0.928
	Training in oral care: yes ^c	-0.428	-2.092	1.236	0.611
Self-efficacy	Intercept	16.184	14.255	18.112	<0.001
	Care assistant ^a	2.195	0.349	4.042	0.020
	Practical nurse ^a	0.720	-0.806	2.245	0.351
	<1 year of work ^b	0.634	-1.222	2.490	0.499
	1–6 years of work ^b	-0.623	-2.007	0.761	0.374
	7–12 years of work ^b	-1.677	-3.764	0.411	0.114
	Training in oral care: yes ^c	-1.445	-2.699	-0.190	0.024
Internal locus of control	Intercept	14.749	12.242	17.255	<0.001
	Care assistant ^a	1.502	-0.898	3.903	0.217
	Practical nurse ^a	0.665	-1.317	2.648	0.507
	<1 year of work ^b	-2.478	-4.890	-0.066	0.044
	1–6 years of work ^b	-2.061	-3.860	-0.262	0.025
	7–12 years of work ^b	-3.382	-6.095	-0.669	0.015
	Training in oral care: yes ^c	-0.915	-2.545	0.716	0.268
External locus of control	Intercept	18.687	16.171	21.204	<0.001
	Care assistant ^a	3.270	0.860	5.680	0.008
	Practical nurse ^a	1.385	-0.605	3.376	0.170
	<1 year of work ^b	-3.204	-5.626	-0.782	0.010
	1–6 years of work ^b	-2.709	-4.515	-0.903	0.004
	7–12 years of work ^b	-3.268	-5.992	-0.543	0.019
	Training in oral care: yes ^c	-1.262	-2.899	0.375	0.129
Total score	Intercept	64.239	57.421	71.057	<0.001
	Care assistant ^a	9.453	2.923	15.983	0.005
	Practical nurse ^a	5.702	0.309	11.095	0.038
	<1 year of work ^b	-4.170	-10.732	2.393	0.210
	1–6 years of work ^b	-5.800	-10.694	-0.906	0.021
	7–12 years of work ^b	-7.886	-15.267	-0.506	0.037
	Training in oral care: yes ^c	-3.911	-8.348	0.525	0.083

^a as compared to registered nurses, ^b as compared to more than 12 years, ^c as compared to no training in oral care.

Care assistants had higher scores on the DCBS, OHB, EL and Self-efficacy compared to registered nurses. Similar results were found comparing licensed practical nurses to

registered nurses on two subscales. Work experience (>12 years) was associated with higher total scores and external locus of control and internal locus of control scores compared to the other work experience categories.

Summary statistics of the distribution of responses to OHB and Self-efficacy can be seen in Table 18, and the IL and EL domains are shown in Table 19. A low score (1–2) indicates that the more appropriate answer was chosen, and a higher score (3–4) indicates a negative attitude to the question. All subscales except SE had items with a mean score of around 3 or higher, which indicates that participants were unsure or negative in their dental coping beliefs.

Table 18. Items on DCBS measuring oral health beliefs and self-efficacy (N = 109).

Item	Oral health beliefs	Strongly* disagree		Partly disagree		Unsure		Partly agree		Strongly ^o agree		Mean	± SD
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)		
1	I believe that the patients themselves report when oral health care assistance is needed.	28	(25.7)	46	(42.2)	17	(15.6)	14	(12.8)	4	(3.7)	2.3	± 1.1
4	I believe that fluoride products are most suitable for children.	10	(9.2)	17	(15.6)	50	(45.9)	27	(24.8)	5	(4.6)	3.0	± 0.9
14	Once gum disease has started, it is almost impossible to stop it ^a	23	(21.3)	39	(36.1)	36	(33.3)	10	(9.3)	0	(0.0)	2.3	± 0.9
16	If the gums bleed when you floss, this usually means that you should stop flossing.	43	(39.4)	45	(41.3)	16	(14.7)	3	(2.8)	2	(1.8)	1.9	± 0.9
20	I believe visiting the dentist is only necessary when experiencing pain.	60	(55.0)	33	(30.3)	6	(5.5)	2	(1.8)	8	(7.39)	1.8	± 0.9
22	I believe dentures are less trouble than taking care of natural teeth.	9	(8.3)	23	(21.1)	22	(20.2)	33	(30.3)	22	(20.2)	3.3	± 1.2
26	If the gums bleed when you brush, this usually means that you should stop brushing.	55	(50.5)	35	(32.1)	8	(7.3)	5	(4.6)	6	(5.5)	1.8	± 1.1
Item Self-efficacy													
2	If I brush and floss correctly, I expect fewer dental problems.	1	(0.9)	1	(0.9)	3	(2.8)	41	(37.6)	63	(57.8)	1.5	± 0.7
3	I believe that I know how different oral mucosal disorders can be treated.	26	(23.9)	37	(33.9)	17	(15.6)	27	(24.8)	2	(1.8)	3.5	± 1.2
8	If I were given oral health care training, I would be able to practice better oral health care.	2	(1.8)	10	(9.2)	13	(11.9)	55	(50.5)	29	(26.6)	2.1	± 0.9
11	I know how to floss correctly.	2	(1.8)	6	(5.5)	8	(7.3)	59	(54.1)	34	(31.2)	1.9	± 0.9
15	I know how to prevent oral candidiasis.	7	(6.4)	30	(27.5)	30	(27.5)	29	(26.6)	13	(11.9)	3.1	± 1.1
21	If I knew the facts about dental disease, I would be able to practise better oral care. ^a	1	(0.9)	9	(8.3)	22	(20.4)	48	(44.4)	28	(25.9)	2.1	± 0.9
23	I can successfully remove most of the plaque to help prevent cavities and gum disease.	1	(0.9)	13	(11.9)	37	(33.9)	40	(36.7)	18	(16.5)	2.1	± 0.9

Notes: ^a n = 108 * Most appropriate answer on Oral health belief, ^oMost appropriate answer on Self-efficacy.

Table 19. Items on DCBS measuring locus of control (N = 109).

Item	Internal locus of control	Strongly* disagree		Partly Disagree		Unsure		Partly agree		Strongly ^o agree		Mean	± SD
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)		
5	I believe teeth should last a lifetime.	3	(2.8)	17	(15.6)	27	(24.8)	36	(33.0)	26	(23.9)	2.4	± 2.2
7	I believe cavities can be prevented.	1	(0.9)	4	(3.7)	8	(7.3)	47	(43.1)	49	(45.0)	1.7	± 0.8
13	I believe flossing teeth can help prevent gum disease.	3	(2.8)	8	(7.3)	27	(24.8)	45	(41.3)	26	(23.9)	2.2	± 1.0
19	I believe that our patients want me to offer help with oral care.	1	(0.9)	5	(4.6)	10	(9.2)	44	(40.4)	49	(45.0)	1.8	± 0.9
25	I believe gum diseases can be prevented.	1	(0.9)	6	(5.5)	20	(18.3)	54	(49.5)	28	(25.7)	2.6	± 0.8
27	I believe that our patients eat better if they have a healthy, clean mouth.	3	(2.8)	6	(5.5)	15	(13.8)	40	(36.7)	45	(41.3)	1.9	± 0.9
28	I believe brushing can prevent cavities.	2	(1.8)	2	(1.8)	9	(8.3)	30	(27.5)	66	(60.6)	1.6	± 1.1
Item	External locus of control												
6	Only the dentist can prevent cavities and gum disease.	41	(37.6)	47	(43.1)	10	(9.2)	6	(5.5)	5	(4.6)	2.0	± 1.1
9	If both parents have had bad teeth, brushing and flossing will not help.	45	(41.3)	39	(35.8)	14	(12.8)	9	(8.3)	2	(1.8)	1.9	± 1.0
10	I believe that prostheses don't have to be removed during the night unless the patient wants to do so.	11	(10.1)	33	(30.3)	18	(16.5)	34	(31.2)	13	(11.9)	3.0	± 1.2
12	It is not possible to prevent sickness and medicines destroying teeth.	4	(3.7)	27	(24.8)	41	(37.6)	34	(31.2)	3	(2.8)	3.0	± 0.9
17	I believe tooth loss is a normal part of growing old.	24	(22.0)	23	(21.1)	30	(27.5)	26	(23.9)	6	(5.5)	2.7	± 1.2
18	Even if you take good care of your teeth, they fall out as you get older.	31	(28.4)	35	(32.1)	24	(22.0)	13	(11.9)	6	(5.5)	2.3	± 1.2
24	I believe that one method of brushing is just as effective as any other.	12	(11.0)	32	(29.4)	45	(41.3)	18	(16.5)	2	(1.8)	2.7	± 0.9

Notes: ^oMost appropriate answer on Internal locus of control, *Most appropriate answer on External locus of control.

5.3.1.2 Oral care activities and use of oral hygiene materials

Data in the next two tables have been previously published in *Geriatric Nursing*.¹⁹⁸ A summary of self-reported oral hygiene practice among dentate and edentate residents by nursing staff is shown in Table 20. On average, only 9% (n = 10) and 7% (n = 7) of nursing home staff reported brushing teeth and dentures more than once a day, respectively. Although oral care activities were similar between care assistants and licensed practical nurses, with the majority brushing teeth and dentures at least once a day, a significantly higher proportion of registered nurses said they brush teeth (38.5%) and dentures (30.8%) more than once a day.

Table 20. Frequency of oral care of dentate and edentate residents performed by care assistants, practical nurses and registered nurses.

	Care assistants (n = 24) °A		Practical nurses (n = 60) °B		Registered nurses (n = 18) °C		<i>p</i> -value*
	n	(%)	n	(%)	n	(%)	
Teeth							
More than once a day	2	(8.3)	3	(5.0)	5	(38.5)	0.008* °B [0.001]
At least once a day	21	(87.5)	56	(93.3)	8	(61.5)	°C [0.005]
Seldom	1	(4.2)	1	(1.7)	0	(0.0)	
Dentures							
More than once a day	1	(4.2)	2	(3.3)	4	(30.8)	0.009* °B [0.003]
At least once a day	23	(95.8)	56	(93.3)	9	(69.2)	°C [0.035]
Seldom	0	(0.0)	2	(3.3)	0	(0.0)	

*Based on Chi-squared statistics, $p < 0.05$. °Comparisons of column proportions, results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion. Significance level for uppercase letters (A, B, C): 0.05. Tests are adjusted for all pairwise comparisons within a row of each innermost sub-table using the Bonferroni correction.

Table 21 presents a summary of the use of oral care equipment and products in nursing homes. Most used a soft toothbrush (93.6%) on natural teeth and fixed prostheses and used regular toothpaste (76.3%) or water (50.5%) as a cleaning solutions on teeth. Very few used an interdental brush or dental floss (9.6%). Dentures were mostly cleaned using a soft toothbrush (62.7%) or a denture brush (36.8%). Water and mild soap were equally often used (68.8% vs. 68%) as a cleaning solution, though some used toothpaste (42.7%) as a denture cleaning agent.

Table 21. Frequency of oral care of dentate and edentate residents performed by care assistants, practical nurses and registered nurses.

Type of resource	Job title						Total (n/N)	
	Care assistants		Practical nurses		Registered nurses			
	%	(n/N)	%	(n/N)	%	(n/N)	%	(n/N)
Teeth								
Soft toothbrush (N = 88)	90.9	(20/22)	93.2	(55/59)	100	(13/13)	93.6	(88/94)
Hard toothbrush (N = 32)	31.8	(7/22)	37.3	(22/59)	23.1	(3/13)	34.0	(32/94)
Electric toothbrush (N = 24)	22.7	(5/22)	22.0	(13/59)	46.2	(6/13)	25.5	(24/94)
Interdental brush (N = 9)	13.6	(3/22)	8.5	(5/59)	7.7	(1/13)	9.6	(9/94)
Dental floss (N = 9)	0.0	(0/0)	10.2	(6/59)	23.1	(3/13)	9.6	(9/94)
Gauge or sponge (N = 24)*	9.1	(2/21)	35.6	(21/59)	7.7	(1/13)	25.5	(24/94)
Dentures								
Soft toothbrush (N = 59)	58.3	(14/24)	60.3	(35/58)	76.9	(10/13)	62.7	(59/95)
Hard toothbrush (N = 28)	25.0	(6/24)	36.2	(21/58)	7.7	(1/13)	29.5	(28/95)
Electric toothbrush (N = 8)	8.3	(2/24)	8.6	(5/58)	7.7	(1/13)	8.4	(8/95)
Denture toothbrush (N = 35)	29.2	(7/24)	41.4	(24/58)	30.8	(4/13)	36.8	(35/95)
Gauge or sponge (N = 32)	33.3	(8/24)	32.8	(19/58)	38.5	(5/13)	33.7	(32/95)

*Based on Chi-squared statistics, $p < 0.05$.

A positive oral care belief was associated with more frequent use of an electric toothbrush (23% vs. 6%, $p = 0.02$) when compared to a negative oral care belief and theoretical oral care education on the use of dental floss (18% vs. 5%, $p = 0.045$).

6 Discussion

6.1.1 Paper I: Oral health of residents and quality of life

The present study was designed to investigate the clinical oral health of nursing home residents and explore factors that attribute to their subjective OHQoL.

Oral diseases

As mentioned in the literature review, international studies on people 65 years and older living in nursing homes⁶¹ show that they have poor oral health. In agreement with these studies, the prevalence of oral diseases was high in our sample, and 40% had multifactorial chronic oral diseases resulting in edentulousness. Moreover, the majority had untreated oral problems, and significantly more OHQoL problems were detected among those who had resided longer than a year in the nursing home. From a public health perspective, this is a concern because oral diseases have been linked to systematic diseases that may affect general health and vice versa,³ as well as wellbeing and OHQoL, for both nursing home residents and community-dwelling older people.^{71,83,84}

Undetected oral health problems

These findings raise intriguing questions regarding the nature and extent of oral health care in nursing homes. According to the literature, the majority (75%) of older people admitted to nursing homes already have untreated oral diseases,⁶² have poor oral hygiene and have not visited a family dentist for years.⁷² This may be a possible explanation for this high need for dental services, along with the fact that older adults seem to have a different opinion of subjective oral health than younger generations and not feel the need for care.¹⁹⁹ Another possible explanation is the lack of regular oral health assessment, risking leaving oral symptoms unnoticed. Further, Icelandic doctors have recommended regularly monitoring oral health in addition to RAI assessment in health care.³³ Residents are generally unlikely to be aware of or able to detect their own oral diseases until they start to feel symptoms or pain.^{33,200}

Oral health screening

In the literature, RAI-MDS 2.0, which is used in Iceland to assess clinical and functional characteristics of residents,³² has shown poor validity for assessing oral health. The instrument under-detects problems that are connected to known predictors for oral health. Oral health impact reports from RAI show the dental caries rate to be 40%–70%, lower than found in clinical studies by dental professionals.²⁰¹ In an evaluation, the Canadian version of RAI showed few significant variables: dentate status, debris and age at admission to nursing home.²⁰¹

Since RAI-MDS 2.0 has obvious limitations, other alternatives could be considered to assess oral health in Icelandic nursing homes to detect oral diseases. Effort in oral health education for non-dental health care professionals has been recommended to improve the OHQoL of frail people in nursing care.¹⁰⁶ Moreover, the Revised Oral Assessment Guide and Oral Health Assessment index are both recommended as valid screening tools for non-dental healthcare professionals.²⁰² They can be used to help to detect and record oral

problems, i.e., mucosal membrane, gums, teeth, dentures, lips, tongue, saliva, oral hygiene (debris), ability to swallow, voice, and to control referral to dental professionals.²⁰² Nursing staff should recommend dental visits when needed, and IHI supports older people in Iceland to use dental services and reimburses the cost of oral treatments according to the public fee schedule.⁴⁷ However, this may not be the only obstacle because studies have noted that nursing homes may have limited resources to facilitate access to dental services.⁶² To reduce the risk of oral diseases to oral health and general health, regular inspection is needed to regulate oral care. However, concerningly, studies show that nursing home staff lack formal oral health education and training in oral care.^{141,153}

Number of teeth and edentulousness and quality of life

Another important finding in the current study was that poor oral health (high DMFT-28 and edentulousness) was significantly associated with OHQoL, resulting in functional and physical limitations, mostly related to chewing problems, less ability to eat and inability to finish eating due to oral problems. This accords with earlier observations, which showed that poor oral health is associated with OHQoL.⁷⁷ Several studies link few teeth,^{71,147,203} being dentate with sensitive teeth, loose teeth, bleeding gums, toothache and dry mouth,⁷⁴ and high DMFT¹⁴⁷ to poorer OHQoL. Edentulous older people in our study experienced poorer OHQoL compared to dentate people and a similar impact to people with the highest DMFT. Other studies of edentulous older people have reported they have worse OHQoL than dentate people.²⁰⁴ OHIP measures the negative impact of oral symptoms on OHQoL; therefore, higher scoring indicates a problem, though the frequency of the impact may vary.

