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ORAL HEALTH CARE OF OLDER PEOPLE IN DOMICILIARY CARE

Perspectives of the Domiciliary Care Clients and Personnel

Riikka Salmi

TURUN YLIOPISTON JULKAISUJA – ANNALES UNIVERSITATIS TURKUENSIS
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The originality of this publication has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

ISBN 978-951-29-9122-8 (PRINT)
ISBN 978-951-29-9123-5 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)
Painosalama, Turku, Finland 2022

To my family

UNIVERSITY OF TURKU
Faculty of Medicine
Institute of Dentistry
Department of Prosthetic Dentistry and Stomatognathic Physiology
RIIKKA SALMI: Oral Health Care of Older People in Domiciliary Care – Perspectives of the Domiciliary Care Clients and Personnel
Doctoral Dissertation, 106 p.
Finnish Doctoral Programme in Oral Sciences (FINDOS)
December 2022

ABSTRACT

The aim was to study the perceived oral health, oral health-related quality of life (OHRQoL) and oral health behaviours of older people with or without domiciliary care in Finland. Another aim was to examine domiciliary care planning and implementation of oral health aspects from domiciliary care personnel.

Data concerning perceived oral health and OHRQoL of older domiciliary care clients was based on secondary analyses of interview data of the nationally representative Health 2000 and 2011 surveys. Home-dwelling at least 70-year older people with or without domiciliary care were enrolled in the study. Differences in perceived oral health, OHRQoL and oral health behaviours were analyzed in terms of the use of domiciliary care. Respectively, oral health care aspects of domiciliary care personnel were analyzed from two different datasets collected through questionnaires for case managers, CMs (care planning) and nursing personnel (care implementation) in one of the largest cities in Finland.

Poor perceived oral health, edentulousness, chewing difficulties and dry mouth problems were more typical among domiciliary care clients than non-clients. Clients had also tendency for poorer OHRQoL. In particular, the psychological discomfort was emphasized from the dimensions of OHRQoL. In addition, the use of removable dental prostheses (RDP) predicted poorer OHRQoL among the participants. Clients had poorer oral health behaviours indicated as poorer utilization of dental care services and impaired ability to maintain oral hygiene. Oral health-related issues (OHRIs) were considered as important in the care planning but were not routinely included in the assessment of domiciliary care by the CMs. Knowledge about oral health was generally high, yet shortcomings with the received oral health education and difficulties to use the given education in practical work were reported by nursing personnel. Oral care support was to some extent active but not as a part of daily routine.

Oral health care needs and regular use of dental care services ought to be emphasized in domiciliary care since care-dependency among clients extends also to oral health due to frailty, functional and cognitive limitations of the clients. Domiciliary care personnel require practical oral health education and guidelines.

KEYWORDS: domiciliary care, home-dwelling, quality of life, older people, oral health, oral health care, oral health assessment, oral home care, nursing personnel

TURUN YLIOPISTO
Lääketieteellinen tiedekunta
Hammaslääketieteen laitos
Hammasprotetiikka ja purentafysiologia
RIIKKA SALMI: Iäkkäiden suun terveydenhuolto kotihoidossa – Kotihoidon asiakkaiden ja henkilökunnan näkökulmasta
Väitöskirja, 106 s.
Kansallinen suun terveystieteiden tohtoriohjelma (FINDOS)
Joulukuu 2022

TIIVISTELMÄ

Tavoitteena oli tutkia kotona asuvien iäkkäiden henkilöiden koettua suun terveyttä, suun terveyteen liittyvää elämänlaatua ja suun terveystottumuksia kotihoidossa ja sen ulkopuolella olevilla henkilöillä. Toisena tavoitteena oli tarkastella kotihoidon henkilökunnan suun terveydenhuollon suunnittelua ja toteutusta.

Iäkkäiden henkilöiden koettua suun terveyttä ja suun terveyteen liittyvään elämänlaatua käsittävää tietoa saatiin sekundaarianalyyseistä, jotka tehtiin Terveys 2000 ja 2011 tutkimuksien haastatteluaineistoista. Tutkimukseen valittiin vähintään 70-vuotiaita kotona asuvia, kotihoidossa ja sen ulkopuolella olevia iäkkäitä henkilöitä. Eroja koetussa suun terveydessä, suun terveyteen liittyvässä elämänlaadussa ja suun terveyskäyttäytymisessä analysoitiin kotihoidon palveluiden käytöllä. Vastaavasti kotihoidon henkilöstön suun terveydenhuollon näkökohtia analysointiin kahdesta eri aineistosta, jotka kerättiin asiakasohjaajien (hoidon suunnittelu) ja hoitohenkilökunnan (hoidon toteutus) kyselylomakkeiden avulla yhdessä Suomen suurimmista kaupungista.

Huono koettu suun terveys, hampaattomuus, pureskeluvaikeudet ja kuivan suun ongelmat olivat tyypillisempiä kotihoidon asiakkailla kuin heillä, jotka eivät saaneet kotihoitoa. Asiakkailla oli myös taipumus huonompaan suun terveyteen liittyvään elämänlaatuun. Elämänlaadun osa-alueista korostui erityisesti psyykkiseen epämukavuus. Lisäksi irrotettavien hammasproteesien käyttö ennusti osallistujilla heikompaa suun terveyteen liittyvää elämänlaatua. Asiakkaiden heikommat suun terveystavat näkyivät heikompana hammashoitopalveluiden käyttönä ja kykynä ylläpitää suuhygieniaa. Kotihoidon suunnittelussa tärkeäksi koettuja suun terveysasioita ei otettu säännöllisesti huomioon asiakasohjauksessa. Hoitohenkilöstön tietotaso suun terveydestä oli yleisesti korkealla, mutta puutteet koulutuksessa hankaloittivat työn suorittamista. Suun terveyttä tuettiin jokseenkin aktiivisesti, mutta ei osana hoitorutiinia.

Suun terveydenhuollon tarpeellisuutta ja hammashoitopalveluiden säännöllistä käyttöä on korostettava kotihoidossa, sillä asiakkaiden hoitoriippuvuus ulottuu myös suun terveyteen asiakkaiden haurauden, toiminnallisten ja kognitiivisten rajoitusten vuoksi. Kotihoidon henkilöstö tarvitsee ikääntyneen suun hoitoon liittyvää käytännön koulutusta ja ohjeita.

AVAINSANAT: elämänlaatu, hoitohenkilökunta, iäkkäät, kotihoito, koti, suun omahoito, suun terveys, suun terveydenhoito, suun terveyden arviointi

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Abbreviations

CM	Case manager
HRQoL	Health related quality of life
KTL	The National Public Health Institute of Finland
OFoVo	Occassionally, fairly often or very often
OHIP-14	The Oral Health Impact Profile 14
OHRI	Oral Health Related Issue
OHRQoL	Oral health related quality of life
RDP	Removable dental prosthesis
THL	The Finnish Institute for Health and Welfare (former KTL)

Definition of key terms

Oral self-care
Oral self-care refers to behaviours to clean the mouth and/or prosthesis and the oral or prothesis hygiene means are conducted in home environment.

Perceived oral health
Perceived oral health is an individual perspective on personal oral health.

Oral health
Oral health is the health state of the mouth that indicates the overall health, well-being, and quality of life. This definition includes a state of being free from a variety of oral diseases and disorders and oral pain that limit capacity in eating, smiling, speaking and well-being.

Oral health-related quality of life
Oral health related quality of life is defined as multi-dimensional concept of various symptoms and experiences. The individual perspective is represented in the concept and also includes biological, social, psychological and cultural factors.

List of Original Publications

This dissertation is based on the following original publications, which are referred to in the text by their Roman numerals:

I Salmi R, Närhi T, Suominen A, Suominen AL and Lahti S. Perceived oral health and oral health behaviours among home-dwelling older people with and without domiciliary care. *Gerodontology*, 2021; 00: 1-10.

II Salmi R, Närhi T, Suominen A, Suominen AL and Lahti S. Oral health related quality of life among home-dwelling older people with and without domiciliary care. *Gerodontology*, 2022; Epub ahead of print.

III Salmi R, Lahti S, Tolvanen M, Suhonen R and Närhi T. Oral health assessment in domiciliary care service planning of older people. *Special Care in Dentistry*, 2019; 5: 485-490.

IV Salmi R, Tolvanen M, Suhonen R, Lahti S and Närhi T. Knowledge, perceived skills and activities of nursing staff to support oral home care among older domiciliary care clients. *Scandinavian Journal of Caring Sciences*, 2018; 32: 1342-1347.

1 Introduction

A largely aging population (United Nations 2004) with declining edentulousness (Müller et al. 2007, Kassebaum et al. 2014, Suominen et al. 2018) brings multidimensional challenges to maintain good oral health among older people with or without assistance (Coker et al. 2014, McNally et al. 2014). Furthermore, the risk for oral diseases increases with age (Kassebaum et al. 2017, Samson et al. 2008, WHO 2002), especially, when ability to independently maintain oral self-care is deteriorated due to functional (Komulainen et al. 2012, Nakayma et al. 2004, Schembri & Fiske 2001) and cognitive limitations (Chalmers et al. 2002 & 2003, Ribeiro et al. 2012, Nangle et al. 2019) and frailty (MacEntee et al. 2016, Niesten et al. 2017). The need for dental treatment is polarizing in old age groups and tooth loss is delayed for more later in age.

Chronic diseases (WHO 2015), care-dependency (Niesten et al. 2017), and medication-induced hyposalivation (Närhi et al. 1992, Thomson et al. 2021) are prevalent risk factors of poor oral health during older age. Poor oral health has also a negative impact on health, like diabetes (Kudiyrickal & Pappachan 2015), systemic infections (Meurman & Hämäläinen 2006), cardiovascular diseases (Beck et al. 1996), respiratory diseases (Kapila 2021, van der Maarel-Wierink et al. 2013), poor nutrition intake (Algra et al. 2021, Rapp et al. 2021, Ritchie et al. 2002) and lower life expectancy (Matsuyama et al. 2007, Müller et al. 2017). Especially, domiciliary care clients with poor oral health are in a higher risk of negative health implications (de Almeida Mello et al. 2019). In addition, poor oral health is also an important cause of reduced quality of life among older people (van der Rijt et al. 2020, WHO 2002).

Oral health can be improved with prevention and delay of oral diseases, as the overall risk of the chronic disease increases with age (WHO 2002). Therefore, the need of oral care support is evident with decreasing functional capacity (Coker et al. 2014, Nangle et al. 2019) Furthermore, as the population ages, domiciliary care services are increasingly needed by older people, to overcome health and functional limitations while living at home (Jacobzone et al. 1999, Rostgaard et al. 2011).

Promoting oral health with appropriate policies and programmes is emphasised as a part of Active Ageing – Policy Framework by WHO 2002. The consideration of

oral health of older people in the current national legislation (Ikälaki 980/2012, Health Care Act 1326/2010), programmes (Petersen et al. 2010) and recommendations (STM 2020) is highly important as preventive oral health measures can reduce risk factors (WHO 2002) for poor oral health in older age and improve daily activity and cognitive functions (Nakashima et al. 2018, Yoneyama et al. 2002).

However, many studies have reported mostly neglected, or inadequate oral care support among care-dependent older people. Most often poor oral care support originates from a lack of education or neglect to do it for a variety of reasons by nursing personnel. Oral care support is not an easy task in caregiving, as lack of co-operation and compliance of care-dependent older people can also be a barrier to maintenance of oral health hygiene. (Hobien et al. 2017, Lindqvist et al. 2013, Palmers et al. 2022, Reed et al. 2006, Sonde et al. 2011, Wårdh et al. 2000).

This thesis aims to study the perceived oral health, OHRQoL and oral health behaviours of older people with or without domiciliary care in Finland. Furthermore, this thesis examines how oral health aspects are included in Finnish domiciliary care service planning and implementation.

2 Review of the Literature

2.1 Perceived oral health and oral health behaviours of older people

Perceived oral health is defined as an individual perspective on personal oral health. Global question of overall perception of oral health, problem-specific questions and oral health related quality of life are measures for perceived oral health. Oral health related quality of life (OHRQoL) determines overall well-being and health, as oral health has influence on daily functions (eating, speaking, taste), aesthetics and social dimensions. OHRQoL can be divided to seven dimensions that are Functional Limitation, Physical pain, Psychological Discomfort, Physical Disability, Psychological Disability, Social Disability, and Handicap by adaption of Locker. (Locker 1997) Oral health is affected by personal improving or impairing actions that define oral health behaviours. In this study, oral health behaviours include utilization of dental care services and oral hygiene habits of older people.

2.1.1 Perceived oral health

Tooth loss is a major determinant for perceived oral health (Steele et al. 2004), which could also indicate poorer perceived oral health among older people as they are more prone to tooth loss even with decreasing trend of edentulousness (Müller et al. 2007, Vilstrup et al. 2007). However, perceived oral health has shown to be mostly better within the elderly than the younger (Steele et al. 2004, Slade & Sanders 2011). Explanation for better perceived oral health among older people might be in their better ability to adapt to oral health impairments than the younger as the elderly can have quite effective coping mechanisms for long-term illnesses (Tkatch et al. 2017). Furthermore, older people may also have an expectation of tooth loss as they age. (MacEntee et al. 1997, Gregory et al. 2012) Self-reported edentulousness, according to the previous research, concerned around 40% of older people receiving domiciliary care with a different level of care need (Saunders &Friedman 2007). Of these older people nearly 80% reported having removable dental prostheses (RDP).