Many unanswered questions remain about the oral health of nursing home residents. To prevent oral diseases, early detection is best because the progression of oral problems can be slow depending on the individual, environment and health behaviour. For practice, the recommendation made by Monaghan et al.,⁸³ who studied OHQoL with OHIP in nursing homes, is notable. They discovered that reporting dry mouth, current pain or other oral problems were more important predictors of oral health impact than the presence or absence of caries, teeth or dentures. They reasoned in their study that two simple questions could be used to detect oral impacts: “Any problems and pain in your mouth?” and “Do you have frequent dry mouth?”

Oral health issues among nursing home residents are complicated and need attention because neglecting oral care ultimately has consequences for the frail dependent. The goal of oral care for frail older people is to enable them to maintain good oral health throughout life without pain and suffering. Good oral health, low need for dental care, normal chewing function and a high number of teeth in occlusion are factors that may contribute to acceptable OHQoL among older people living in nursing homes.

6.1.2 Paper II: Oral health of residents and nutrition problems

The objective of this study was to examine the associations between the clinical oral health of nursing home residents and nutrition-related problems to identify oral health risk factors. The current study shows that over half of the nursing home residents had poor oral health

(DMFT-28), the mean DMFT was high (M = 26) and more than 40% were edentulous and used dentures. Still, surprisingly, more than 40% rated their own oral health as good. Poor oral health can reduce mastication capability due to tooth loss, and unmet treatment may compromise OHQoL and increase the likelihood of malnutrition.¹¹²

Oral diseases and nutrition-related problems

In an age-adjusted analysis, length of residency of more than a year in the nursing home was related to oral health and nutrition-related problems, i.e., change in taste perception and less taste perception, chewing difficulties, and were marginal significantly associated with digestion problems in our study. Explaining this result is difficult, but it might be related to increased frailty and sarcopenia⁹⁶ or more need for medication that may cause food–drug interactions or deteriorating nutritional status or relate to change in dietary habits.²⁰⁵ Further, increased age has shown to be associated with an increased risk of nutrition-related problems and malnutrition.¹¹⁴ Dry mouth linked to polypharmacy may be one reason, but reduced saliva may cause the progression of oral diseases and development of nutrition problems and malnutrition.^{95,102}

The most important clinically relevant finding from our logistic regression analysis of oral health (adjusted for age and gender) and nutrition-related problems was the association between poor oral health condition (DMFT-28 and dentures) and nutrition problems, which are known to be common precursors of malnutrition. Additionally, poor oral health (DMFT-28) compared to the lowest DMFT index in this sample was significantly associated with subjective oral health status and OHQoL.

The oral health impacts were chewing difficulties, digestion problems, having to avoid food because of problems with their oral health, being unsatisfied with food and not able to eat. A similar impact was associated with having dentures, except denture-wearers additionally experienced that they had to stop eating because of problems with their dentures.

According to Huang et al.,²⁰⁶ who studied self-perceived dry mouth in long-term care facilities, the odds of dry mouth among denture-wearers were 2.62 times more likely compared to non-denture-wearers. Further, participants in their study evaluated their own ability to chew food and reported fresh food and meat to be the most difficult to chew while cooked vegetables i.e., scrambled and braised food, were the easiest to chew and eat.

The frequency of dry mouth symptoms in our study was high (61% of men to 67% of women) and has been reported to be between 20% and 72%²⁰⁷ in similar studies among older people. Individuals in our study who experienced dry mouth felt that they must stop eating during mealtimes and were unsatisfied with food. This finding is consistent with a previous study that showed a strong association between dry mouth and change in food choices (shape, size and consistency) and avoidance of multiple types of food.⁴ Both dry mouth and the high need for dental treatment also reported in our study are oral impacts that might risk change in dietary habits¹⁰⁵ and the development of malnutrition.¹⁰⁶

Oral health, nutrition and oral health quality of life

In accordance with the present study showing an association between poor oral health condition (DMFT-28 and dentures) and nutrition-related problems, previous studies have demonstrated that denture-wearers are at higher risk of malnutrition than dentate people, who had satisfactory nutrition status.²⁰⁸ Nevertheless, poor oral health has been linked to OHQoL,⁷³ and dentures-wearers often report an oral health impact on their OHQoL because of problems with eating and chewing properly.^{74,199} Evidence in the literature suggests a relationship between edentulousness, poor appetite and malnutrition.⁸

However, Bakker et al.¹²⁶ found no association between edentulism, oral health problems and malnutrition, but corroborated an association with OHQoL as did our study. Previous studies evaluating nutrition-related problems have obtained inconsistent results on whether oral health and malnutrition are linked⁷⁷ to OHQoL.¹²⁶ A recent systematic review by Wong et al. recommended that the association between nutrition, oral health impacts and nutrition should be further investigated.⁸⁰

6.1.3 Paper III: Oral care and dental coping beliefs of staff

This study aimed to investigate self-perceived nursing dental coping beliefs among nursing home staff and identify their daily oral care activities.

Nursing home staff and oral health beliefs

Only one third of care assistants and half of the licensed practical nurses had some oral health education or practical training in oral care, which was significantly less than registered nurses. One interesting finding is that all care assistants in this study provided oral care but were the most unlikely to have education in oral health care. This absence of oral health education corroborates the findings of many previous studies on the education of nursing home staff.^{12,87,150-152,209}

One unanticipated finding was that registered nurses found the clinical oral health of residents more acceptable than did licensed practical nurses or care assistants. Further, though not statistically significant, the majority of registered nurses agreed more often that oral care might be left out if staff were short-handed. Workload and other care are often prioritised in nursing homes, leaving oral care as missed care for various reasons.^{16,17,146,210} This difference in oral health beliefs may be explained by the different roles and responsibilities of health professionals and other associates. Registered nurses organise the daily care in nursing homes and direct who performs specific tasks, so oral care is most likely the responsibility of other professionals.¹⁶⁷ Registered nurses are no doubt in a powerful position to support oral care in nursing homes and from other staff providing oral care.¹⁵²

If regular oral health assessment is not performed by a health professional in nursing homes, it may explain the differences in opinion in this study. Staff who provide oral care may see or notice oral problems that nurses are not aware of until complaints of oral symptoms or pain arise. Studies have shown that nursing home staff agree that oral hygiene is important in nursing homes, but they have a negative attitude to oral care. This indicates that nursing home staff lack self-efficacy and may have little belief in being able to

accomplish goals,¹⁵³ including effective oral hygiene. Though some DCBS items in the current study had a similar agreement or disagreement rate to those found by Garrido et al¹⁶⁶ and Pihlajamaki et al.,¹⁹³ our respondents were more often unsure in their oral health beliefs. This uncertainty is concerning and may be related to the minimal oral health education in this sample. In this study, registered nurses had more positive oral health beliefs than other nursing home staff, which may probably relate to their educational background and knowledge of oral health issues.

Oral hygiene

Enormous evidence exists in the literature of the power of oral hygiene to prevent oral diseases and promote good oral health. Multiple evidence-based clinical guidelines intended for nursing home staff and physicians are also available for oral care in nursing homes.^{36,168} To provide oral health care, the individual must be assessed with a valid tool, with a care plan made on clinical status, executed and followed, and revised if necessary. Older people may not see their oral health as a risk factor for general health. They may deprioritise oral hygiene, forget or be unwilling to ask for help in oral care, refuse oral care or be uncooperative.³² Oral care of frail people is a complex task and not easily performed.

This study supports evidence from our previous observations (Paper I) that the gold standard of cleaning the oral cavity at least twice a day⁵² is seldom met. These results corroborate findings that oral hygiene has been repeatedly reported as poor^{89,136} in these settings and seldom met recommended standards.¹³⁴ Our study shows brushing teeth or dentures once daily is the method of choice (residents, 59%; 26/44 vs. nursing home staff 88%; 85/97). However, the majority of respondents (Paper I) received no help from nursing home staff with oral hygiene (dentures: 76%, 38/50 vs. teeth: 85%, 17/20). This mismatch may be a result of recall bias or may show the necessity to both encourage residents in their oral care and offer assistance with oral care regularly.

Another issue was the frequent report of water as the cleaning material of choice to brush teeth and dentures. This may relate to the fact that providing oral care materials is the responsibility of the resident or their family or spouse. Again, different oral hygiene equipment is needed for dentate, edentate and dental rehabilitation patients. Therefore, certain limits may exist in nursing homes for staff to complete effective oral hygiene with the most appropriate tools and materials. This has also been confirmed as a barrier to oral care in nursing homes.^{152,186,211}

Moreover, to our best knowledge, no current standards are available to implement in oral care in Icelandic nursing homes. Therefore, oral health care policy may differ between homes and between wards in the same nursing home. Further, oral care standards in these settings may consequently differ and be linked to head nurse oral health interest, lack of interest or priorities. This finding has important implications for developing an oral care policy in nursing care aimed to provide vulnerable people with the necessary care to preserve oral health and prevent oral infections and pain to maintain QoL.

Nursing homes should provide a caring environment, where people feel at home and are treated with dignity and respect. Further, older people's independence, rights and values

should be respected. The basic oral health and health care services must fit individual needs and help the person to live their life to the fullest. People should feel safe in nursing homes and not neglected. Motivating oral care by residents and valuing their decision is important. Professional oral care and implementation of evidenced-guided protocols can empower oral care and engagement in effective oral hygiene practice. Further, oral health promotion in nursing homes is equally likely to have a positive effect on staff providing oral care as well as the oral health and wellbeing of residents.

7 Methodological considerations

The first aim of the study was to evaluate the oral health of nursing home residents and investigate QoL and nutrition-related problems (Papers I, II). The second aim was to investigate oral health beliefs and oral care activities among nursing staff (Paper III) in these settings. This chapter addresses the methodological considerations of the study and limitations of the selected research design, sample selection bias and focus on the instruments and data used in this thesis.

Cross-sectional studies

The cross-sectional study design is suitable to investigate the prevalence of disease, associated factors and association with service use or behaviour in a population at one point using, for example, a questionnaire, interview or examination.²¹² This method was used to collect information on the characteristics of interest in two samples in the nursing homes involved in the study: clinical oral health examination of residents and a retrospective survey to inspect the association with QoL and past oral care activities and current oral health beliefs.

Within the limitation of the study design, it is not possible to identify the direction of an observed association, i.e., what is a cause and what is a consequence in the relationship of two variables.²¹² Further, given the limited sample size that may undermine the internal and external validity of the study, statistical power was insufficient to detect several increased ORs as significant.^{212,213}

7.1.1 Strengths and limitations

Due to the frailty of participants, only one clinician assessed their oral health. Therefore, an inter-rater reliability check was not performed, which is a limitation to the study. A strength of this study is that an experienced dentist inspected oral health among residents and an experienced clinical dental technician (denturist) registered the OHS variables. The first screening registration form was double-checked as the denturist read aloud the patient data while the dentist screened for the second time. The screening was performed with limited tools in a reclining chair and beds not optimal for clinical screening. Some of the residents had difficulties opening their mouth that made examination more problematic. We can neither exclude that some oral health variables remained undetected and therefore not registered, nor exclude over reporting in single cases

Sample selection bias – Settings

The samples were primarily selected based on the general and specific study aims. Their selection was purposive and non-probability-based, so the sample has limited representativeness.²¹⁴ The sample in this study was geographically concentrated because the nursing homes in the study were selected based on availability (the largest nursing homes, the highest number of residents) and accessibility, being in Reykjavik or nearby municipalities. Two out of four nursing homes agreed to take part in this research; they were run by the same origination, with the same structure and services. This limits the sample selection in the study and the representativeness of the settings for the study

findings in general. Other nursing homes in Iceland might have different approaches to oral health care. Therefore, the results may not reflect the oral diseases of general nursing home residents or the oral health beliefs and oral care activities in these settings nationwide.²¹⁵

Sample selection – Participants

The study was introduced to next of kin in association with keyholders on site and advertised on notice boards in the settings. People interesting in the research could add their names to a list in nursing home A, but participants were hand-selected by head nurses in nursing home B. Head nurses made their own lists of potential participants that fit the inclusion criteria, and they later evaluated the capability of volunteers to participate in the study. Bedridden residents and those with dementia living in closed wards were excluded from the study. The characteristics of the sample may not be representative of the population because involvement was not offered to other individuals on site or someone eligible may have been missed.^{216,217} Further, the self-selection of participants in the study is more likely to characterise the nursing home residents interested in oral health issues. In the literature, cross-sectional oral health studies in nursing home settings comprise frail older people over 80 years, where the majority of participants are women.^{77,119,147,218-220} The participants in this study (Papers I, II) were thus no exception and shared similar characteristics.

Nursing home personnel caring for the residents in the study were eligible to be involved in the oral care part of the study (Paper III). Involvement was voluntary, and respondents selected themselves for the study. This may have caused self-selection bias because respondents may not represent the general population working in nursing home settings.^{214,217}

Head nurses distributed the questionnaire to eligible nursing home personnel according to our inclusion criteria. The researchers had no control over who completed the questionnaires on site. A potential limitation to the study is that the questionnaire was in Icelandic and therefore we may have missed respondents with migrant backgrounds not fluent in the language. Nearly 11% of the common labour market are women with a migrant background, and 14% of this population work in the healthcare sector or social services.²²¹

In the oral care literature, nursing personnel most often comprise women who are formal caregivers, i.e., registered nurses and practical nurses or allied nursing personnel. In the current study, the participants (Paper III) comprised 23% care assistants, 60% practical nurses and 17% registered nurses. The proportions of nursing professionals in Iceland are estimated to be 63% care assistants¹⁰, 18% practical nurses and 12% registered nurses.¹⁴² The sample in our study is therefore not identical to the general proportions found in the literature.

Other studies investigating oral health knowledge and attitudes among nursing home staff have shown that in Switzerland the sample comprised 60% qualified nurses and 40% care

assistants,²¹¹ in Canada 42% nurses and 52% allied nurse assistants,¹⁵¹ and in Finland 50% assistant nurses, 28% registered nurses and 22% care assistants.¹⁴⁸

Limitation of questionnaires

Oral health survey

DMFT describes the clinical status of present teeth in the oral cavity and can be used to estimate the prevalence of oral diseases in the population of interest. The index has been criticised because it is a summation of the number of affected teeth and DMFT scores are irreversible. The index is dependent on diagnostic thresholds for status and does not distinguish between teeth treated with caries or abutment teeth used for dental rehabilitation.¹⁹⁶ For example, an individual may have DMFT 28 but still have four to eight implants in the upper and lower jaw to support well-fitting dentures. This individual may therefore not experience a similar impact due to successful dental rehabilitation.