Advanced tooth loss (Lahti et al. 2008), tooth mobility (Christensen et al. 2011), residual roots, and perceived need for dental care are related to poorer perceived oral

health among dentate older people. (Ekanayke et al. 2005) On the part of edentulous older people, in addition to perceived need for dental care, taste dysfunction and eating difficulties (Salmi et al. 2022) are connected to poorer perceived oral health. (Ekanayke et al. 2005). Eating difficulties related to chewing, swallowing, use of RDP and edentulousness are found to be typical among domiciliary care clients (Salmi et al. 2022). Furthermore, care-dependent older people including domiciliary care clients have risk for malnutrition, which is also increasingly related to perceived experience of dry mouth, chewing and swallowing problems (Lindroos et al. 2014, Soini et al. 2003 & 2004). Dry mouth problems are typical concerns of domiciliary care clients, and polypharmacy and depression are most often background factors (Saunders & Friedman 2007, Viljakainen et al. 2016).

Socio-demographic background is also associated as to how perceived oral health is experienced; foreign place of birth, educational background, and historical events are examples of contributing factors (Ekbäck et al. 2008, Ettinger & Marchini 2020, Ståhlnacke et al. 2003). Regional variation in one population by local residence is more evident than population differences between different countries when perceived oral health is compared (Ekbäck et al. 2008). Poorer perceived oral health has shown to be more typical among people with lower educational background than with high educational background (Lahti et al. 2008, Ekbäck et al. 2008).

For older people, historical events along with the development of dentistry (Ettinger & Marchini 2020), and induvial experiences (Gregory et al. 2012) have an effect on how they experience their oral health. However, good perceived oral health is a result of regular use of dental care services despite of the age (Torppa-Saarinen et al. 2019). Perceived oral health among Finnish older people has shown to change for the better between 2000 and 2011 but perceived dental care need has decreased among older women (Torppa-Saarinen et al. 2018). The opposite direction of poorer perceived oral health among older people has been noted after 2011 (Koponen et al. 2018).

Moreover, professionally assessed health and functional capacity associate with perceived health (Bardage et al. 2005), and again perceived health is connected to perceived oral health (Matthias et al. 1995). Already in home-environment, impaired physical ability and comorbidities of older people decrease perceived oral health in older people (Tiisanoja et al. 2020). Furthermore, less active older people have more impairments in oral health than those who remain active (Kotronia et al. 2022, Petersen & Nörtov 1989). However, older people experience less need for dental care even when the necessity of treatment is assessed by dental professional (Colussi et al. 2009).

2.1.2 Oral health related quality of life

Oral health-related quality of life (OHRQoL) of older people is significantly affected by the number of remaining teeth (Massood et al. 2017), as OHRQoL is higher among those who have at least 25 remaining teeth (Steele et al. 2004, van de Rijt et al. 2020). Tooth loss is common along ageing, but older people are retaining more of their own teeth (Kassebaum et al. 2014, Müller et al. 2007). Yet, older people have poorer OHRQoL than the younger people (Steele et al. 2004).

Relating to OHRQoL of older people, several contributing factors have been studied. Lower educational background has been connected to poorer OHRQoL among older people (Tsakos et al. 2009), and same effect is seen with higher age (Massood et al. 2017). Yet, poor oral health is more a common factor for poorer OHRQoL (Jensen et al. 2008, Koistinen et al. 2020, Lahti et al. 2008), for example caries activity (Massood et al. 2017). Not only discomfort from poor oral health but also the use of RDP can cause functional and social limitations to daily life, such as eating difficulties and appearance concerns (Elgestad Stjernfeldt et al. 2020, Smith & Sheiham 1979, Stenman et al. 2011, Tsakos et al. 2009). The use of RDP is already connected to poorer OHRQoL (Lahti et al. 2008, Massood et al. 2017). Furthermore, older people with advanced tooth loss and those who are wearing RDP have lower OHRQoL than in younger individuals (Lahti et al. 2008). Associating to OHRQoL, lower self-esteem, changed self-image, reduced social interactions, and increased stress are possible causes from poor oral health (Bennadi & Reddy 2013).

From oral discomforts, pain is a notable reason for poorer OHRQoL (Bennadi & Reddy 2013, Hassel et al. 2009, Masood et al. 2017). Furthermore, hyposalivation is a common oral health-related problem that has a negative impact on OHRQoL among older people (Locker 2003, Skośkiewicz-Malinowska et al. 2019), especially induced by systemic diseases or polypharmacy (Närhi et al. 1992). Hyposalivation, and even perceived feel of dry mouth can easily lead to eating difficulties which again decreases OHRQoL (Willumsen et al. 2010).

Eating problems can also result from failing retention of RDP, which decreases OHRQoL (Hassel et al. 2009), and moreover, decreased chewing ability causes impairment of HRQoL (Cho & Kim 2018). Impaired chewing ability, swallowing disorders and xerostomia can create burden of oral problems which is associated with poor nutrition eventually affecting well-being and survival of care-dependent older people (Lindroos et al. 2019). Preserving good oral health with regular dental care attendance is important, as unregular use of dental care services is a contributor to lower OHRQoL (Torppa-Saarinen et al. 2019). Even a perceived need for dental care due to oral health-related problems is associated to poorer OHRQoL (Ekanayke & Perera 2005).

Domiciliary care clients are more prone to impaired health, functional disability, and frailty (Miettinen etl al. 2017), which predispose not only to poorer oral health

but also to lower OHRQoL among older people (Henni et al. 2022, Koistinen et al. 2020) Especially, poorer OHRQoL among care-dependent, home-dwelling older people is associated with impaired mental health and cognitive function, tooth loss (Hoeksema et al. 2018), poor perceived oral health, and perceived need for dental care (Jensen et al. 2008) and lack of oral health care (Gluzman et al. 2013). Xerostomia and complicated brushing of teeth have also shown to have connection with poorer OHRQoL among domiciliary care clients (Willumsen et al. 2010). In case of patients suffering from Alzheimer's disease or other memory disorders, assessment of OHRQoL can be more complicated as cognitive impairment complicate the assessment of oral health related problems to daily life (Ming et al. 2020).

2.1.3 Oral health behaviours

Use of dental care services is lower among older people who assess their perceived health as poor or have lower educational background (Niesten et al. 2017) than those who have better perceived health or high educational background (Tickle & Worthington 1997). Older people with lower educational background tend to use oral health services less frequently, and appointments to dentists are more based on symptomatic treatment when compared to those with higher educational background (Tickle & Worthington 1997).

Furthermore, important influencing factors to use dental care services for older people are availability (location), accessibility (transportation, unobstructed accessibility), and cost of dental care services (Gregory et al. 2012). Frailty along with care-dependency also decreases use dental care services (Niesten et al. 2017). Moreover, historical events along with the development of dentistry (Ettinger & Marchini 2020), and induvial experiences (Gregory et al. 2012) have an effect on use of dental care services.