Oral health impact profile

Self-administrated structured questionnaires (OHIP-49, DCBS) were used in this study with pre-coded responses that may not fully represent the participants' views. The respondents may not share the same perspectives on concepts or terms used in the questionnaires. Questionnaires are susceptible to limitations if respondents have difficulty understanding the questions, their reaction is subconscious or they suffer recall bias.²²² These factors may threaten the internal validity if respondents under- or overreport true exposure. Further, memory failure regarding prior events may lead to measurement error, which may lead to loss in statistical power, biasing the test of hypothesis.²²³ Some of the residents asked to have OHIP-49 read aloud to be answered, making it susceptible to interview bias. In these instances, the interviewer could repeat questions and responses to clarify concepts if needed for the respondent. However, Reissmann²²⁴ tested the influence of different administrations of the OHIP-14 questionnaire and found that if data were collected using interviews, the method did not influence the psychometric properties of OHIP scores. Nevertheless, using long questionnaires can cause response fatigue or response bias, such as respondents avoiding the ends of scales or answering the same. The purpose of using the OHQoL assessment tool should be considered beforehand since longer versions are better for detecting specific details and the short versions seem to advantage correspondence.^{5,191}

Dental Coping Belief Scale

Multiple studies have used the 28-item English version of the DCBS by Wårdh and Sorensen,¹⁸⁶ which they adapted from the 44-item version of the original questionnaire by Wolfe et al.^{163,182} The DCBS has been used in nursing homes and long-term settings^{149,162,193,195} to investigate oral health beliefs and priorities in oral care among staff, professional²²⁵ or informal caregivers¹⁶⁶ working in long-term care. It has been validated¹⁹⁴ in Spanish but shown a low Cronbach's alpha on all domains. Others have published their findings without clarification of the validation process.^{193,225}

The analysis of internal reliability of the DCBS domains in this study showed a low Cronbach's alpha except for IL (Section 4.2 Instruments, page 23), indicating that some

items in the domains are not representative of the behaviour they are measuring. Similar findings have recently been reported by Edman and Wårdh.¹⁹⁵

Rasch item-response theory analysis was used to postulate the probability of individual responses to items in the multiple-response categories of the DCBS. The Rasch model was fitted using RStudio statistical software (RStudio 2020, PBS, Boston, MA, USA) and the likelihood ratio test, Wald test, subgroup homogeneity plots, and infit and outfit intra-class correlation coefficient plots, and local dependency was analysed.²²⁶ The Rasch model checks data unidimensionality, equal item discrimination and whether items had low susceptibility to guessing. The unidimensionality of DCBS items was further assessed using principal components analysis (PCA) of Rasch residuals to compare the observed responses in sets of items with expected values predicted by the Rasch model. The results of the Rasch PCA confirmed that questions in all domains (OHB 4, 22, SE 2, 11 23, IL, 19, 27, EL 6, 10, 24; Table 18 and Table 19) did not meet the threshold of unidimensional measurement in the question sets. These questions need to be revised and analysed further within these domains to ensure they measure behaviour within these domains.

Strengths

The strength of this research is its use of the international OHS survey assessment tool by the WHO to record clinical oral health status and the DMFT index to describe the prevalence of oral diseases.^{80,189,227,228} The OHIP-49 is a widely tested and used assessment tool to record older people's perceived OHQoL, both in its original length and in shorter versions.^{174,188,191,229} Hebling et al.¹⁸⁸ undertook a critical appraisal of existing OHQoL assessment tools for older people. They concluded that seven instruments fulfilled both the quantitative and qualitative criteria in their study: the original OHIP-49 and shorter versions (OHIP-14, OHIP-German version), Geriatric Oral Health Assessment Index, Subjective Oral Health Status Indicators, Dental Impact on Daily Living and Oral Impact on Daily Performances.

The DCBS has been widely acknowledged as a valid instrument and used in Sweden,^{149,186,195} Finland,¹⁹³ the USA^{182,225} and Chile¹⁶⁶ in nursing home settings and long-term care.

7.1.2 Ethical consideration

The study was performed in accordance with the ethical standards as described by the Declaration of Helsinki 1964 and its later amendments. It was also performed according to Icelandic laws and regulations on research and data protection, the European Code of Conduct for Research Integrity²³⁰ and the Icelandic code of conduct for public universities in Iceland.²³¹ Ethical clearance was sought from The Data Protection Authority (S-6034) and The Icelandic National Bioethics Committee, who approved the study protocol (VSN 12-207, 12-207-1).

The participants gave their written informed consent before participation in the study. No risk was involved for participants.

The researchers have no affiliations with or involvement in any organisation or entity, financial interest in conducting the research or conflict of interest to report. After completion of data collection in 2013 within nursing home A, this novel study was granted an award from the Research Fund of Hrafnista and Icelandic Public Health.

8 Conclusion

This study reached its scientific aims: The first specific aim was to inspect clinical oral health of nursing home residents and explore factors that contributes to self-perceived OHQoL. Further, the second specific aim was to examine the associaton between their clinical oral health and nutrition-related problems to indentify oral health risk factors. Finally the third specific aim was to describe the self-preceived nursing dental coping beliefs among care assistants, licensed practical nurses and registered nurses working in nursing homes and identify their daily oral activities.

Within the limitations of this observational study, the findings have identified a high prevalence of oral diseases and untreated oral health problems among residents in this sample of nursing homes. A greater length of residency in nursing homes showed a higher need for dental therapy. Moreover, having poor oral health and being edentate were associated with less mastication ability, which was associated with nutrition-related problems. Residents with poor oral health in this study had reduced OHQoL.

The second major finding was that oral care providers other than registered nurses in this study had little oral health education and training, though they were most likely to provide oral care. Further, they were less convinced they could control the oral health outcomes of residents in their care, risking the quality of oral care.

Oral care in nursing homes is a complex task that has been a constant discussion in the literature for years.

In general, it thus seems wise to review current oral health care policies in nursing homes and study if there would be a support of a valid oral health assessment tool for non-dental health professionals to regulate oral health care. Further, support seems to be lacking for oral health education and training for nursing home staff in geriatric oral health care. Further studies are needed.

9 Future perspective

Many unanswered questions remain regarding the support of the healthcare system for the oral health of nursing home residents and their care in Icelandic nursing homes.

Oral health care for the geriatric population living in institutions and the community should not be overlooked in our health care policy. The burden of oral diseases is costly for the healthcare system and has negative consequences for the individual, risking their general health, wellbeing and QoL.

The burden of oral care will continue to rise in nursing care settings. To change the current status of oral health care, groups and organisations need to work together to form inclusive oral health policy to improve and manage oral health care and deliver quality oral health services. This includes local governments and policymakers, dental associations, health and public health professionals, researchers, academia, patients and families.

HEALTHCARE SYSTEM

To develop a full picture of oral health care, additional studies will be needed to investigate how the healthcare system supports evidence-based oral care in nursing home environments. Further, investigating and documenting oral care standards in Icelandic nursing homes and their implementation into practice might be useful.

ORAL HEALTH

Certain limitations exist in investigating clinical oral health in nursing homes. This population is frail and vulnerable, and most have chronic health problems. Various research shows that oral health is poor in these settings and worse in patients with dementia, excluded from our study. Assessment of oral health and the prevalence of oral diseases is needed in these settings to evaluate the quality of oral care.

In the future, it may be feasible to implement oral care intervention in nursing homes, examine oral health at baseline, or implement oral care protocols and evaluate clinical outcomes.

ORAL CARE

Considerably more work is needed to determine the oral care competence needed for oral health care in the healthcare system. Additionally, investigations into oral health education of non-dental professionals and practical training might be useful. Moreover, documenting the current curriculum, required oral health knowledge and oral care competencies across institutions and educational levels might reveal useful information that needs to be addressed.

The voices of nursing home staff and healthcare administrators in Iceland are unknown in the literature, and qualitative research might reveal important information regarding oral care from their perspective.

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Original publications

Paper I

Munnkvillar aldraðra algengir á hjúkrunarheimilum, þörf fyrir breytingar á heilbrigðisþjónustu

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Inngangur

Lífaldur íslensku þjóðarinnar hefur hækkað og eru meðallífslíkur Íslendinga með því hæsta sem gerist í heiminum (82,5 ár). Í aldursþópnum 70 ára og eldri eru 8,3% íbúar í hjúkrunar- og dvalarrýmum samkvæmt Hagstofu Íslands, þessi hópur er fjölveigur og lifir við langvinna sjúkdóma, skerta færni og hefur takmarkaða sjálfsbjörg.^{1,2} Meðalaldur íbúa á íslenskum hjúkrunarheimilum hefur farið hækkanði síðustu ár og er um 84,7 ár,³ samhliða hefur heilsufar þeirra versnað og eins árs lifun nýfluttra lækkað úr 73,4% í 66,5%.⁴ Meirihluti íbúa er með heilabilunarsjúkdóma (39%) eða Alzheimer (29%)⁵ en heilabilaðir eru útsettari fyrir verri munnheilsu en heilsuhraustari íbúar.⁶

Minnisglöp, sjónskerðing og skert hreyfigeta getur valdið öldruðum vandkvæðum við venjubundin verk eins og daglega munn- og tannhirðu.² Öldrun getur aukið hættu á munnkvillum og stefnt munnheilbrigði í voða,^{7,8} en sjúkdómsbyrði munnkvilla er tengd við slæmt heilsufar að mati aldraðra, verri andlega líðan og aukna dánartíðni.¹ Því er mikilvægt að heilbrigðisstarfsfólk á hjúkrunarheimilum sé vel meðvitað um mikilvægi góðrar munnheilsu.

Munnurinn er fyrsta stig meltingar, með góðri tann- og munnheilsu og eðlilegum styrk í munni er hægt að nærast betur. Mikilvægt er að kynging sé virk í fæðuinntöku auk þess sem tennur, tunga, gómar og varir eru mikilvægir þættir til tjáningar. Með

Á G R I P

TILGANGUR

Erlendar rannsóknir benda til þess að munnheilsa íbúa á dvalar- og hjúkrunarheimilum sé slæm, munnkvillar séu algengir og að íbúar þurfi á tannlækningum að halda. Markmið rannsóknarinnar var að kanna ástand munnheilsu íbúa dvalar- og hjúkrunarheimila hér á landi og skoða tengsl hennar við líðan og lífsgæði þeirra.

EFNIVÍÐUR OG AÐFERÐIR

Íbúum (N=82) á tveimur dvalar- og hjúkrunarheimilum í Reykjavík var boðin þátttaka í þessari lýsandi þversniðsrannsókn. Munnheilsa íbúa var skoðuð á vettvangi og þátttakendur svöruðu spurningalista sem mat neikvæð áhrif slæmrar munnheilsu á lífsgæði.

NIÐURSTÖÐUR

Alls luku 89% (N=73) rannsókninni, meðalaldur var 86,8 ár (sf=5,7, spönn 73-100 ár). Þriðjungur íbúa var með eigin tennur og sambærilegur fjöldi var með tennur og lausa parta, en 41,5% íbúa voru alfarið tannlausir. Klínísk skoðun á munnheilsu sýndi að hátt hlutfall íbúa (67%) voru með ómeðhöndlaða munnkvilla. Íbúar með verstu munnheilsuna upplifðu að hún hefði marktækt neikvæðari áhrif á lífsgæði ($p=0,014$) færniskerðingu ($p=0,002$) og líkamleg óþægindi ($p=0,000$) en þeir sem voru betur tenntir í þessari rannsókn. Helstu vandamál vegna slæmrar munnheilsu tengdust tyggingargetu og erfiðleikum við að matast sem hafði áhrif á fæðuval sem getur leitt til ófullnægjandi mataræðis.

ÁLYKTANIR

Endurskoða þarf þjónustuúrræði á hjúkrunarheimilum og tryggja að starfsfólk hafi sértæka þekkingu á vandamálum, tengdum munnheilsu, sem kunna að hrjá íbúa. Samstillt átak opinberra aðila og heilbrigðisstarfsfólks þarf til að tryggja úrræði við hæfi á hjúkrunarheimilum þegar kemur að því að viðhalda einstaklingsbundinni munnheilsu íbúa og tengdum lífsgæðum ævina á enda.

hækkandi aldri minnkar munnvatnsframleiðsla af náttúrulegum völdum,⁹ og auk þess getur lyfjameðferð vegna langvarandi sjúkdóma eða samverkun lyfja einnig orsakað munnþurrk^{7,10} sem er slæmt fyrir tannheilsu og næringarástand.^{11,12}

Hägglund og félagar sýndu fram á að kyngingarörðugleikar og slæm munnheilsa eru óháðir áhættuþættir sem tengjast dauðsföllum meðal aldraðra sem bíða eftir varanlegri búsetu á hjúkrunarheimili. Samkvæmt niðurstöðum þeirra er mælt með því að meta reglulega munnheilsu og kyngingu í allri umönnun.¹³

Erlendar rannsóknir sýna að sterk fylgni er á milli umönnunarþarfar íbúa á dvalar- og hjúkrunarheimilum og versnandi tann- og munnheilsu.¹⁰ Fjölveikir búa oft við lélega munnheilsu¹⁴ og takmarkað aðgengi að tannlæknisþjónustu⁸ eða eiga erfitt með að sækja slíka þjónustu utan heimilis vegna hrumleika.² Munnhirða íbúa er oft ábótavant, ekki eingöngu vegna minni sjálfsbjargar,^{2,7} heldur er munnheilsuvernd ekki forgangsraðað í skipulagðri umönnun.¹⁰ Munnhirðu er ekki sinnt sem skyldi¹⁵ eða jafnvel sleppt vegna manneklu¹⁶ og tímaskorts.¹⁷

Þróun tannsjúkdóma má fyrst og fremst rekja til mataræðis¹¹ og ónógrar munnhirðu. Langvarandi sýkingar í munni geta valdið vannæringu,¹⁸ haft áhrif á þróun hjarta- og æðasjúkdóma, leitt til skammtíma blóðsmits eða ásvelgslungnabólgu ef bakteríur berast í öndunarferin.^{19,20}

Til að hægja á versnandi tann- og munnheilsu og stighækkandi umönnunarþörf síðustu æviárin er mikilvægt að skipuleggja einstaklingsbundna munnheilsuvernd, út frá þekkingu á forvörnum svo hægt sé að bæta eða viðhalda núverandi munnheilsu til æviloka.⁸ Þetta er fyrsta rannsókn hérlandis sem metur klínísku munnheilsu íbúa á hjúkrunarheimilum og því grunnur að lausnamiðuðum breytingum í þjónustu til að viðhalda eða bæta munnheilsu aldraðra.

Efniviður og aðferðir

Rannsóknin var meginindleg þversniðsrannsókn, þátttakendur (N=82) voru valdir með þægindaúrtaki úr hópi íbúa (67 ára og eldri) sem bjuggu á tveimur af fjórum stærstu (n=471) dvalar- og hjúkrunarheimilum á höfuðborgarsvæðinu. Tvö heimili vildu ekki taka þátt í rannsókninni. Heimilin sem tóku þátt voru rekin af sama rekstraraðila og buðu upp á sambærilegan aðbúnað og þjónustu fyrir íbúana. Ekki var boðið upp á þjónustu tannlækna á þessum heimilum.

Rannsóknin fékk leyfi Vísindasiðanefndar og tilkynnt til Persónunefndar.

Úrtak

Fyrirhuguð rannsókn var kynnt á vettvangi fyrir starfsfólki og íbúum og bréfleiddis fyrir aðstandendum. Mögulegir þátttakendur í rannsókninni voru íbúar með fasta búsetu á hjúkrunarheimilinu sem gátu gefið upplýst samþykki, höfðu áhuga, færni og heilsu til þess að taka þátt án þess að þurfa aðstoð starfsfólks til þess. Undanskildir voru íbúar með heilabilun og rúmbundnir. Endanlegt úrtak samanstóð af íbúum sem yfirhjúkrunarfræðingar mátu að uppfylltu þátttökuskilyrði rannsóknarinnar.

Aðferðir

Tannlæknir framkvæmdi klínísku skoðun og skráði niðurstöður á eyðublaðið *Oral Health Survey* (OHS) ásamt klínískum tannsmið sem sá síðar um gagnasöfnun (viðtal) meðal þátttakenda með lífsgæðakvarðanum *Oral Health Impact Profile* (OHIP-49) hjá þeim sem óskuðu eftir því. Að öðrum kosti fylltu þátttakendur sjálfir út lífsgæðakvarðann á eigin vegum og skiluðu til rannsakenda þegar þeir voru skoðaðir af tannlækni.

OHS listinn er notaður á alþjóðavísu til að fylgjast með breytingum á alvarleika tannsjúkdóma, faraldsfræðilegri þróun tann- og munnsjúkdóma eða þörf fyrir forvarnir eða aðgerðir til að viðhalda góðri munnheilsu.

Skoðun á munnheilsu

Á heimili A var sett upp skoðunarherbergi með stillanlegum stól fyrir þátttakendur og íbúar á heimili B voru skoðaðir í herbergjum sínum í stillanlegu rafmagnsrúmi. Notuð voru skoðunargleraugu með (2,8 x) stækkun og ljósi (ExamVision™), fjölnota munnspeglar (KERR™), einnota penslar (3M ESPE™), persónuhlífar, plastglös og pappírshakkar, spritt og sótthreinsiefni (Micro 10+™ Unident). Ef þátttakandi var með tannátu var borið flúorlakk 22600 ppm (Duraphat™) á meðferðarsvæðið.

Lífsgæðakvarði

Notaður var þýddur, staðfærður og forprófaður lífsgæðakvarði OHIP-49²¹ sem byggir á hugmyndafræði Alþjóðaheilbrigðisstofnunarinnar að flokka afleiðingar sjúkdóma stighækkandi, eftir því hversu alvarleg áhrif þeir hafa á einstaklinginn. Með því að nota hann samhliða faraldsfræðilegum rannsóknum á munn- og tannsjúkdómum getur kvarðinn veitt upplýsingar um sjúkdómsbyrði í þýði og hversu skilvirk heilbrigðisþjónusta er að draga úr sjúkdómsbyrðinni.

Kvarðinn inniheldur 49 spurningar og mælist innra réttmæti hátt (Cronbachs Alpha 0,936), hann spannar 7 svið með 5-9 spurningum: 1) *Færniskerðing*, 2) *Líkamleg óþægindi*, 3) *Sálræn óþægindi*, 4) *Líkamlegar hömlur*, 5) *Sálrænar hömlur*, 6) *Félagsleg skerðing* og 7) *Höft eða fötlun*.²¹ Til viðbótar voru spurningar um bakgrunn þátttakenda (kyn, aldur, menntun, búsetutíma á heimili, nýtingu tannlæknisþjónustu og fleira).

Munnheilsa, tanngerfi og lífsgæði

Tannátustuðull var skráður sem Decayed, Missed and Filled Teeth (DMFT) á OHS-listanum og er mæling á fjölda skemmdra, fylltra eða tapaðra tanna hjá einstaklingi. Skráðar voru upplýsingar um 28 tannseti, talningu fjögurra endaxla var sleppt, þar sem ekki var hægt að staðfesta uppkomu þeirra eða hvort þeir höfðu tapast af öðrum orsökum. Tannátustuðull 0 þýðir að einstaklingurinn hafi allar 28 skimaðar tennurnar til staðar og að þær séu heilar, en DMFT 14 þýðir að jafnmargar tennur séu heilar og þær sem eru skemmdar, fylltar eða tapaðar.

Klínískar breytur voru kóðaðar til að skoða hvort tengsl væru á milli tannheilsu og lífsgæða eftir: A) tegund tanngerva (1=tennur, 2=tennur og partar, 3=heilgómar, B) þörf fyrir meðferð hjá tannlækni (1=já, 2=nei) og C) lengd búsetu íbúa á hjúkrunarheimilinu (1=<1 ár, 2=≥1 ár).

Tafla I. Samanburður á bakgrunni íbúa (N= 73) eftir búsetu á dvalar- og hjúkrunarheimili.

Bakgrunnur þátttakenda		Hjúkrunarheimili						P gildi ^a
		A (N=38)		B (N=35)		Samtals (N=73)		
		Fjöldi (%)		Tíðni %		Tíðni %		
Kyn	Karlar	13	(34,2)	15	(42,9)	28	(38,4)	
	Konur	25	(65,8)	20	(57,1)	45	(61,6)	
	Samtals	38		35		73		0,448
Aldurshópar	Yngri en 80 ára	5	(13,2)	3	(8,6)	8	(11,0)	
	80-89 ára	23	(60,5)	14	(40,0)	37	(50,7)	
	Eldri en 90 ára	10	(26,3)	18	(51,4)	28	(38,4)	0,027 ^a
	Samtals	38		35		73		0,088
Búseta ^o	Reykjavík	26	(70,3)	29	(82,9)	55	(76,4)	
	Kaupstað	9	(24,3)	4	(11,4)	13	(18,1)	
	Þorpi	0	(0,0)	1	(2,9)	1	(1,4)	
	Sveit	2	(5,4)	1	(2,9)	3	(4,2)	
	Samtals	37		35		72		0,338
Menntun	Barnaskóli	24	(68,6)	18	(51,4)	42	(60,0)	
	Gagnfræðaskóli	11	(31,4)	10	(28,6)	21	(30,0)	
	Tæknigreinar	0	(0,0)	7	(20,0)	7	(10,0)	
	Samtals	35		35		70		0,019
Hjúskaparstaða	Ógift - ókvæntur	2	(5,4)	2	(5,7)	4	(5,6)	
	Gift - kvæntur	2	(5,4)	2	(5,7)	4	(5,6)	
	Ekkja - ekkill	27	(73,0)	23	(65,7)	50	(69,4)	
	Fráskilin(n)	6	(16,2)	1	(2,9)	7	(9,7)	
	Gift - kvæntur en maki býr annars staðar	0	(0,0)	7	(20,0)	7	(9,7)	
	Samtals	37		35		72		0,028

Skýringar: ^a Kí-kvaðrat próf. ^b Tvíhliða marktektarpróf á hlutfallstöðni í dálkum. ^oBúseta fyrir flutning á hjúkrunarheimili.

Breytur í lífsgæðakvarða eru mældar á 5 bila Likert-kvarða (0=aldrei, 1=mjög sjaldan, 2=stundum, 3=oft, 4=mjög oft). Heildarsumma á skalanum getur verið frá 0-196 stig,²¹ sá sem fær 0 stig upplifir engin neikvæð áhrif eigin munnheilsu á lífsgæði en þeir sem herra skora upplifa skert lífsgæði.²¹

Tölfræðileg úrvinnsla

Reiknuð var lýsandi og greinandi tölfræði með forritinu IBM SPSS Statistics, útgáfa 27.0. Reiknað var summuskor fyrir lífsgæðakvarðann í heild sinni og fyrir hvern undirkvarða. Meðalskor voru borin saman milli tveggja óháðra hópa og reiknað t-próf (jafnbilabreytur), kí-kvaðrat próf (raðbreytur) og miðað var við marktæknimörk p=0,05 í öllum útreikningum. Í aðhvarfsgreiningu við samanburð á meðaltölum milli óháðra hópa í var leiðrétt fyrir aldri og kyni þátttakanda. Ef gildi vantaði í spurningalistum var þeim

sleppt í útreikningum. Skýribreyta rannsóknar er klínísk tannheilsa þátttakenda, skráð samkvæmt OHS (fjöldi tanna og ástand tanna, tegund tanngerva, ástand slímhúðar). Útkoma er mæld með OHIP-49 lífsgæðakvarðanum sem mælir neikvæð áhrif munnkvilla á félagslega, sálræna og líkamlega virkni einstaklingsins og lífsgæði.

Niðurstöður

Þátttakendur og bakgrunnur

Alls gáfu 82 íbúar tveggja hjúkrunarheimila (heimili A og heimili B) kost á sér í rannsóknina, af þeim luku rúmlega 89% (N=73) báðum hlutum rannsóknar sem var að láta skoða munnheilsu og ljúka við að svara spurningalista. Fjórir hættu þátttöku (4,9%) á meðan rannsóknin stóð yfir og 5 íbúar (6,1%) mættu ekki í klíniska

Tafla II. Tannheilsa og lífsgæði í tengslum við lengd búsetu íbúa á heimilinu (N=60), meðaltal +/- staðalfrávik, hlutfall (%).

Lífsgæðakvarðar	Tími búsetu	N	Meðaltal/staðalfrávik	%	P-gildi ^a
OHIP – 49	< 1 ár	27	33,3 ± 20,3		0,159
	1 ár eða lengur	33	40,6 ± 19,6		
Færniskerðing	< 1 ár	27	9,0 ± 5,8		0,056
	1 ár eða lengur	33	11,6 ± 5,7		
Líkamleg óþægindi	< 1 ár	27	5,4 ± 4,6		0,507
	1 ár eða lengur	33	6,1 ± 3,8		
Sálræn óþægindi	< 1 ár	27	5,4 ± 4,2		0,499
	1 ár eða lengur	33	4,8 ± 3,6		
Líkamlegar hömlur	< 1 ár	27	7,7 ± 6,2		0,061
	1 ár eða lengur	33	10,8 ± 6,2		
Sálrænar hömlur	< 1 ár	27	2,1 ± 2,6		0,513
	1 ár eða lengur	33	2,5 ± 2,5		
Félagslegar hömlur	< 1 ár	27	0,9 ± 1,4		0,158
	1 ár eða lengur	33	1,6 ± 2,3		
Höft eða fötlun	< 1 ár	27	2,7 ± 2,6		0,471
	1 ár eða lengur	33	3,3 ± 3,3		
Tannheilsa					P-gildi^b
DFMT 28 – tannátustuðull ^c	< 1 ár	27		(48,1)	0,148
	1 ár eða lengur	33		(66,7)	
Munnþurrkur (mjög oft)	< 1 ár	27		(74,1)	0,881
	1 ár eða lengur	33		(75,8)	
Slímhúð (eðlileg)	< 1 ár	27		(81,5)	0,768
	1 ár eða lengur	33		(84,4)	
Þarfnast tannlæknaþjónustu	< 1 ár	27		(51,9)	0,028
	1 ár eða lengur	33		(78,8)	
Til tannlæknis	< 1 ár	27		(48,0)	0,113
	1 ár eða lengur	33		(68,8)	
Með heilgóm	< 1 ár	27		(29,6)	0,087
	1 ár eða lengur	33		(51,5)	
Tannheilsa (góð)	< 1 ár	27		(50,0)	0,221
	1 ár eða lengur	33		(40,6)	

Skýringar: ^aT-próf tveggja óháðra úrtaka. ^bKí-kvaðrat próf. ^cDMFT 28: Allar 28 tenner eru skemmdar, fylltar eða tapaðar.

skoðun. Þátttakendur voru á aldrinum 73 til 100 ára og var meðalaldur þeirra 86,8 ár (± 5,7). Aldur íbúa á heimili A var örlítið lægri (85,5 ára, ± 5,6 ár) heldur en íbúa á heimili B (88,2 ára, ± 5,8 ár) og fleiri konur (61,6%) en karlar tóku þátt í rannsókninni, sjá töflu I.

Niðurstaða skimunar á munnheilsu

DMFT-stuðull allra þátttakenda sem lýsir fjölda skemmdra, tapaðra eða fylltra tanna var á bilinu 12-28, einn einstaklingur skar sig úr með bestu tannheilsuna, eða 16 heilar tenner. Meðaltals DMFT var 25,7 (± 3,3) sem telst vera hátt og bendir til þess að útbreiðsla munnkvilla sé algeng í þessum hópi M= (karlar 25,5 ± 3,9, n=28; konur 25,8 ± 2,9, n=45). Meirihluti tanna hafði tapast en 32,5% tanna var til staðar hjá þátttakendum (karlar 30,1%; konur 33,4%),

af tönnum voru 9,4% heilar en aðrar voru viðgerðar (20,7%) eða með tannskemmd (2,4%). Að meðaltali voru um 9 tenner til staðar í munn þátttakenda (karlar 8,7 ± 9,9 tenner; konur 9,4 ± 9,2 tenner).

Algengast var að íbúar væru með heilgóm í efri kjálka (60,3%; n= 44), tenner og föst tanngervi (31,5%; n=23) og parta (8,2%; n=6). Tafla V í viðauka sýnir fjölda tanna og algengustu tanngervi í báðum kjálkum meðal þátttakenda.

Skoðun tannlæknis á ástandi munnheilsu sýndi að meirihluti allra þátttakenda (67,1%; n=49) þurfti á tannlæknaþjónustu að halda (tannhreinsun, skemmdir, brotnar tenner, tannhalds- eða tannholdsþólga, þarf tanngervi, tannsteinn, aðrir munnkvillar). Í sjálfsmati íbúa (n=70) á eigin tannheilsu reyndist meirihluti (88,6%, n=62) það er jafn margir meta tannheilsu sína *góða* (44,3%) eða

Tafla III. Samanburður á meðalskori^a á lífsgæðakvörðum eftir fjölda skemmda, fylltra eða tapðra tanna meðal íbúa (N=73), meðaltal +/- staðalfrávik.

Lífsgæðakvarðar	DMFT hópar	Meðaltal/staðalfrávik	P-gildi
OHIP 49	<23 (n=20) ^a	26,5 ± 4,4	0,014
	24-27 (n=12) ^b	34,7 ± 5,7	0,425
	28 (n=41) ^c	39,8 ± 3,1	ref. [#]
Færniskerðing	<23 ^a	7,0 ± 1,2	0,002
	24-27 ^b	9,4 ± 1,6	0,185
	28 ^c	11,8 ± 0,9	ref.
Líkamleg óþægindi	<23 ^a	4,2 ± 0,9	0,078
	24-27 ^b	5,7 ± 1,2	0,711
	28 ^c	6,2 ± 0,6	ref.
Sálræn óþægindi	<23 ^a	5,4 ± 0,8	0,359
	24-27 ^b	5,8 ± 1,1	0,278
	28 ^c	4,4 ± 0,6	ref.
Líkamlegar hömlur	<23 ^a	4,8 ± 1,3	0,000
	24-27 ^b	8,2 ± 1,7	0,191
	28 ^c	10,7 ± 0,9	ref.
Sálrænar hömlur	<23 ^a	2,1 ± 0,6	0,551
	24-27 ^b	2,1 ± 0,8	0,635
	28 ^c	2,5 ± 0,4	ref.
Félagslegar hömlur	<23 ^a	1,0 ± 0,4	0,727
	24-27 ^b	1,5 ± 0,5	0,595
	28 ^c	1,2 ± 0,3	ref.
Höft eða fötlun	<23 ^a	2,0 ± 0,6	0,172
	24-27 ^b	2,0 ± 0,8	0,291
	28 ^c	3,0 ± 0,5	ref.

Skýringar: ^aHópar skilgreindir eftir DMFT bornir saman við viðmiðunarhóp með allar tennur skemmdar, fylltar eða tapðar, leiðrétt var fyrir aldri og kyni. ^bDMFT < 23: Íbúar með 12-23 tennur, skemmdar, fylltar eða tapðar (5-16 tennur heilar). ^cDMFT 24-27: Íbúar með 24-27 tennur skemmdar, fylltar eða tapðar. (1-4 tennur heilar). [#]DMFT 28: íbúar með allar 28 tennurnar skemmdar, fylltar eða tapðar. #ref: Viðmiðunarhópur.

hvorki góða né slæma, en fáir íbúar (11,4%) mátu eigin tannheilsu slæma.

Munnheilsa og lífsgæði

Samband milli munnheilsu og lífsgæða (meðalskor) var skoðað hjá þeim sem gáfu upplýsingar um hversu lengi þeir hefðu búið á heimilinu (N=60). Í töflu II sést að þeir íbúar sem höfðu búið skemur en eitt ár á heimilinu voru með betri munnheilsutengd lífsgæði heldur en þeir sem höfðu búið þar lengur á öllum kvörðum, nema kvarðanum sem metur *Sálrænar hömlur* (svo sem kviða, áhyggjur eða vanlíðan tengt tannheilsu).