For older people, attendance to dental treatment by perceived treatment need is mostly related to pain (Gregory et al. 2012). Other oral health-related problems, esthetical concerns, asymptomatic treatment need, and regular use of dental care services are also related to perceived treatment in older people. (Tickle & Worthington 1997)

Home-dwelling, independent older people are more capable to maintain oral health by brushing teeth twice a day than those who need to rely on care assistance (Strömberg et al. 2012). Older women are more active with maintaining oral health, especially in brushing teeth two times a day, when compared to older men (Koskinen et al. 2012, Pentala-Nikulainen et al. 2017-2018, Wiener et al. 2012). This can explain that poor oral self-care is more frequent among men than women (Strömberg et al. 2012). Cleaning interproximal spaces is not daily routine in the same way as

brushing teeth (Wiener et al. 2012). Furthermore, use of mouth rinses among older people is more occasional (Wiener et al. 2012), and dry mouth is less often treated independently by home-dwelling older people (Willumsen et al. 2010).

Nevertheless, promoting and supporting oral hygiene means are needed among older people, and already in domiciliary care (Nihtilä et al. 2017). Especially, among those who are care-dependent, as activities of daily living along with lower ability to maintain good oral health without support are restricted by cognitive impairments (Lee et al. 2020). Frailty among home-dwelling older people is less likely among those who have better oral hygiene and more teeth (Kim et al. 2022). Furthermore, in domiciliary care oral hygiene is poor among care-depended, frail cognitively impaired, and functionally disabled older people (Nihtilä et al. 2017, Tuuliainen et al. 2020).

2.1.3.1 Oral health in care-dependent

Home-dwelling, care-dependent older people have more oral health impairments, like caries and gingivitis compared to those without functional limitations. Oral health impairments depend on the level of needed support; the more oral health impairments, the more care-depended older people are. Care-depended older people are also more prone to tooth loss due to impaired health when compared to healthy ones, and tooth loss has occurred even before becoming care-depended. (Henni et al. 2022, Holmén et al. 2012)

Functional disability and impaired cognitive function increase caries activity among older people (Nihtilä et al. 2017), especially among those who are care dependent. Furthermore, caries activity is higher among those who have fewer remaining teeth when compared to those with better dentition despite of care-dependency (Vilstrup et al. 2007). Among domiciliary care clients, functional disability is a significant cause for poor oral health and complicated oral hygiene (Tuuliainen et al. 2020). Oral health-related care-dependency is already evident in domiciliary care environment, and not only in long-term care facilities as it can be referred in the previous study by Tuuliainen et al. 2020.

Oral health is known to be poor in long-term facilities, where the need for oral care support and dental care are high due to care-dependency (Peltola et al. 2004). Care-dependency is also connected to the increased risk of impaired oral health as oral hygiene of care-dependent older people relies on the given support (Koistinen et al. 2019). Importance of required oral hygiene support is evident as care-dependency along with frailty causes reduced frequency in tooth brushing (Henni et al. 2022, Kim et al. 2022, Niesten et al. 2017, Strömberg et al. 2012) Home-dwelling, but care-depended older people who receive assistance with tooth brushing have lower frequency in brushing teeth independently twice a day than those who are

independently capable in brushing teeth. Furthermore, cleaning interproximal spaces is rarely daily routine among care-dependent older people (Strömberg et al. 2012). Frailty among domiciliary care clients is a reason for lower frequency of tooth brushing (Tuuliainen et al. 2020).
Care-dependent older people also assess their oral self-care poorer than those who receive less aid due their health impairments (Strömberg et al. 2012). In addition, unregular use of dental care services is more common among frail older people (Niesten et al. 2017).

2.2 Domiciliary care

Domiciliary care, colloquially known as home care, is a care service for older people and with people with special needs. The purpose of domiciliary care is to enable and support daily living at home for as long as possible. Consequently, the given care replies to client needs, and care can be provided regularly or only for emergency cases. Regular visits can vary from several times in a day to weekly or monthly visits. Domiciliary care can include health- and social care services, and aid services for example catering service, cleaning assistance, technological aid, trade and transaction services, shuttle service, housing safety services and social day center activities. (THL 2021, STM 2021, Valvira 2021) Domiciliary care can be implemented variously in different countries (Rostgaard et al. 2011), in this study Finnish domiciliary care system is represented.

2.2.1 Organization of domiciliary care

2.2.1.1 Regulation and implementation

Supporting wellbeing and health together with functional capacity and independent living among ageing population (Ikälaki 980/2012) is significant for healthy and active ageing (WHO 2002), especially in elderly care, including domiciliary care. Enabled opportunities for older people to influence, and client-oriented services should also be emphasized (Ikälaki 980/2012, Social Welfare Act 1301/2014), as these support wellbeing and create more person-based elderly care services. Living in home-environment is highlighted in legislation (Ikälaki 980/2012). This emphasizes the importance of domiciliary care as long-term nursing facility services have reduced (Jacobzone et al. 1999, Rostgaard et al. 2019).

The public sector, more specifically Finnish municipalities are responsible for arranging domiciliary care for older people. For organizing domiciliary care services, municipalities are obligated to co-operate with other parties, like private sector and organizations. (Ikälaki 980/2012, Health Care Act 1326/2010)

Domiciliary care is publicly funded, but a public and private sector can provide domiciliary care services.

The majority of domiciliary care clients are older people, 70% of all 199 840 clients were at least 75 years old in 2019. Women of age at least 75 years received 58% of domiciliary care visits in the same year. Regular or intensive domiciliary care was given mostly for 75-94 years old, about 70% in both of cases. (Saukkonen et al. 2020)

2.2.1.2 Care planning and implementation

The cognitive, physical, daily life performance, nutritional, psychological and social performance of older people can be assessed with various measures (Äijö et al. 2022). One of the most used instruments is Resident Assessment Instrument (RAI) (Hirdes et al. 2008). Assessment for domiciliary care need is made by a legal professional (Health Care Professionals Act 559/1994, Act on Qualification Requirements for Social Welfare Professionals 272/2005) who primally in co-operation with the client agrees the care plan options for domiciliary care. If necessary, a relative of client, a trustee or health care professional (for example doctor, nurse, social worker, physiotherapist, or occupational therapist) can participate in the care planning. (Ikälaki 980/2012).

Domiciliary care planning is made by case manager (CM) (colloquially known as a service navigator, client counselor or service coordinator). To act as CM, a legal professional degree by the Social Care (Ammattihenkilölaki 817/2015) or Health Care (Health Care Professional Act 559/1994) is required. Social worker, sosionom, geronom, rehabilitation instructor, registered and public nurse are examples of these kind of regulated professions (Ammattihenkilölaki 817/2015 and Health Care Professional Act 559/1994).