Í töflu II sést að íbúar sem búið höfðu lengur en eitt ár á hjúkrunarheimili voru marktækt oftar útsettir (78,8%) fyrir ómeðhöndluðum munnkvillum og höfðu þörf fyrir tannlæknisþjónustu heldur en íbúar sem búið höfðu innan við 12 mánuði á hjúkrunarheimili (51,9%).

Niðurstöður í töflu III sýna að marktækur munur var á milli þeirra sem höfðu hæsta tannátustuðulinn (DMFT 28) á undirkvörðunum *Færniskerðing* og *Líkamlegar hömlur*, auk þess var meðaltal á kvarðanum *Líkamleg óþægindi* (kjálkaverkir, höfuðverkur, tannkul eða hitaþól, tannpína, sár í munni) nærri martæknimörkum, það er í samanburði við þá sem voru betur settir (tafla III).

Samkvæmt niðurstöðunum upplifa einstaklingar með hæsta tannátustuðulinn marktækt verri lífsgæði í tengslum við tyggingargetu en aðrir hópar. Vandamálin lýsa sér helst í því að íbúinn þarf að hætta að borða í miðjum matartímum, hann getur ekki ekki borðað hvaða mat sem er (epli, gulrætur, kjöt og fleira) og metur ástandið þannig að eigin melting og mataræði sé ófullnægjandi vegna munnheilsunnar.

Kannað var hvort marktækur munur væri á meðaltalsskori á lífsgæðakvörðunum með tilliti til tannheilsu og tanngerva. Tafla IV sýnir að notendur heilgóma (gervitanna) í báðum gómum upplifa marktækt verri lífsgæði á kvörðunum *Færniskerðing*, *Líkamlegar hömlur* og *Höft eða fötlun* (til dæmis verri heilsa, fjárhagsleg byrði, minni lífsánægja eða vera ófær um venjubundin störf) í samanburði við tennta íbúa án eða með föst tanngervi eða tannstudda parta. Síðarnefndi hópurinn upplifði martækt oftar *Sálræn óþægindi* (til dæmis uppnám, depurð, einbeitingarskort, svefntruflanir) en tannlausir.

Umræða

Þátttakendur

Meðalaldur þátttakenda (N=73) í rannsókninni var 86,8 ár (± 5,7),

Tafla IV. Samanburður á meðalskori^a tennra íbúa (n=43) og tannlausra með heilgómasett (n=30) meðaltal +/- staðalfrávik, hlutfall (%).

Lífsgeðakvarðar	Klínísk staða	Meðaltal/staðalfrávik	P-gildi
OHIP 49	Tennur, föst tanngervi, partur ^a	31,9 ± 3,1	0,083
	Heilgómasett ^b	40,2 ± 3,6	
Færniskerðing	Tennur, föst tanngervi, partur	8,7 ± 0,9	0,011
	Heilgómasett	12,1 ± 1,0	
Líkamleg óþægindi	Tennur, föst tanngervi, partur	4,9 ± 0,6	0,118
	Heilgómasett	6,5 ± 0,7	
Sálræn óþægindi	Tennur, föst tanngervi, partur	5,7 ± 0,6	0,022
	Heilgómasett	3,7 ± 0,7	
Líkamlegar hömlur	Tennur, föst tanngervi, partur	6,8 ± 0,9	0,002
	Heilgómasett	11,3 ± 1,1	
Sálrænar hömlur	Tennur, föst tanngervi, partur	2,4 ± 0,4	0,744
	Heilgómasett	2,2 ± 0,5	
Félagslegar hömlur	Tennur, föst tanngervi, partur	1,4 ± 0,3	0,303
	Heilgómasett	0,9 ± 0,3	
Höft eða fötlun	Tennur, föst tanngervi, partur	2,0 ± 0,4	0,027
	Heilgómasett	3,5 ± 0,5	

Skýringar: ^aHópar skilgreindir eftir tanngervum bornir saman við viðmiðunarárhóp án eigin tanna, leiðrétt var fyrir aldri og kyni. ^bEinstaklingar með eigin tennur, föst tanngervi (brýr, krónur) og/eða part studdan af eigin tönnum. ^cEinstaklingar sem tapað hafa eigin tönnum og nota heilgóm (gervitennur) í báðum kjálkum.

fleiri konur (62%) en karlar tóku þátt sem er í samræmi við aðrar rannsóknir.²² Samsetning íbúa á báðum heimilum var sambærileg að flestu leiti, en hlutfallslega fleiri íbúar í aldurshópnum 90 ára og eldri bjuggu á heimili B.

Munnheilsa íbúa á hjúkrunarheimilum

Niðurstöður rannsóknarinnar benda til þess að þó tannleysi sé meðhöndlað með sérsníðuðum tanngervum eins og heilgómasetti, komi slíkt ekki í staðinn fyrir eigin tennur. Notendur heilgóma upplifa sömu vandamálin og þeir sem eru með hæsta tannátustuðulinn (samanber tafla III) sem er skert tyggingarfærni, verri melting og ófullnægjandi mataræði. Tannlausir upplifa marktækt oftar að munnheilsan valdi þeim erfiðleikum við tyggingu og tal, óþægindum við að matast, versnandi heilsufari og minni lífsánægju en þeir íbúar sem hafa tennur, í þessari rannsókn.

Í Heilbrigðisáætlun til 2030 er lítið talað um tannheilsu aldradra,²³ en árið 2010 var stefnt á að yfir 50% fólks 65 ára og eldra hefði að minnsta kosti 20 tennur í samanbiti sem er talið vera ásættanlegt til að tyggja og tjá sig.²⁴ Þessi markmið hafa ekki náðst í þessum hópi þar sem meðalfjöldi tanna eru 9 á hvern íbúa. Tannleysi hjá 80 ára og eldri var 76%²⁵ um aldamótin en hefur lækkað í 41% í þessari rannsókn.

Það er mikilvægt að þekkja tengsl milli tannheilsu og almennrar heilsu ásamt tengsla tann- og munnheilsu við fæðuval og næringarástand aldradra.¹² Vannæring er algeng hjá eldra fólki, ástandið hefur áhrif á andlega- og líkamlega færni einstaklingsins.¹²

Heilsuvernd, munnhirða og aðgengi að þjónustu

Öldrunarteymi heilbrigðisstofnana er ráðgefandi aðili um greiningu og meðferð aldradra til starfsmanna sem sinna heilsuvernd. Hérlandis mæla öldrunar- og lyflæknar með að til viðbótar við heilsufarsskráningar í RAI-matstækið á hjúkrunarheimilum sé sérstaklega fylgst með tannheilsu, sjón og beinheilsu í heilsuverndarskyni.²⁶ Taka verður undir þessar ábendingar því fjöldi ómeðhöndlaðra munnkvilla (67%) er áhyggjuefni og sýnir þörfina á forvörnum og því að fylgst sé reglulega með munnheilsu íbúa, ekki síst þar sem þeir eru ólíklegir til að gera sér grein fyrir alvarleika ástandsins sjálfir.^{20,26}

Erlendar rannsóknir sýna að starfsfólk hjúkrunarheimila skortir formlega menntun og þjálfun^{16,27,28} til að takast á við verkefnið og að þessum þætti sé sleppt í daglegri umönnun¹⁵ af ýmsum orsökum, svo sem tímaskorti.

Sjúkratryggingar Íslands taka fullan þátt í niðurgreiðslu vegna

tannlækninga aldraðra og er þjónustan íbúum á hjúkrunarheimilum að kostnaðarlausu²⁹ samkvæmt gildandi gjaldskrá ríkisins. Því ættu þjónustugjöld tannlækna ekki að íþyngja íbúum, aðstandendum eða hjúkrunarheimilinu.²⁴

Æskilegt er að sett verði stefna um munnheilsuvernd í heilbrigðisþjónustu íbúa og tryggja aðgengi þeirra að tannlækniþjónustu. Munnhirða þarf að vera regluleg og við hæfi og þjálfun og þekking starfsfólks tryggð í samræmi við gæðastaðla í heilbrigðisþjónustu.³⁰

Niðurstöður rannsóknarinnar eru gagnlegar og birta fyrstu upplýsingar um munnheilsu íbúa á hjúkrunarheimilum og áhrif munnkvilla á lífsgæði þeirra. Einnig kom í ljós að fjöldi skemmdra, fylltra og tapaðra tanna, tannleysi og tanngervi skipta máli í þessu sambandi. Mælt er með frekari rannsóknum á munnheilsuvernd íbúa á hjúkrunarheimilum og skimunartækjum sem starfsfólki, öðru en tannheilsuvenntuðu, stendur til boða.

Styrkleikar og veikleikar

Eiginleikar þverfræðilegra rannsókna eru þess eðlis að ekki er hægt að greina á milli orsaka og afleiðinga. Úrtakið var valið af hentugleika og þátttaka íbúanna takmarkaðist við áhuga og heilsufar þeirra til að taka þátt. Mismunandi vinnuaðstæður við klíniska skoðun gætu hafa komið í veg fyrir að munnkvillar greindust á heimili B. Hluti úrtaksins (n=13) svaraði ekki spurningu um hversu lengi þeir höfðu búið á heimilinu sem getur þjagað samanburð eftir búsetu í svo litlu úrtaki og verið vísbending

um minnisglöp en þekkt er að meðaldvalartími heilabílaðra á hjúkrunarheimilum er lengri hérlandis en annarra íbúa.⁴

Rannsóknin gefur mynd af munnheilsu íbúa tveggja hjúkrunarheimila sem rekin eru af sömu rekstraraðilum. Niðurstöður hefðu hugsanlega orðið aðrar ef fleiri heimili hefðu gefið kost á sér í rannsókna.

Styrkleikar rannsóknarinnar felst í því að nota þekkta alþjóðlega mælikvarða um munnheilsu OHS og tannheilsutengd lífsgæði OHIP-49.

Ályktun

Breytingar á tannheilsu aldraðra kallar á endurskoðun á þjónustuúrræðum á hjúkrunarheimilum og sýnir fram á þörf fyrir haldgóða þekkingu starfsfólks á sértækum munn-, tann- og tanngervatengdum vandamálum sem búast má við að finnist hjá íbúum.

Samstillt átak opinberra aðila og heilbrigðisstarfsfólks þarf til að tryggja úrræði við hæfi á hjúkrunarheimilum þegar kemur að því að viðhalda tannheilsu íbúa svo hægt verði að tryggja að munnheilsutengdum lífsgæðum sé viðhaldið ævina á enda.

Þakkir

Lýðheilsusjóður og Rannsóknarsjóður Hrafnistu fá þakkir fyrir styrki vegna rannsóknar. Starfsfólk fyrir aðstoð á vettvangi og þátttakendur fyrir framlag sitt til rannsóknar.

Greinin barst til blaðsins 22. febrúar 2022, samþykkt til birtingar 10. júní 2022.

Viðauki

Tafla V. Fjöldi íbúa með tennur og föst tanngervi, tennur og parta eða heilgóma í báðum gómum.

	Karl	Kona	Samtals
Tannheilsa	Fjöldi (% ^a) (% ^b)	Fjöldi (% ^a) (% ^b)	Fjöldi (% ^b)
Tennur og föst tanngervi	8 (28,6) (11,0)	15 (33,3) (20,5)	23 (31,5)
Eigin tennur og laus tanngervi ^c	8 (28,6) (11,0)	12 (26,7) (16,4)	20 (27,4)
Heilgómur (tannlaus)	12 (42,9) (16,4)	18 (40,0) (24,7)	30 (41,1)
Samtals	28 (100,0) (38,4)	45 (100,0) (61,6)	73 (100,0)

Skýringar: ^ahlutfall innan kyns, ^bhlutfall af heild. ^cMeð heilgóm eða tennur og part í öðrum gómi á móti eigin tönnum með eða án parts.

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ENGLISH SUMMARY

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Oral health problems in nursing homes, revision of oral health care delivery is needed

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Key words: Oral Care, Nursing homes, Geriatric care, Health care, Oral health, Quality of life.

INTRODUCTION: Prevalence of oral health problems among nursing home residents is common, they suffer from oral diseases and need dental service. The aim of this study was to examine clinical oral health of Icelandic nursing home residents and their oral health quality of life.

MATERIAL AND METHODS: Total (N=82) residents in two nursing homes in Reykjavik gave their consent to be involved in this descriptive cross-sectional study. Residents participated in a clinical oral health examination at site and answered oral health quality of life questionnaire.

RESULTS: Total 89% (N=73) residents completed the study, mean age 86.8 years (SD=5.7, range 73-100 years), of whom third had their own teeth and like had teeth, and partial dentures, while 41.1% were completely edentulous. The clinical oral health examination showed high prevalence of untreated oral health problems (67%).

Residents with the worst oral health scored significantly higher than those who were better dentate, affecting their oral health quality of life (p=0.014), functional limitation (p=0.002) and physical disability (p=0.000). Most oral health problems interrelated to chewing, eating and limited ability to eat certain foods affecting their capability of food intake.

CONCLUSION: Current administration of oral health care in nursing home needs alteration and the qualification in geriatric oral health and oral health care must be guaranteed among nursing staff in these settings. The public and health professions should work together in oral care matters in nursing homes to maintain oral health and lifelong oral health quality of life among residents.

Paper II



Oral Care, Oral Health and Associated Nutrition Related Problems in Icelandic Nursing Home Residents

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Abstract

Background and aims: Old adults in nursing homes have often poor oral health and malnutrition. The aim of this study was to investigate the associations between oral health and nutrition related problems in Icelandic nursing home residents.

Methods: This cross-sectional study included older adults (> 67 years, N = 82) from two nursing homes from the Reykjavik capital area, Iceland. Two dentists performed a clinical examination using the Oral Health Survey form and a clinical dentist collected further data. Information on nutrition related problems (possible range from 0 to 8) were retrieved from the Oral Health Impact Profile.

Results: The mean decayed, missed and filled teeth (DMFT) index was around 26, however, still 42% of participants rated their oral health as good. Two thirds of the participants were in need of dental therapy and a similar proportion of participants had the last dentist's visit > 1 year ago. More than 40% had complete dentures and the number of nutrition related problems was 4.8 ± 2.5 .

According to age and sex adjusted analysis, poor DMFT was significantly related to difficulties to chew, avoiding certain foods, stop eating food and to not being able to eat, however, not to changes in taste perception. Having complete dentures was very similarly associated with these nutrition related problems. Length of residence was related to changes in taste perception and difficulties to chew, however no significant relations could be seen between need for dental therapy, last dentist's visit and nutrition related problems.

Conclusion: In Icelandic nursing home residents oral health is poor and there is a great need for improved oral care. The frequency of nutrition related problems related to malnutrition is high and poor oral health is significantly associated with these problems as it is length of residence.

Keywords: Oral Health; Malnutrition; Old Adults

Introduction

Older adults living in long term care facilities often face difficulties in approaching dental care when needed, which increases the risk for poor oral health in this group. High expenses related to a dentist's visit, ignoring the importance of appropriate oral care, mobility limitations and anxiety related to the discomfort of dental interventions have been speculated to be related to a low frequency of dental care access [1]. Additionally, a limited enthusiasm of

some dentists to bring dental service to institutionalized old adults can worsen oral health in this group [1].

Thus, not surprisingly, research has been shown that older adults staying in nursing homes have poor oral health status [2]. Further typical characteristics of nursing home inhabitants, e.g. multi-morbidity, help needed for oral hygiene, functional limitations in hands as well as polypharmacy, have been reported to further negatively affect oral diseases older adults [3].

Several studies have indicated that a poor oral health status is related to higher odds of malnutrition [4]. The frequently observed loss of teeth and/or failure of dental rehabilitation can be related to a loss of chewing abilities and potentially to a decrease of intake of nutritious food. Residents of institutions who have become completely toothless face great restrictions in their dietary choices and experience less satisfaction when eating, unintentional weight loss as well as a risk of being undernourished [5].