Implementation of domiciliary care is carried out according to the care plan by nursing personnel. Nursing personnel are often practical nurses, home aids or helpers (STM 2021) from which practical nurses and home aids are legal professions (Ammattihenkilölaki 817/2015).

2.2.2 Oral care support of care-dependent

Older people, especially who have impaired health, functional capacity and cognitive function, and frailty, have more need for aided oral care (Coker et al. 2014, Kim et al. 2022, Nangle et al. 2019, Niesten et al. 2017). Oral hygiene of dependent older people mostly relies on nursing personnel in a short- or long-term facilities, yet several studies have reported neglected support of oral care widely in nursing care field in general (Hobien et al. 2017, Lindqvist et al. 2013, Reed et al. 2006, Sonde et

al. 2011, Wårdh et al. 2000). Oral health in long-term care facilities is known to be poor. In nursing care oral health problems among dependent older people are typical without proper preventive oral care measures (Rantzow et al. 2018), and dental care is needed in nursing care (Peltola et al. 2004).

Maintaining good oral health is vital for preventing impairment in nutrition intake (Algra et al. 2021, Lamy et al. 1999, Nowjack-Raymer et al. 2003, Rapp et al. 2021, Ritchie et al. 2002), several health complications (Kapila 2021, Pizzo et al. 2010, Meurman et al. 2006, Beck et al. 1996), especially pneumonia (Scannapieco 2021, Van der Maarel-Wirink et al. 2013) and obtaining good OHRQoL (Baniasadi et al. 2021, Reed et al. 2006, van de Rijt et al. 2020). Furthermore, daily activity and cognitive functions can be improved with sufficient oral hygiene as suggested by the previous research (Yoneyama et al. 2002).

2.2.2.1 Challenges to provide oral care support

Barriers to perform oral care can take place due to inadequate oral care support by nursing personnel, or lack of co-operation or compliance of dependent older people. Oral care is also perceived as a difficult task in caregiving, and division of responsibilities for oral care among nursing personnel is obscured. (Hobien et al. 2017, Lindqvist et al. 2013, Reed et al. 2006, Sonde et al. 2011, Wårdh et al. 2000).

Neglecting oral care is often a cause of time limits and workload which are due to unmet resource needs on the part of nursing personnel (Hobien et al. 2017, Lindqvist et al. 2013, Reed et al. 2006, Visschere et al. 2015, Unfer et al. 2012). Lack of guidelines and daily oral care routines have also been noted to be a barrier to perform oral care in depend older people (Jablonski et al. 2009, Unfer et al. 2012, Visschere et al. 2015, Wårdh et al. 2000).

In some cases, consideration and intervention regarding oral health are only managed if oral health problems like pain or other problems with oral hygiene appear, and these are acknowledged by nursing personnel. Nursing personnel are aware of difficulties concerning oral care for depended older people, but in practice oral care is challenging to perform without specific training, guidelines, and education. (Nicol et al. 2005, Sonde et al. 2011, Visschere et al. 2015). However, oral health problems can be also neglected if nursing personnel do not consider these significant (Visschere et al. 2015). Problems relating to neglected oral care can be also considered less visible than other omitted hygiene measures (Yoon & Steele 2012).

Oral care of care-dependent older people, especially with dementia can be challenged due to lack of co-operation or compliance. Refusing, defensiveness and even aggressiveness can prevent oral care (Hobien et al. 2017). Dependent older people who have poor oral health and refuse of receiving oral health care can lead to

neglected oral care as nursing personnel are less motivated. Furthermore, causing pain due to challenged oral care is feared among nursing personnel. Ethical issues are also included in the given oral care and maintaining the integrity of patient is respected. (Visschere et al. 2015). In a case of refusal from the patient, oral care can be left as undone care. (Lindqvist et al. 2013, Jablonski et al. 2009, Sonde et al. 2011, Wårdh et al. 2000)

2.2.2.2 Attitudes, knowledge and skills of nursing personnel

Oral health is positively recognised and considered as an important part the health and wellbeing of the patient by nursing personnel. Debilitating effect of poor oral health to health is also acknowledged. (Lindqvist et al. 2013, Jablonski et al. 2009, Pihjalamäki et al. 2016, Wårdh et al. 1997) Many studies have shown that oral health is considered as a separate part of nursing care, and mostly out of responsibility range of nursing personnel (Lindqvist et al. 2013, Nicol et al. 2005, Reed et al. 2006). Oral care is also considered as a low priority care in practice, which can cause misdirecting oral care to the responsibility of a patient (Lindqvist et al. 2013, Nicol et al. 2005, Wårdh et al. 2000). Furthermore, oral care is often preferred as an unfavourable nursing task and difficulty to be managed in nursing practice (Lindqvist et al. 2013, Pihjalamäki et al. 2016, Reed et al. 2006). Low co-operation with oral care of depended older people has shown to lower favourableness of oral care task among nursing personnel (Forssel et al. 2011). Personal experiences regarding oral health and oral care of nursing personnel are also reflected to patient work - oral hygiene means may be considered as unpleasant to be done to others (Visschere et al. 2015).

Many studies have reported knowledge about oral health being insufficient among nursing personnel and highlighted the need for additional education about oral health (Nicol et al. 2005, Sonde et al. 2011, Visschere et al. 2015). Differences in oral health knowledge between different nursing personnel has also been reported, for example one study reported more lack of knowledge in domiciliary care personnel than personnel of nursing facilities (Hasson & Arnetz 2008).

Knowledge and competence of nursing personnel about oral health depends on how well they have received oral health education during their initial training (Lindqvist et al. 2013). Nonetheless, oral care practices are improved with oral health education, and more routine oral care is obtained as nursing personnel are more confident and acknowledge with oral care practices (Lindqvist et al. 2013, Nicol et al. 2005, Paulsson et al. 2002, Pihjalamäki et al. 2016). Especially, education is needed in improving practices in challenging situations, for example in managing oral care procedures of less co-operative persons (Sonde et al. 2011). Furthermore,

attitudes can be changed more favourable towards oral care with education even in more challenged cases (Forsell et al. 2011, Paulsson et al. 2002)

2.2.2.3 Implementation of oral care

Brushing teeth twice a day is not a routine-like care that is provided by nursing personnel (Jablonski et al. 2009, Nicol et al. 2005, Visschere et al. 2015, Unfer et al. 2012). Regardless of the level care-dependency of home-dwelling older people, oral care support is mostly neglected (Henni et al. 2022, Strömberg et al. 2012). Most often provided oral care procedures are cleaning dental prosthesis and toothbrushing. The more care-dependent older people receive more assistance with toothbrushing than those with less care-dependency (Strömberg et al. 2012). Toothpaste and mouthwash are also used. Interdental cleaning is less reported in the studies. Cleaning oral mucosa is also rarely performed (Visschere et al. 2015). Regarding cleaning dental prosthesis cleansers are often used along with brushing. (Coker et al. 2017, Jablonski et al. 2009, Unfer et al. 2012)

Denture cleaning is the easiest and more tolerant able oral care task among nursing personnel. Tooth brushing is more challenged due to physical (hindrance of cheeks or tongue, restricted mouth opening, undesirable reflexes) and mechanical barriers (bad working position, poor visibility, inability to utilize water point in bedridden). (Visschere et al. 2015)

Oral care documentation is also sparse (Lindqvist et al. 2013). Different patient systems and poor communication (Visschere et al. 2015) effect negatively not only to information flow between nursing personnel, but also to oral health care professionals.

3 Aims

The general aim of this thesis was to examine oral health care of older people in domiciliary care from the perspective of the domiciliary care clients, and domiciliary care personnel who are involved in the planning and implementation of domiciliary care.

The study was based on the working hypotheses that oral health care issues are neglected among domiciliary care dependent older people. The following specific aims were set to examine the hypotheses:

1. To study the perceived oral health in terms of global and problem-oriented questions, oral health-related quality of life and oral health behaviours of older people with or without domiciliary care in Finland (Publication I and II)
2. To examine domiciliary care service planning and implementation of oral health aspects in domiciliary care (Publication III and IV)

4 Materials and Methods

This dissertation is based on the secondary analysis of the nationally representative Health 2000 and Health 2011 Surveys (BRIF8901), and two independently conducted cross-sectional surveys among domiciliary care personnel. In this dissertation, the analysis of Health 2000 and 2011 Surveys represent the oral health perspectives of domiciliary care clients and non-clients (Publication I and II). Respectively, the study in domiciliary care represents the oral health perspective of domiciliary care case managers (CMs) and nursing personnel (Publication III and IV).

4.1 Study population

Participants aged 70 years or older, living at home with or without domiciliary care services, and who participated in the interviews were included from Health 2000 (n=1298) and Health 2011 (n=1027) Surveys for secondary analysis on perceived oral health and oral health behaviours. Those who were living in nursing care facilities or had incomplete information about living circumstances or utilization of domiciliary care service were excluded (Health 2000 n=140 and Health 2011 n=540). (Publication I) Inclusion criteria for participants of OHRQL study from Health 2011 Survey (n=1027) were the same as in the study I, but completely missing OHIP-14 responses or values for the survey-specific weighting coefficient led to exclusion (n=269). Consequently, the remaining number of participants was 758. (Figure 1). (Publication II)

Out of all 25 domiciliary care CMs, 22 CMs participated to the study (Publication III). On the part of domiciliary care nursing personnel, the Webropol survey links were directed to all nursing employees (n=465). For nursing personnel, reportedly forwarded links were 302, and 163 links were assumed not to be sent by contact person. From the opened survey links (n=245) 115 nursing employees completed the survey (47%). Response rate was 25%, out of 465 nursing employees. (Figure 1) (Publication IV)

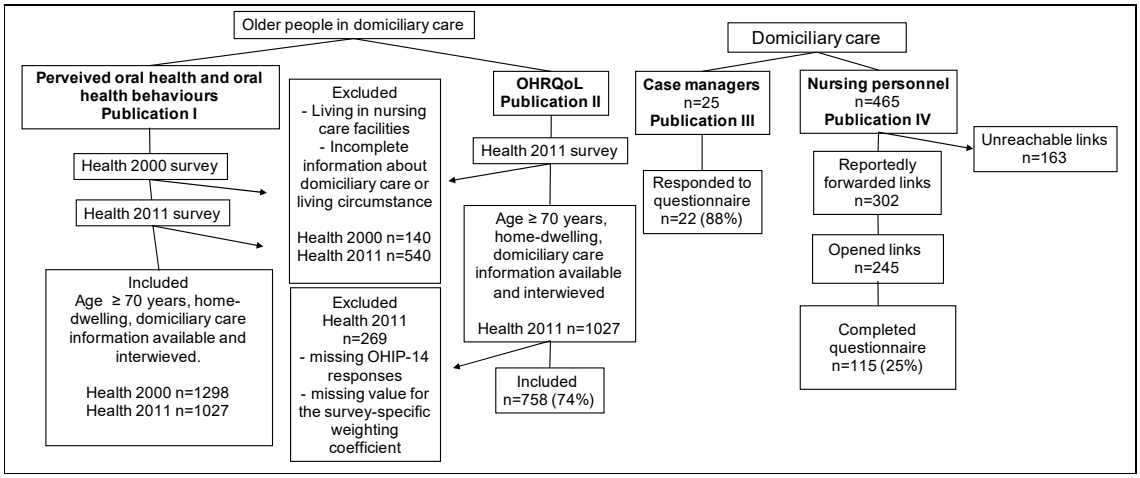

Figure 1. Flow chart of the study.

4.2 Surveys

4.2.1 The perceived oral health of older people with and without domiciliary care (Publication I)

For this study, the perceived oral health of domiciliary care clients and non-clients were determined through the questions about perceived oral health, toothache or other troubles, and difficulties in eating or chewing using from the Health 2000 and 2011 Surveys (Heistaro 2008, Lundqvist & Mäki-Opas 2016). Respectively, oral health behaviours of domiciliary care clients and non-clients included questions about cleaning teeth, mouth and dentures, and use of oral health services. Utilized questions from the Health 2000 and Health 2011 Surveys are presented in **Figure 2**. Questions about gender and education were also used. Level of education was determined with the question of the highest attended school level that was dichotomised as low (less than primary school, primary school, or secondary school) and middle/high (grammar, comprehensive or high school or matriculation examination). Utilization of domiciliary care services was determined in both study years using self-reported responses to following questions. "Do you receive repeated assistance or help in your everyday activities (for example household work, washing up, shopping) because of your reduced functional capacity?" (yes or no). If response was yes, the next question was "Have you received help from a home care assistant or a nurse?" Domiciliary clients were defined as those who received help from a home care assistant or nurse.

Some variations of the questions were between the Health 2000 and Health 2011 Surveys due to improvements based on the Health 2000 Survey analytics. In 2011,

question about visit to a dentist was supplemented with dental assistant or dental technician, as in 2000 only visit to a dentist was questioned. Ability to eat dry bread or biscuits without drinking liquid at the same time was only asked in 2000. Similarly, ability to clean one`s own teeth and mouth without assistance (categorised as no difficulties/difficulties or not able) was also asked only in 2000. Furthermore, in both study years different questions were asked to dentate and edentulous participants, as how often do you usually brush your teeth was only asked among dentate. (Heistaro 2008, Lundqvist & Mäki-Opas 2016)

Perceived oral health	
Is the condition of your teeth and the health of your mouth at present?	poor, rather poor, satisfying, rather good, good
Do you have removable dentures?	own teeth, partial dental prosthesis, edentulous
Have you during the past 12 months had tooth-ache or other trouble related to your teeth or dentures?	yes, no
Are you able to chew hard or tough food, such as rye bread, meat or apple?	can not chew, some difficulties, no difficulties
Are you able to eat dry bread or biscuits without drinking liquid at the same time?	yes, no
Do you think you need dental treatment now?	yes, no

Figure 2. Questions with response alternatives about perceived oral health for the study from Health 2000 and 2011.