Recognizing the growing number of old adults living in long term care facilities as well as the the relevance of oral health status for the general health as well as potentially for nutrition status in older adults, the aim of this study was to investigate the associations between oral care, oral health and nutrition related problems in Icelandic nursing home residents.

Materials and Methods

Subjects and study design

This cross-sectional study included older adults (67 years and older, N = 82) who were recruited from two nursing homes from the Reykjavik capital area in Iceland which were run by the same operator and thus offered comparable facilities and services for residents. The participants were permanent residents at the nursing homes. Potential participants were excluded from participation if they had a diagnosis of dementia or if they were bedridden. After presenting the study's objectives at the nursing home facilities, residents could volunteer for study participation. The head nurses from the wards confirmed that potential participants met the inclusion criteria.

The study was authorized by the Icelandic National Bioethics Committee (nos. 12-207 and 12-207-1) and reported to the Data Protection Committee (no. 6204) and has therefore been performed in accordance with the ethical standards as described by the Declaration of Helsinki 1964 and its later amendments. The subjects gave their written informed consent before participation in the study.

Study conduct

Two dentists performed a clinical examination at the nursing homes in an examination room which was equipped with an adjustable chair for the participants, including examination lights, multi-purpose mouth mirrors, periodontal scalers, fluoride var-

nish, disposable brushes, alcohol and disinfectants, and disposable personal protective equipment (rubber gloves, face masks). If a participant had caries, fluoride varnish was applied to the treatment area. The same materials and utensils were used in both homes.

A clinical dentist collected further oral health related and general data from the participants using various self reported questionnaires, although participants received support when needed in answering the questionnaires.

Measurements

Clinical examination

The results from the clinical examination of oral and dental health were recorded using the Oral Health Survey form (OHS) according to the standards of the World Health Organization. The OHS instrument has been widely used to monitor dental and oral diseases and also to examine the need for prevention and measures to maintain the dental health of residents in residential and nursing homes. For the present study, the following variables from the clinical examination were used: Need for oral therapy (yes vs. no), complete dentures (yes vs. no), decayed, missed and filled teeth (DMFT) index.

The dental index was recorded as DMFT, which is a measure of the number of damaged, filled or lost teeth in an individual. Information was recorded on 28 of the 32 teeth, i.e., third molars were not included in the evaluation. An index of 0 means that the individual has all 28 teeth present and they are undamaged, while a DMFT 28 means that all 28 teeth are damaged, filled or lost [6].

Self rated oral health

The participants rated their oral health in three categories: good vs neutral vs bad.

Oral Health Impact Profile (OHIP)

OHIP is a 49 items questionnaire consisting of 7 subscales which assesses the social impact of poor oral health. It measures people's perception of the impact of oral disorders on their well-being, i.e., functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap caused by oral conditions. The questions are answered using a Likert scale (0 = never, 1 = very rare, 2 = sometimes, 3 = often, 4 = very often), thus, OHIP results into a score between 0 and

196 and higher scores indicating higher negative impact on well being due to poor total health [7].

Information on eight nutrition related problems was retrieved from single questions from OHIP

- Do you have experienced changes in taste perception because of problems with your teeth, mouth, or dentures?
- Do you have less taste perception because of problems with your teeth, mouth, or dentures?
- Do you have difficulties to chew because of problems with your teeth, mouth, or dentures?
- Do you have difficulties with your digestion because of problems with your teeth, mouth, or dentures?
- Do you avoid food because of problems with your teeth, mouth, or dentures?
- Do you have to stop eating because of problems with your teeth, mouth, or dentures?
- Are you unsatisfied with food because of problems with your teeth, mouth, or dentures?
- Are you not able to eat because of problems with your teeth, mouth, or dentures?

These nutrition related answers were dichotomized into “yes” and “no”. The summary score of these possible nutrition related problems had a potential range from 0 to 8.

Background variables

Data on background variables, i.e., gender, age, education, length of residence (≤ 1 year vs. > 1 year), help with oral hygiene, smoking, etc. were collected using questionnaires.

Statistical analysis

The data were analysed using statistical software (SPSS, version 26.0, SPSS, Chicago, IL, USA). Normality of data variables was checked using the Kolmogorov-Smirnov test. Data are presented as mean ± standard deviation (SD).

Differences between groups at baseline were calculated using independent samples’ t-test (normally distributed variables) or Mann-Whitney-U test (not normally distributed variables) and chi-square test for categorical variables.

Associations between length of residence, oral care and nutrition related problems were investigated using logistic regression models adjusted for age and sex. Associations between oral health and nutrition related problems were also investigated using logistic regression models. All estimates were reported as odds ration (OR) with 95% confidence intervals (95% CI). The level of significance was set at P < 0.05.

Results

The characteristics of the participants can be seen in table 1. The characteristics of male and female participants were similar (with exception of education). The mean DMFT index was around 26 and more than 55% had at DMFT of 28, however, still 42% of participants rated their oral health as good. Around two thirds of the participants were in need of dental therapy and a similar proportion of participants had the last dentist’s visit more than one year ago. More than 40% had complete dentures and the mean number of nutrition related problems was 4.8 ± 2.5.

	Men			Women			
Variable	(n = 28)			(n = 45)			P-value*
Age (years)	86.6	±	5.7	86.9	±	5.9	0.817
smoking (yes)		17.9%			8.9%		0.257
Basic school education		50.0%			82.2%		0.004
Widowed/alone/not married/divorced		92.9%			95.6%		0.622
Length of residence more than 1 year		50.0%			44.4%		0.644
Good self rated oral health		39.3%			46.7%		0.176
DFMT index	25.5	±	3.9	25.8	±	2.9	0.765

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DFMT index = 28		57.1%			55.6%		0.929
OHIP	34.4	±	20	36.3	±	19.9	0.691
Frequent dry mouth		60.7%			66.7%		0.606
In need for oral therapy		67.9%			66.7%		0.916
Last dentist visit more than 1 year ago		64.3%			64.4%		0.989
Complete dentures		42.9%			40.0%		0.809
Receive no help with cleaning dentures or teeth		66.7%			79.5%		0.410
Nutrition related problems	4.6	±	2.7	5.0	±	2.3	0.579

Table 1: Characteristics of the participants.

*P-value based on chi square test for categorical variables, independent samples t-test for normally distributed continuous variables and Mann Whitney U test for not normally distributed continuous variables.

Table 2 shows the association between length of residence, oral care and nutrition related problems. In this age and sex corrected analysis, length of residence was related to changes in taste perception, less taste and difficulties to chew, however no significant relations could be seen between need for dental therapy, last dentist’s visit and nutrition related problems.

Variable	Outcome	OR	95%CI		P-value
Length of stay more than one year	Change in taste perception	3.19	1.13	9.01	0.029
	Difficulties to chew	2.82	1.04	7.64	0.041
	Less taste perception	3.57	1.28	9.99	0.015
	Difficulties in digestion	2.61	0.98	6.96	0.056
	Avoid food	1.38	0.49	3.87	0.543
	Stop eating	2.09	0.79	5.48	0.135
	Unsatisfied. with food	2.36	0.88	6.38	0.089
In need for oral therapy	Not able to eat	0.67	0.23	1.97	0.466
	Change in taste perception	2.21	0.79	6.21	0.133
	Difficulties to chew	2.26	0.82	6.19	0.114
	Less taste perception	0.86	0.31	2.41	0.774
	Difficulties in digestion	1.97	0.71	5.49	0.195
	Avoid food	1.39	0.48	4.03	0.543
	Stop eating	1.04	0.38	2.82	0.941
Last visit to dentist more than one year ago	Unsatisfied. with food	2.33	0.84	6.43	0.103
	Not able to eat	1.04	0.33	3.23	0.948
	Change in taste perception	1.09	0.38	3.09	0.873
	Difficulties to chew	1.35	0.49	3.70	0.556
	Less taste perception	1.24	0.45	3.42	0.682
	Difficulties in digestion	1.18	0.44	3.18	0.750

	Avoid food	0.86	0.29	2.56	0.786
	Stop eating	1.56	0.57	4.27	0.392
	Unsatisfied. with food	1.16	0.42	3.20	0.778
	Not able to eat	1.16	0.42	3.20	0.778

Table 2: Associations* between length of stay, oral care and nutrition related problems.

*Analysis based on logistic regression adjusted for sex and age.

Table 3 shows the associations between oral health and nutrition related problems. Poorer DMFT status was significantly related to difficulties to chew, avoiding certain foods, stop eating food and to not being able to eat, however, not to taste perception. Hav-

ing complete dentures was very similarly associated with nutrition related problems. Having frequently a dry mouth was related to stop eating and being unsatisfied with food.

Variable	outcome	OR	95%CI		P-value
DFMT 24-27 teeth**	Change in taste perception	1.68	0.37	7.69	0.507
DFMT 28 teeth**		2.07	0.67	6.41	0.207
	Difficulties to chew	1.43	0.34	6.14	0.626
		5.25	1.64	16.82	0.005
	Less taste perception	1.69	0.38	7.58	0.492
		1.79	0.59	5.42	0.303
	Difficulties in digestion	3.14	0.67	14.67	0.145
		3.31	1.00	10.96	0.050
	Avoid food	4.59	0.92	22.80	0.063
		9.00	2.56	31.76	<0.001
	Stop eating	2.02	0.43	9.44	0.371
		3.06	0.93	10.06	0.065
	Unsatisfied with food	3.13	0.68	14.38	0.142
		4.32	1.37	13.64	0.013
	Not able to eat	3.13	0.68	14.38	0.142
		4.32	1.37	13.64	0.013
Having complete dentures	Change in taste perception	1.42	0.52	3.89	0.498
	Difficulties to chew	3.89	1.32	11.50	0.014
	Less taste perception	1.52	0.56	4.10	0.410
	Difficulties in digestion	1.23	0.48	3.16	0.670
	Avoid food	6.61	1.72	25.34	0.006
	Stop eating	4.62	1.68	12.72	0.003
	Unsatisfied. with food	5.46	1.74	17.16	0.004
	Not able to eat	5.46	1.74	17.16	0.004
Having frequently a dry mouth	Change in taste perception	1.34	0.48	3.72	0.576
	Difficulties to chew	1.06	0.39	2.87	0.912
	Less taste perception	1.61	0.59	4.40	0.349
	Difficulties in digestion	1.12	0.42	2.98	0.824

	Avoid food	2.04	0.71	5.81	0.184
	Stop eating	3.65	1.23	10.78	0.019
	Unsatisfied. with food	3.15	1.14	8.75	0.028
	Not able to eat	2.79	0.96	8.16	0.061

Table 3: Associations* between oral health and nutrition related problems.

*Analysis based on logistic regression adjusted for sex and age.

** As compared to DFMT 12 - 23 teeth.

Discussion

This study investigated the associations between oral care, oral health and nutrition related problems in Icelandic nursing home residents. We found that oral health is poor in these older adults and that there is a great need for improved oral care. The frequency of nutrition problems which are often a precursor of malnutrition is high and poor oral health is significantly associated with these problems as it is length of residence. However, we could not find any associations between need for dental therapy and nutrition related problems.

Appropriate oral care and oral rehabilitation are important for the maintenance of good oral health in older adults [8]. It has been previously reported that nursing home participants have difficulties in either taking care about their own teeth/dentures by themselves and they do not always get the help needed for this task [9,10]. Further, it has also been suggested that old adults at care facilities do not have good access to a dentist’s service [8,9]. Our results support these previously observed findings as the great majority of participants in our study did not receive support from staff for daily oral hygiene. Also, around two thirds of the participants were in need for dental therapy and a similar proportion reported the last visit to a dentist to be more than one year ago. It has been previously shown that older adults in long term care facilities have a high prevalence of a variety of oral health concerns [11,12].

Oral health is a crucial pillar of general health [13] and poor oral health has also been associated with nutrition related problems along with malnutrition in older adults [14]. Biofilm accumulation, dental caries and periodontal diseases have also been reported to decrease dietary intake and to increase the risk of malnutrition [15]. Our participants had very poor dental status with a mean DMFT index around [26] and nearly half of the participants had complete dentures. Not surprisingly, a high DMFT status and having complete dentures were both significantly related to higher odds of nutrition related problems.

Similar results were reported from a cross-sectional study from the United Kingdom, where around 50% of nursing home residents had poor oral function, which was associated with malnutrition [16]. In our study, the odds were particularly high for difficulties to chew and avoiding food due to oral health, but lower and/or not significant for changes in taste perception or less taste. As both high DMFT and having complete dentures were related to the majority of nutrition related problems, either of them can restrict dietary intake of affected older adults and predispose them for malnutrition [17] which by itself has been reported to be an important predictor of negative health outcomes [18].

It was unexpected that neither the last dentist’s visit > 1 year ago nor needing dental therapy were significantly related to any of the nutrition related outcomes. It is possible that, considering the high DMFT and the high proportion of complete dentures, a visit to the dentist does not necessary change the likelihood of experiencing nutrition related problems in this group of older adults given the poor state of oral health they were in. However, it should be mentioned that the numbers indicated that need for dental therapy to be related to higher odds of several nutrition related problems, although the calculation did not reach statistical significance, probably related to the limited statistical power of the present study.

Interestingly, length of residence was negatively related to taste perception in our participants. As this result is based on an age-adjusted analysis, higher age in participants who have higher length of residence does not explain this relationship. However, length of residence might be related to general poorer health and thus to a higher amount of medication [19], which both can negatively affect taste perception in old adult [20,21], although this remains speculative, as we did not have information on general health status or medication use of our study participants.

Strengths and limitations

It is a limitation of this study that it is of cross-sectional design and thus cannot identify the direction of an observed association,

i.e., what is a cause and what is a consequence in a relationship of two variables. Further, given the limited sample size, statistical power was not enough to be able to detect several increased odd ratios as significant.

Unfortunately, there was no data available on body weight or nutrition status of the study participants, which would have strengthened the results of our study. But we think that our study still provides valuable information about old adults in long term care facilities in Iceland, highlighting the urgent need of improved oral care and considering the high frequency of nutrition related problems, also highlighting the emphasis on appropriate nutrition in order to maintain good nutrition status and health in old adults.

Conclusion

This cross-sectional study in Icelandic nursing home residents showed that oral health is poor in this older adults and that there is a great need for improved oral care. The frequency of nutrition related problems related to malnutrition is high and poor oral health is significantly associated with these problems as it is length of residence.

Conflict of Interest

The authors declare no conflict of interest.

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Paper III



Cross-sectional study of oral health care service, oral health beliefs and oral health care education of caregivers in nursing homes



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ABSTRACT

Objectives: To assess oral care beliefs and oral hygiene procedures among nursing home personnel to identify strengths and weaknesses in managing oral care.

Methods: A cross-sectional study in two nursing homes using an oral health care questionnaire including the Nursing Dental Coping Belief Scale.

Results: A total of 109 health personnel participated. Oral care was seldomly achieved twice a day and dental supplies were not guaranteed. Registered nurses found the oral health of residents more acceptable than did allied health personnel with less oral care education, who mostly delivered daily care. Conversely, nursing staff with oral care education had lower dental coping beliefs, suggesting a lack of self-reliance in controlling oral health outcomes.

Conclusion: Dental supplies should be part of nursing care equipment. Educational programs could increase positive oral health beliefs and enhance the quality of care in these settings, particularly among those who are accountable for oral care.