4.2.2 Oral health-related quality of life of older people with and without domiciliary care (Publication II)

Data for assessment of OHRQoL of older people with and without domiciliary care was from participants of the Health 2011 Survey (Lundqvist & Mäki-Opas 2016). Returned self-reported questionnaire with the OHIP-14 (Slade 1997) and participation to the interviews were required of participants for this study. Total of 14 questions about OHRQoL in seven dimensions formed the OHIP-14 (Slade 1997) in the Health 2011 Survey. The dimensions consisted of Functional Limitation, Physical Pain, Psychological Discomfort, Physical Disability, Psychological Disability, Social Disability and Handicap. Frequency of oral health related problems during the last month was determined using the 5-point Likert scale response alternatives: “never”,” hardly ever”, “occasionally”, “fairly often” and “often”.

The same two questions were used to determine the utilization of domiciliary care as in the previous research (Publication I). A positive (yes) answer to question “Do you receive repeated assistance or help in your everyday activities (for example household work, washing up, shopping) because of your functional capacity?” lead

to another question "Have you received help from a home care assistant or a nurse?". Domiciliary care clients were defined as those who responded positively to receiving help from a home care assistant or a nurse.

Data about gender, educational background, and the use of dental care services and the use of RDP from the Health 2011 Survey (Lundqvist & Mäki-Opas 2016) were used as confounding variables. Educational background was classified into three categories from the ordinal question about education: low (less than primary school, primary school, or secondary school), middle (grammar or comprehensive) and high (high school or matriculation examination). Use of dental care services was determined with the question "When did you last visited dental care in 2011?" to which response alternatives were categorized to "1-2 years ago", "3-5 years ago" and "over 5 years ago or never". Dichotomized response alternatives "dentate" (no dentures, has own teeth) and "RDP" (complete dentures with no teeth nor roots, partial dentures and own teeth; and no dentures nor teeth) were applied to the question about the use of RDP.

4.2.3 Oral health behaviours of older people with and without domiciliary care (Publication I)

Oral health behaviours of older people with and without domiciliary care were surveyed with questions about cleaning teeth, mouth and dentures, and use of oral health services. Used questions from the Health 2000 and Health 2011 Surveys are presented in **Figure 3**. The Health 2011 survey included improvements based on analyses of the Health 2000 survey (Lundqvist et al. 2016). Hence, different questions were asked of dentate and edentulous participants in 2000 and 2011. In 2011 visits to a dentist, dental hygienist, dental assistant, or dental technician were asked, as in 2000 only question about visits to dentists were included. Similarly, ability to clean one`s own teeth and mouth without assistance (categorised as no difficulties, difficulties or not able) was also asked only in 2000 (not shown in Figure 2). Otherwise, the corresponding survey methods as in the part of perceived oral health survey were used.

Oral health behaviours	
When did you last visit a dentist/received dental care?	less than 12 months, 1-2 years ago, 3-5 years ago, over 5 years ago, never
How often do you usually brush your teeth? (among dentate only)	once a day or fever, atleast two times or more
How often do you clean your removable dentures?	once a day or fever, atleast two times or more
Are you able to clean your teeth and mouth yourself?	can not, difficult, no difficulties

Figure 3. Questions with response alternatives about oral health behaviours for the study from Health 2000 and 2011 Surveys.

The Health 2000 and 2011 Surveys

The National Public Health Institute of Finland (KTL) conducted the Health 2000 Survey that aimed to determine public health problems with causes and treatment, functional capacity and welfare in the Finnish population. Oral health was also included in the study. The study took place from 2000 to 2001. (Heistaro 2008)

A two-stage stratified cluster sample was used as a design sample. Strata was determined by five university hospital districts in Finland. Respectively, 80 health centres were elected for clusters. Representative 9922 randomly selected Finns aged 18 or older were interviewed, and health examinations were conducted for 8000 persons. Older people aged 80 or older were oversampled to ensure adequate observations for older age groups. (Heistaro 2008)

Data was collected with interviews, questionnaires, and health examinations. Home interviews, based on validated questionnaires, were conducted by professional interviewers of Statistics Finland in 2000. Oral health related questions included dental health (teeth and dentures), maintenance of oral hygiene (self-care habits and instruments) and utilization of dental care services (number and cost of visits). In addition, OHIP-14 (Slade 1997) was used to assess OHRQoL. (Heistaro 2008)

The Health 2000 Survey was followed by the Health 2011 Survey that was conducted by THL (formerly KTL). All participants were reinvited from the previous Health 2000 Survey. Mortality, moving abroad, refusal to participate and incomplete address information were reasons for reduced sample size. Reinvited sample was N=8135 that was complemented with an additional sample of younger adults (N=1579). In 2011, trained nurses conducted the interviews. (Lundqvist & Mäki-Opas 2016)

Publications about the Health 2000 and 2011 Surveys include more detailed methodology and results of the Health 2000 and 2011 Surveys (Heistaro 2008, Lundqvist & Mäki-Opas 2016, Aromaa & Koskinen 2004, Koskinen et al. 2012).

4.2.4 Surveys of domiciliary care service planning and implementation of oral health aspects – case managers and nursing personnel (Publications III and IV)

Two separate cross-sectional surveys were conducted in domiciliary care in the city of Tampere, Finland, in Autumn 2013. One survey was for CMs (N=25) and the other for nursing personnel (N=465). The survey for CMs was about oral health-related issues (OHRIs) that were considered during service planning. Knowledge, perceived skills, and activities were researched by a nursing personnel survey. CMs were responsible for treatment plan which served as a guide for nursing personnel taking care of around 2100 elderly domiciliary care clients in 2013 (Väyrynen & Kuronen 2013).

The questionnaires were created as new because comparable questionnaires were not available. The items were developed based on clinical expertise, literature overview and previous national surveys. Questionnaires were pilot tested with five dental students for clarity and feasibility.

Questions addressed to CMs were multiple-choice, dichotomous questions (yes/no), or open-ended questions. Six questions were about considering OHRIs during domiciliary care planning, which four of the questions are presented in **Figure 4**. Two specifying questions were also asked. First question was "What kind of oral health-related issues are considered in domiciliary care?", if OHRIs were considered during service planning. Following questions were asked: "client´s ability to perform oral home care, need for assistance in maintaining oral home care, need for oral hygiene products, client´s dental prosthesis, diet or other issues (and what)". Second question was "Should domiciliary care consider oral health-related issues routinely?" with response alternatives: yes, no, and do not know.