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Introduction

Nursing homes face the challenge of providing complete care to frail and multimorbid older residents to maintain their quality of life. Oral health conditions among older people vary and are related to economics, culture, oral care habits, diet, access to oral health care, and dental cost subsidies.¹ A systematic review on the oral health status of older adults in medium- to long-stay health and social care settings in Europe, Asia, and Australia concluded that developing oral health protocols and accordingly training responsible personnel are necessary to improve oral health outcomes in these settings.²

In nursing, oral care may be defined as basic nursing targeted to assess, maintain, and care for the oral cavity to keep it intact and free from oral and dental diseases.³ The ultimate goal is to support frail residents to maintain good oral health, which is associated with well-being,⁴ general health,^{5,6} and quality of life^{7–10} in older adults. Thus, nursing homes should include oral care as an integral part of planning residents' care,¹¹ combining need assessments, execution plans, quality control,¹¹ and monitoring delivery.¹²

During recent decades, a positive shift has occurred in oral health among older adults, resulting in an increased number of dentate residents,¹³ with complex restorations and prostheses.¹⁴ Oral hygiene regimens must meet these challenges in nursing homes.

Hilton et al. summarized evidence-based practice guidelines in the literature for standard oral care practices for older adults. Most agreed that oral hygiene should be ideally performed twice a day for dentate individuals,^{15,16} typically using a toothbrush with high-fluoride toothpaste.¹⁶ Dentures should be cleaned daily using a toothbrush or denture brush and mild soap or water, and they should be soaked in water or cleaning solution overnight.¹⁶ Other guidelines recommend brushing dentures twice daily with abrasion-free cleaning products.¹⁵ Hilton et al. found little information in the literature of the achievability of implementing these practices in geriatric oral care.¹⁶ However, oral hygiene is reported to be poor^{8,17} in nursing homes, and oral care activities vary greatly and seldom meet recommended oral care standards¹² in long-term care.¹⁵

Recent studies have shown that 72% to 78% of nursing home residents need dental treatments.^{8,10,18} The most frequent oral health problems are associated with natural teeth^{8,17} showing high caries prevalence,¹⁹ requiring dental fillings and extractions.^{8,10} Denture wearers are also susceptible to severe oral health irregularities¹⁷ such as oral candida²⁰ and dry mouth, with an associated risk of malnutrition.^{20,21}

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Oral health screening has found that 78% of residents in long-term care need help with oral hygiene, but less than 7% receive such help.²² This is concerning since most residents do not ask for daily oral health support.²³ Several studies have also shown that oral care in nursing homes is neglected²⁴ or missed intentionally.²⁵ Further, the standard of toothbrushing for 2 minutes¹² is rarely met, with the average time varying from 16 seconds for teeth¹² to 52 seconds for both teeth and dentures.²⁶ This neglect could be explained by different care cultures, which can affect the prioritization and integration of oral care into general care practices²⁷ and daily routines,²³ as well as a lack of training and support to provide oral care and a poor understanding of the connection between oral care, oral diseases, and general health.^{5,9,11,28}

In particular, licensed practical nurses and care assistants²⁹ have reported lacking the necessary oral health knowledge in their area of responsibility³⁰ and rated their knowledge of oral care conditions significantly lower than registered nurses.³¹ Insufficiencies in both oral health education³² and practical oral care training^{28,32} have been reported as barriers to oral care and hygiene.^{32–34}

Oral health knowledge is considered an important prerequisite for health-related behaviors and attitudes,¹³ and studies have shown an association between improved knowledge and attitudes and better oral care.³⁵ Further, oral health knowledge and attitudes and perceived behavior control are predictors of intention to improve oral health behaviors.³⁶ Individuals with poor knowledge, attitudes, and perceived behavior control may have low oral care priorities and little belief in their power to change oral health outcomes, hindering the promotion of good oral health.^{30,37} Those with positive attitudes toward oral care are more likely to have good oral health knowledge³⁸ and value their oral health.³⁶ Correspondingly, health personnel with a positive attitude toward oral health are more likely to prioritize oral care during their routine work in the nursing home.^{34,37,38}

Oral care in long-term care is well-documented worldwide but have gained little attention from Icelandic authorities and policymakers. Currently, local authorities only demand that nursing homes set their own oral hygiene aims and facilitate access to dentists when needed.³⁹ Local public information on oral health education and oral care provider training is not clear, and in general, dental and oral health material is seldom included in the curricula of health care disciplines other than dental professions.⁴⁰ Consequently, the delivery of oral care in nursing homes is often left in the hand of care givers who may have different priorities in geriatric oral care.

This situation may show that local authorities and policymakers are confident in the power of the hidden curriculum in interpersonal education and training,⁴¹ that is, the influence of experienced health professional and clinical associate role models on novices, students, and peers. Moreover, they rely on expertise, experience, and attitudes toward nursing practice and successful performance being transferred to inexperienced personnel. This may impact self-efficacy when the novice worker accomplishes an activity themselves, reinforcing their outcome expectations.⁴² Notably, negative characteristics of role models can result in poor clinical competency.⁴¹

The current literature on institutional oral hygiene practices is very limited in Iceland.^{43,44} To our knowledge, oral care experiences among nursing home personnel have not been studied. It is also unclear, how background education of care givers or years of experience are related to oral health care beliefs and attitudes.

To gain more knowledge on oral care in nursing homes in Iceland, we focused on nursing home employees and conducted a cross-sectional study to investigate oral care activities, beliefs, and education in three groups of caregivers: care assistants, licensed practical

nurses, and registered nurses. We hypothesized that higher education, oral health education, and longer work experience are associated with positive oral health beliefs.

Material and methods

Study participants

This cross-sectional study used a convenience sample of employees at two nursing homes in Reykjavik, Iceland, both operated by the same organization with identical structures and services. The criteria for selecting nursing homes were based on official information. The four nursing homes with the highest ratio of non-bedbound residents were invited to participate; they occupied a third ($n = 471$) of the nursing capability in the area and nearby municipalities. Two of the nursing homes declined to participate in the study.

The number of eligible participants was $N = 200$ employees with or without formal health education. Employees from dementia units within the nursing homes were excluded¹⁰ from the study.

Procedures

The head nurse in each nursing home introduced our study at staff meetings, identified potential participants, distributed the printed questionnaires, and arranged the return protocol in cooperation with the researchers. The health care providers completed the written questionnaire during one shift at a quiet place in the nursing home and returned their responses in a sealed box on site.

Involvement in the study was voluntary and anonymous. By returning the self-administrated questionnaire, participants gave their written informed consent to participate in the study.

Data collection

Nursing dental coping beliefs and oral care opinions

The Nursing Dental Coping Belief Scale used in this study was translated to Icelandic with written permission from corresponding author Wardh⁴⁵ and adapted and tested. Cronbach's analysis was used to test the reliability of the Icelandic version. The alpha value was 0.776, and 0.786 based on standardized items, indicating an adequate level of inter-item reliability. The scale has 28 questions divided equally into four constructs⁴⁵ describing attitudes on a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). (1) The oral health coping belief items rationalize personal conviction of being able to influence health behaviors. (2) Self-efficacy determines whether coping behavior will aid in a favorable oral health outcome. (3) Internal locus of control describes opinions of being able to control events. (4) External locus of control clarifies whether a person believes that events or success are based on fate, luck, or elements out of their control.

Total scores range from 28–140. Lower scores represent an individual's positive dental coping belief⁴⁵ and strong conviction in their ability and competence to influence oral health behaviors.

Participants were also asked to respond to statements such as "Oral care might be left out if staff are short-handed" and "I dislike cleaning teeth or prostheses of residents," answering either "disagree," "unsure," or "agree."

Socio-demographics and work experience

Further questions collected information on socio-demographics, including age (≤ 25 , 26–35, 36–45, 46–55, and ≥ 56 years), gender (male and female), level of education (care assistants, with at least 10 years of compulsory education; licensed practical nurses, with college secondary education from a 3-year vocational program; and

Table 1
Characteristic of the study population (N = 109) in nursing homes A (n = 52) and B (n = 57).

Variable		Nursing home A n (%)		Nursing home B n (%)		Total n (%)		P-value*
Gender (n = 107)	Male	1	(1.9)	5	(9.1)	6	(5.6)	0.107
	Female	51	(98.9)	50	(90.9)	101	(94.4)	
Age group (n = 105)	≤25 years	21	(41.2)	13	(24.1)	34	(32.4)	0.122
	26–35 years	6	(11.8)	12	(22.2)	18	(17.1)	
	36–45 years	5	(9.8)	10	(18.5)	15	(14.3)	
	46–55 years	9	(17.6)	5	(9.3)	14	(13.3)	
	≥56 years	10	(19.6)	14	(25.9)	24	(22.9)	
Education (n = 106)	Care assistant	13	(25.5)	11	(20.0)	24	(22.6)	0.003*
	LP nurse ^a	36	(70.6)	28	(50.9)	64	(60.4)	
	R nurse ^b	2	(3.9)	16	(29.1)	18	(17.0)	
Work experience (n = 107)	<1 year	7	(13.5)	9	(16.4)	16	(15.0)	0.447
	1–6 years	25	(48.1)	22	(40.0)	47	(43.9)	
	7–12 years	3	(5.8)	8	(14.5)	11	(10.3)	
	>12 years	17	(32.7)	16	(29.1)	33	(30.8)	
Oral care service (n = 109)	Yes	49	(45.0)	50	(45.9)	99	(90.8)	0.239
	No	3	(2.8)	7	(6.4)	10	(9.2)	
Oral care training (n = 105)	Practical Yes	26	(49.1)	27	(50.9)	53	(50.5)	0.766
		24	(46.2)	28	(53.8)	52	(49.5)	
	Theoretical Yes	17	(43.6)	22	(56.4)	39	(36.4)	0.523
		34	(50.0)	34	(50.0)	68	(52.3)	

* Based on chi-squared statistics, ^a Licensed practical nurse, ^b Registered nurse.

registered nurses, with university tertiary education with 4-year baccalaureate degree). Participants were asked to report how long they had worked in a nursing home (<1, 1–6, 7–12, and >12 years) and the type of oral care education they had received: formal theoretical oral health education, defined as participation in oral health lectures in school, in seminars, or at a nursing home (yes or no); and practical training in oral hygiene practices, defined as hands-on training in school, in seminars, or at a nursing home (yes or no).

Oral care activities, equipment, and dental supplies

The oral care activities of participants for residents in their care were self-reported as the frequency of care (seldom [not every day], at least once a day, or more than once a day); type of equipment used for dentate, partially dentate, and edentulous residents (soft, hard, or electronic toothbrush; denture brush; interdental brush; dental floss; gauge; and sponge); and dental supplies used (toothpaste, fluoride toothpaste, mouthwash, mouthwash with alcohol, chlorhexidine, mild soap, gel or denture paste, and water). Open-end questions allowed participants to write their own comments or clarifications if needed.

Statistical analysis

The data were analyzed using SPSS statistical software version 26.0 (SPSS, Chicago, IL, USA). Data are presented as frequencies (counts and percentages) and mean ± standard deviation. Data were checked for normality using the Kolmogorov–Smirnov test. Differences between groups were calculated using the chi-squared test (categorical variables) and independent samples t-test (continuous variables). Multiple linear regression models (SPSS general linear model; univariate) were constructed to investigate the relationships

of education, work experience, and oral hygiene training with Nursing Dental Coping Belief Scale scores (dependent variables). The level of significance was set at $P < 0.05$.

Ethical approval and informed consent

The study protocol was approved by the Icelandic Data Protection Authority (S-6034) and The Icelandic National Bioethics Committee (VSN 12-207 and 12-207-1). No risk was involved for participants in the study.

Results

The study response rate was 54.5% (109/200). The study included individuals aged from 18 to 70 years, with 94.4% female. The mean age was 38.5 ± 15.8 years, and male participants were on average 10 years younger than the female participants (29.7 ± 8.1 years vs. 39.1 ± 15.9 years; $P < 0.05$).

The characteristics of the participants from each nursing home are shown in Table 1. Gender and age distribution, work experience, oral care delivery, and oral care training were similar between nursing homes A and B. However, a significantly higher proportion of registered nurses worked in nursing home A. Although most participants (>90%) provided oral care, only around half had received practical oral care training, and only 36% had received theoretical oral care training.

The results in Table 2 show the oral care delivery, oral health education, and attitudes among care assistants, licensed practical nurses, and registered nurses. Registered nurses were less likely to deliver oral care compared to licensed practical nurses and care assistants, but the latter two groups were less likely to have received some form of oral care training. Registered nurses more often agreed with the

Table 2
Oral health education, practices, and beliefs among care assistants, practical nurses, and registered nurses.

		Care assistants		Practical nurses		Registered nurses		P-value*
		n	(%)	n	(%)	n	(%)	
Oral care provider	Yes	24	(100.0)	60	(93.8)	13 _b	(72.2)	0.004*
	No	0	(0.0)	4	(6.2)	5	(27.8)	
Theoretical and/or practical oral health education	Yes	8	(33.3)	34	(54.0)	15	(83.3)	0.006*
	No	16	(66.7)	29	(46.0)	3	(16.7)	
All residents in my care want assistant with oral hygiene	Agree	14	(58.3)	30	(46.9)	10	(55.6)	0.087
	Unsure	4	(16.7)	18	(28.1)	0	(0.0)	
	Disagree	6	(25.0)	16	(25.0)	8	(44.4)	
Oral care might be left out if staff are short-handed	Agree	12	(50.0)	38	(59.4)	13	(72.2)	0.294
	Unsure	2	(8.3)	11	(17.2)	2	(11.1)	
	Disagree	10	(41.7)	15	(23.4)	3	(16.7)	
I dislike cleaning the teeth or prostheses of residents	Agree	0	(0.0)	7	(10.9)	3	(17.6)	0.110
	Unsure	1	(4.2)	8	(12.5)	0	(0.0)	
	Disagree	23	(95.8)	49	(76.6)	14	(82.4)	
Oral health service is lacking in the nursing home	Agree	8	(34.8)	31	(48.4)	13	(76.5)	0.071
	Unsure	10	(43.5)	18	(28.2)	1	(5.9)	
	Disagree	5	(21.7)	15	(23.4)	3	(17.6)	
Overall, the oral health of residents is acceptable	Agree	2	(8.7)	13	(20.6)	9	(52.9)	0.007*
	Unsure	11	(47.8)	23	(36.5)	1	(5.9)	
	Disagree	10	(43.5)	27	(42.9)	7	(41.2)	
Nursing dental coping belief (total score)		69 ± 7		64 ± 10		58 ± 13		0.001*

*Based on chi-squared statistics, $P < 0.05$.

statement “Overall, the oral health of residents is acceptable” than did care assistants or licensed practical nurses. Though not statistically significant, more registered nurses than care assistants or licensed practical nurses agreed that residents were not always willing to accept assistance with oral hygiene (44.4%), oral care might be left out if staff were short-handed (72.2%), and oral health service was lacking in the nursing homes (76.5%).

Nursing staff with oral care education scored significantly lower on the Nursing Dental Coping Belief Scale (62.1 ± 11.5) compared to those with no formal oral care education (66.1 ± 9.5), as well as on the self-efficacy subscale (15.3 ± 3.1 vs. 17.0 ± 2.8). The scores in other subscales were not significantly different.

General linear models were used to investigate the relationships between education, work experience, practical training in oral care, and scores on the Nursing Dental Coping Belief Scale and its subscales (oral health coping belief, self-efficacy, internal locus of control, and external locus of control; [Table 3](#)). Compared to registered nurses, care assistants and licensed practical nurses had higher total scores and higher scores on several subscales. Practical oral care training was associated with lower total and self-efficacy scores (not significant for other subscales). Work experience >12 years was associated with higher total, internal locus of control, and external locus of control scores compared to the other work experience categories.

The frequencies of oral care for dentate and edentate residents by care assistants, practical nurses, and registered nurses are shown in [Appendix A](#). On average, only 7% and 9% of caregivers reported brushing teeth and dentures more than once a day, respectively. Although oral care activities were similar between care assistants and licensed practical nurses, with the majority brushing teeth (87.5%) and dentures (95.8%) at least once a day, a significantly higher proportion of registered nurses reported brushing teeth (38.5%) and dentures (30.8%) more than once a day.

Most used a soft toothbrush (93.6%) on natural teeth and fixed prostheses and regular toothpaste (76.3%) or water (50.5%), but very few used an interdental brush or floss (9.6%). Dentures were most often cleaned using a soft toothbrush (62.7%) or denture brush (36.8%). Most used water (68.8%) and/or mild soap (68%) as denture cleaning agents, and some used toothpaste (42.7%; for details, see [Appendices B and C](#)).

A positive oral care belief was associated with more frequent use of an electric toothbrush (23% vs. 6%, $P = 0.02$) compared to a negative oral care belief. Further, practical oral care education was associated with more frequent cleaning of dentures (at least twice a day; 13% vs. 4%; $P = 0.082$), and theoretical oral care education was associated with greater use of dental floss (18% vs. 5%, $P = 0.045$).

Discussion

We investigated the oral care delivery, oral health care beliefs, and oral health care education of caregivers in Icelandic nursing homes. We found that care assistants, the caregivers most likely to deliver oral care, were the least likely to have some form of oral health care education compared to licensed practical nurses or registered nurses.

Further, many caregivers felt that oral health service was lacking³¹ in the nursing home, and most employees thought that oral care might be left out if staff were short-handed, which has been also reported in previous studies.^{25,34,46} Registered nurses had more positive oral health beliefs compared to care assistants²⁹ and licensed practical nurses. Unexpectedly, registered nurses found the oral health of residents more acceptable than did care assistants or licensed practical nurses. Care assistants and licensed practical nurses were often unsure in these matters, possibly due to their lesser degree of education or oral care training. These differences in opinion may reflect the different roles and responsibilities of staff within nursing. Registered nurses are likely not involved in daily oral care unless³⁰ their expertise is required, such as in complex oral care

Table 3
Multiple linear regression models of the relationships of education, work experience, and oral hygiene training with Nursing Dental Coping Belief Scale scores.

Dependent variable	Parameter	B	95% CI		P-value
Oral health coping belief	Intercept	14.032	11.475	16.590	<0.001
	Care assistant ^a	3.095	0.646	5.544	0.014
	Practical nurse ^a	3.242	1.219	5.265	0.002
	<1 year of work ^b	0.259	-2.202	2.721	0.835
	1–6 years of work ^b	-0.514	-2.350	1.321	0.579
	7–12 years of work ^b	-0.126	-2.894	2.643	0.928
	Training in oral care: yes ^c	-0.428	-2.092	1.236	0.611
Self-efficacy	Intercept	16.184	14.255	18.112	<0.001
	Care assistant ^a	2.195	0.349	4.042	0.020
	Practical nurse ^a	0.720	-0.806	2.245	0.351
	<1 year of work ^b	0.634	-1.222	2.490	0.499
	1–6 years of work ^b	-0.623	-2.007	0.761	0.374
	7–12 years of work ^b	-1.677	-3.764	0.411	0.114
	Training in oral care: yes ^c	-1.445	-2.699	-0.190	0.024
Internal locus of control	Intercept	14.749	12.242	17.255	<0.001
	Care assistant ^a	1.502	-0.898	3.903	0.217
	Practical nurse ^a	0.665	-1.317	2.648	0.507
	<1 year of work ^b	-2.478	-4.890	-0.066	0.044
	1–6 years of work ^b	-2.061	-3.860	-0.262	0.025
	7–12 years of work ^b	-3.382	-6.095	-0.669	0.015
	Training in oral care: yes ^c	-0.915	-2.545	0.716	0.268
External locus of control	Intercept	18.687	16.171	21.204	<0.001
	Care assistant ^a	3.270	0.860	5.680	0.008
	Practical nurse ^a	1.385	-0.605	3.376	0.170
	<1 year of work ^b	-3.204	-5.626	-0.782	0.010
	1–6 years of work ^b	-2.709	-4.515	-0.903	0.004
	7–12 years of work ^b	-3.268	-5.992	-0.543	0.019
	Training in oral care: yes ^c	-1.262	-2.899	0.375	0.129
Total score	Intercept	64.239	57.421	71.057	<0.001
	Care assistant ^a	9.453	2.923	15.983	0.005
	Practical nurse ^a	5.702	0.309	11.095	0.038
	<1 year of work ^b	-4.170	-10.732	2.393	0.210
	1–6 years of work ^b	-5.800	-10.694	-0.906	0.021
	7–12 years of work ^b	-7.886	-15.267	-0.506	0.037
	Training in oral care: yes ^c	-3.911	-8.348	0.525	0.083

^a as compared to registered nurses, ^b as compared to more than 12 years, ^c as compared to no training in oral care.

situations or if resistant oral care behavior³¹ arises. Since oral care standards for nursing homes are not set by Icelandic authorities, screening, planning oral care, execution, and follow-up can vary both between nursing homes and within wards.

Regular oral care⁴⁷ is important to oral health,¹³ which affects both quality of life^{5,10} and general health.⁵ In our study, caregivers did not dislike cleaning the teeth or prostheses of residents, although only a minority doing so more than once a day. Oral care in nursing homes seldom meets minimum standards,¹² risking the accumulation of dental plaque and progression of oral diseases.¹³ Other studies have also shown that oral care is poorly integrated into everyday care²⁷ and often missed in nursing homes.^{48,49}

For practice, using existing data on oral health, such as from the Resident Assessment Instrument, may be helpful to establish clinical guidelines for oral care. These could be useful to support staff in decision-making when performing oral care based on individualized needs.

Although care assistants and licensed practical nurses provided most of the oral care, they were less likely to have oral health education compared to registered nurses. In Iceland, oral health education is part of the curriculum for dental professions, but as in other countries, it is limited for registered nurses⁵⁰ and associated professions.⁴⁰ The lack of oral care education has been discussed in previous papers^{28,32} because it relates to low prioritization and oral care neglect. In our study, oral health education tended to be associated with more frequent brushing of dentures and use of dental floss.

Oral care beliefs are an important factor and can predict how people perceive their ability to control oral health outcomes. A positive attitude is more likely to value oral health,³⁴ increase the priority of oral care in the daily care of older people,^{37,45} and result in better oral hygiene outcomes.³⁵ Oral health coaching programs can influence oral health beliefs and support health personnel to maintain good oral health of those in their care.³⁸

According to our multivariate analyses, care assistants and licensed practical nurses had higher scores on the Nursing Dental Coping Belief Scale (i.e., lower beliefs) compared to registered nurses, and this was consistent for the subscales. Similar results have been seen in other studies using the scale,^{45,51} showing that less educated caregivers responsible for oral care have low beliefs in their oral care competence and limited knowledge and skills to perform the care. Unexpectedly, work experience >12 years was also associated with poorer beliefs. The potential positive effects of education on beliefs may fade over time⁵⁰ when training is not renewed regularly, such as through continuing education. On the other hand, oral care education was associated with higher beliefs (independently from being a registered nurse, care assistant, or licensed practical nurse), which indicates that oral care education was associated with enhanced confidence in oral care practices.

To strengthen and support oral care competence, Icelandic authorities could mandate nursing homes in the service agreement to guarantee residents have access to trained oral care workers, similar to the Swedish legislation.³⁴ Accordingly, oral

care workers would need access to formal education on oral health, including oral diseases and their detection and prevention, as well as training in geriatric oral care techniques. A multidisciplinary approach is needed⁵² to form an oral health education program for oral care workers, involving health care personnel and dental professionals.

Our study also shows that the use of some types of equipment for cleaning teeth and dentures among residents is infrequent. For example, the use of electric brushes, floss, and interdental brushes range from only 8–29%, similar to the findings of previous studies.^{46,53,54} Although more frequent use of this equipment is desirable, this is not necessarily related to the caregivers' beliefs or education: the availability of dental equipment and supplies is dependent on the resident (or their family) and is not provided by the nursing home in Iceland. Since nursing home residents have limited financial resources, they might not see toothbrushes, toothpaste, dental floss, or special oral care equipment as necessary. This could explain the infrequent use of mouthwash and other dental supplies in our study compared to findings in a similar setting,⁵⁴ as well as the frequent use of water as a cleaning material (teeth: 50.5%; dentures: 68.8%). To prevent the lack of necessary dental supplies, oral care guidelines should recommend regular staff follow-ups on private supplies and the use of a notification system (first verbal, then by email or SMS) to a contact person (spouse or family) if the resident does not renew the necessary dental supplies themselves.

Though the Icelandic health care system is similar to other Scandinavian health care systems in many aspects, all dental work is in the private sector. Dental expenses for nursing home residents are not fully covered by the public health care system and are excluded from service agreements with Icelandic nursing homes.³⁹ Consequently, the financial burden of dental expenses stays with residents, adding risk to their oral health. This might affect the quality of oral health care in nursing homes and increases oral health inequalities among residents.

In Iceland, care assistants represent the largest proportion (63%) of nursing home employees.⁵⁵ Registered nurses (12% of nursing home staff) mostly oversee medication administration and daily care planning, but licensed practical nurses (18%)⁴⁹ and care assistants perform the actual health care.²⁹ Consequently, registered nurses are less likely to be directly involved in oral care³⁰ than care assistants or licensed practical nurses, and it is unsurprising that the three groups do not always share opinions on the oral health care or status of residents. In the future, documenting available oral health education and training in geriatric oral care techniques in nursing homes and schools and identifying oral care delivery and personal oral health beliefs among staff are equally important^{35,45} since these factors might affect the prioritizing and quality of oral care delivery.

Strengths and limitations

This is a cross-sectional study, which cannot distinguish between cause and consequence in an observed association. Although it sounds reasonable that oral care training leads to a better oral care belief, we cannot exclude the possibility that staff with better beliefs would rather attend oral care training.

The study used a convenience sample from two out of the four largest nursing homes in the area, both run under the same management umbrella. The results might have been different if the other organizations had been involved in the study.

Only a few care assistants took part in this survey, although they represented most caregivers in Icelandic nursing homes. Because many care assistants have a migrant background, they might have been missed because the questionnaire was in Icelandic. Further, the small sample size limits the ability to detect smaller differences between groups as statistically significant.

A further limitation of this study is that we used self-reported questionnaires. Respondents may be susceptible to bias when asked about their own experiences and influenced by social desirability, causing them to exaggerate in their responses. Nevertheless, a strength of the current study is that we used the well-accepted Nursing Dental Coping Belief Scale^{38,45,51} and connected it to education, oral care training, and working years, thus yielding useful and interesting results.

Conclusion

This study found that in Icelandic nursing homes, care assistants, the caregivers most likely to deliver oral care, were the least likely to have some form of oral health care education compared to licensed practical nurses and registered nurses. Further, many caregivers felt that oral health service was lacking, and although they did not dislike cleaning the teeth or prostheses of residents, only a minority reported doing so more than once a day. Care assistants and licensed practical nurses had lower dental coping beliefs and thus a lesser conviction in their ability and competence to influence oral health behaviors compared to registered nurses. Unexpectedly, longer work experience was also associated with poorer dental coping beliefs.

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Declaration of Competing Interest

The authors declare no conflict of interest.

Appendix A. Frequency of oral care of dentate and edentate residents performed by care assistants, practical nurses, and registered nurses.

	Care assistants		Practical nurses		Registered nurses		P-value*
	n	(%)	n	(%)	n	(%)	
Teeth							
More than once	2	(8.3)	3	(5.0)	5	(38.5)	0.008*
At least once a day	21	(87.5)	56	(93.3)	8	(61.5)	
Seldom	1	(4.2)	1	(1.7)	0	(0.0)	
Dentures							
More than once	1	(4.2)	2	(3.3)	4	(30.8)	0.009*
At least once a day	23	(95.8)	56	(93.3)	9	(69.2)	
Seldom	0	(0.0)	2	(3.3)	0	(0.0)	

*Based on chi-squared statistics, $P < 0.05$.

Appendix B. Type of equipment used for cleaning teeth and dentures among residents by care assistants, practical nurses, and registered nurses.

Type of resource	Job title			Total
	Care assistants	Practical nurses	Registered nurses	
	% (n/N)	% (n/N)	% (n/N)	% (n/N)

(continued)

(Continued)

Type of resource	Job title							
	Care assistants		Practical nurses		Registered nurses		Total	
	%	(n/N)	%	(n/N)	%	(n/N)	%	(n/N)
Teeth								
Soft toothbrush (N = 88)	90.9	(20/22)	93.2	(55/59)	100	(13/13)	93.6	(88/94)
Hard toothbrush (N = 32)	31.8	(7/22)	37.3	(22/59)	23.1	(3/13)	34.0	(32/94)
Electronic toothbrush (N = 24)	22.7	(5/22)	22.0	(13/59)	46.2	(6/13)	25.5	(24/94)
Interdental brush (N = 9)	13.6	(3/22)	8.5	(5/59)	7.7	(1/13)	9.6	(9/94)
Dental floss (N = 9)	0.0	(0/0)	10.2	(6/59)	23.1	(3/13)	9.6	(9/94)
Gauge or sponge (N = 24)*	9.1	(2/21)	35.6	(21/59)	7.7	(1/13)	25.5	(24/94)
Dentures								
Soft toothbrush (N = 59)	58.3	(14/24)	60.3	(35/58)	76.9	(10/13)	62.7	(59/95)
Hard toothbrush (N = 28)	25.0	(6/24)	36.2	(21/58)	7.7	(1/13)	29.5	(28/95)
Electronic toothbrush (N = 8)	8.3	(2/24)	8.6	(5/58)	7.7	(1/13)	8.4	(8/95)
Denture toothbrush (N = 35)	29.2	(7/24)	41.4	(24/58)	30.8	(4/13)	36.8	(35/95)
Gauge or sponge (N = 32)	33.3	(8/24)	32.8	(19/58)	38.5	(5/13)	33.7	(32/95)

*Based on chi-squared statistics, P < 0.05.

Appendix C. Types of material used to clean teeth and dentures among residents by care assistants, practical nurses, and registered nurses.

Material	Job title							
	Care assistants		Practical nurses		Registered nurses		Total	
	%	(n/N)	%	(n/N)	%	(n/N)	%	(n/N)
Teeth								
Toothpaste (N = 74)	66.7	(16/24)	76.7	(46/60)	92.3	(12/13)	76.3	(74/97)
Toothpaste with fluoride (N = 43)	45.8	(11/24)	43.3	(26/60)	46.2	(6/13)	44.3	(43/97)
Mouthwash (N = 28)	8.3	(2/24)	35.0	(21/60)	38.5	(5/13)	28.9	(28/97)
Mouthwash with alcohol (N = 2)	0.0	(0/0)	3.3	(2/60)	0.0	(0/0)	2.1	(2/97)
Chlorhexidine solution (N = 2)	0.0	(0/0)	3.3	(2/60)	0.0	(0/0)	2.1	(2/97)
Water (N = 49)	45.8	(11/24)	53.3	(32/60)	46.2	(6/13)	50.5	(49/97)
Dentures								
Toothpaste (N = 41)	41.7	(10/24)	44.1	(26/59)	38.5	(5/13)	42.7	(41/96)
Toothpaste with fluoride (N = 10)	8.3	(2/24)	11.9	(7/59)	7.7	(1/13)	10.4	(10/96)
Mouthwash (N = 36)	20.8	(5/24)	40.7	(24/59)	53.8	(7/13)	37.5	(36/96)
Mouthwash with alcohol (N = 2)	0.0	(0/0)	3.4	(2/59)	0.0	(0/0)	2.1	(2/96)
Chlorhexidine solution (N = 6)	8.3	(2/24)	3.4	(2/59)	15.4	(2/13)	6.2	(6/96)
Mild soap (N = 66)	66.7	(16/24)	68.3	(41/60)	69.2	(9/13)	68.0	(66/97)
Gel, paste for dentures (N = 20)	12.5	(3/24)	23.3	(14/60)	23.1	(3/13)	20.6	(20/97)
Water (N = 66)	54.2	(12/24)	78.0	(46/59)	53.8	(7/13)	68.8	(66/96)

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