The questionnaire of nursing personnel consisted of 14 questions about knowledge, perceived skills, and activities in supporting oral home care in domiciliary care clients. Analyses were based on 12 included questions that are presented in **Figure 5**. Furthermore, educational background (profession), age, gender and working experience in years were asked from participants in both surveys.

The surveys were conducted electronically through Webropol application. Limiters were used to ensure that participants could answer only once through the link of electronic survey. In accordance with the privacy policy of the city, the links were sent by contact persons of the city. Reminder messages were delivered for nursing personnel through the contact persons, but for CMs reminders were not sent due to active response rate.

How client´s oral health-related issues are considered in home care? Arises in the evaluation of the need for home care Arises only in special cases Arises only when the care has already begun Arises if client or relative contacts	Never, seldom, mostly, always, do not know
How much attention is paid to oral health-related issues during the service planning?	None, little, if needed, routinely, do not know
Are any guidelines regarding the oral health related issues used in the service planning?	Guidelines (city spesific), guidelines (general), no guidelines but self-awareness, no guidelines
Should client's oral hygiene be supported by home care	Yes (for client specific), yes (for everyone), no (client is responsible), do not know

Figure 4. Questions with response alternatives about oral health-related issues for case managers of domiciliary care.

Knowledge			
How to clean the dental prostheses?	yes/no	**Client has a dry mouth. What would you recommend?**	yes/no
Not in a boiling water		Sugar free pastilles	
With a denture brush		Care products for dry mouth	
Prosthesis is rinsed after cleaning		Water	
Not cleaning by wiping with a paper		No juice	
With a dental prosthesis cleaning agent		Lozenges	
Soaking in cleaning solution (e.g. Corega Tabs®)		Visit a dentist	
Not with toothpaste		Xylitol pastilles	
With a soft toothbrush		Visit a doctor	
With a liquid soap		Chewing gum	
How to clean the oral surfaces under removable dental prosthesis?	yes/no	**What is a good thirst-quencher?**	yes/no
The mucous membranes need to be cleaned		Not soft drink	
Not with a toothbrush		Water	
With a moist gauze		Not juice	
No routine-like rinsing with a mouthwash		Milk	
How removable dental prosthesis is stored when not used?	yes/no	**Oral hygiene**	yes/no
Not wrapped in the moist paper		The mouthwash does not replace toothbrush and toothpaste	
In a vessel as dry		Interdental spaces should not be only cleaned if there is food in the gaps (regular cleaning)	
Not soaking in a glass of water		The bleaching toothpaste is not for daily use	
In a cleaning solution (e.g. Corega Tabs®) during night			

Figure 5. Questions with response alternatives about knowledge, perceived skills, and activity for domiciliary care nursing personnel.

Perceived skills	
How capable you feel to guide the client in oral home care?	none, weak, cannot say, good, excellent
cleaning removable dental prosthesis	
brushing teeth	
problems with dry mouth	
pain in the mouth	
complicated eating	
cleaning interdental spaces	
Did your studies include studies about oral health?	yes, no, do not know
My education inclued studies about oral health	
Have you been able to use your given education in practical work	
My education inclued practical studies about oral health of older people	
Personal know-how	none, weak, cannot say, good, excellent
I have knowledge for guiding the client in teeth cleaning	
I know how to arrange appointment for dentist	
I know how removable prostheses are washed and how often	
I know how medicines affect the mouth	
I have sufficient instructions available how oral health services are arranged for the clients in my area	
Would you like additional education on oral health?	yes/no
Would you need more knowledge of oral health?	
Would you like education regarding oral health and it´s maintenance?	
Would you like education how the client is guided in the self-care to maintain oral health?	
Do you need general instructions by home care, how the client is guided to the dentist if needed?	

Activity	
How often you deal following oral health related issues with customer?	never, few times a month, few times a week, daily or cannot say
Inspection of the mucous membrane under removable prosthesis	
Brushing the client's teeth (client is not able)	
Reminding about the cleaning of removable prostheses	
Following the brushing technique	
Guiding the client during tooth brushing	
Cleaning of client's removable prostheses (client is not able)	
Guiding to tooth brushing (remind, accompany, give the cleaning tools)	
Visit-specific controls concerning to oral health	never, few times a month, few times a week, daily or cannot say
Checking that teeth were cleaned during evening visit	
Checking that client has fluoride toothpaste	
Checking that teeth were cleaned during morning visit	
Taking care that the client has a proper toothbrush	
Changing the toothbrush for a new one every three months	
Checking that client has tools for cleaning the interdental spaces	
Checking that client has xylitol products	

4.3 Statistical analyses

Descriptive statistics included calculations of perceived oral health (subjective oral health, toothache or other troubles, difficulties in eating or chewing) and oral health behaviours (cleaning teeth, mouth and dentures, and use of oral health services). Data were analysed by gender and use of domiciliary care services. Due to different oral health behaviour of women, gender was used to stratification, as women more often use oral health services (Suominen et al. 2017), have better perceived oral health (Torppa-Saarinen et al. 2018) and more frequently brush their teeth (Karpio et al. 2012) than men. Differences between perceived oral health and oral health behaviours between older people with and without domiciliary care was tested with chi-square test. Stratification was also used to compare chi-square tested differences by gender. (Publication I)

OHRQoL was measured with the OHIP-14 by forming three outcome variables from the OHIP-14 items. The variables were prevalence, severity (OHIP-total), and sum score for seven dimensions. Prevalence describes the percentage of participants

who reported at least one impact "occasionally", "fairy often" or "very often" (OFoVo). Severity (mean sum score) is the sum of ordinal responses with a range of 0-56. The sum of ordinal responses to two items of forming each dimension was calculated for dimensions. The missing data for both items of any of the seven OHIP-14 domains was one exclusion criteria. The missing value was imputed with value 0 if one item of a domain was missing. (Publication II)

As confounding factors, gender, educational background, use of dental services, and use of RDP were used. Data was analysed by use of domiciliary care. The statistical significance of the associations between use of domiciliary care and cofounding factors were analysed by χ^2 test, Mann-Whitney U, Kruskal-Wallis, and Fisher exact tests. Graphs and the Kolmogorov-Smirnov test were used as needed for testing to verify that the assumptions were met. To determine the prevalence and severity outcomes, logistic and negative binomial regression analyses were used in multivariable analyses. (Publication II)

A mediation analysis, Valeri-VanderWeele (Valeri & VanderWeele 2013), was used to analyse the mediating effect of education due to bivariate associations. The applied model to assess the mediation is presented in **Figure 6** that was published in Publication II. In the analysis, assessment was done with exact closed-form mediation effect formulas for binary-binary logistic. The associations were evaluated using mediation analysis that enabled causal interpretation. In the evaluation process, the mediating effect of education with the direct and indirect pathways were considered and the confounders: RDP, gender and use of dental services were also controlled. (Publication II)

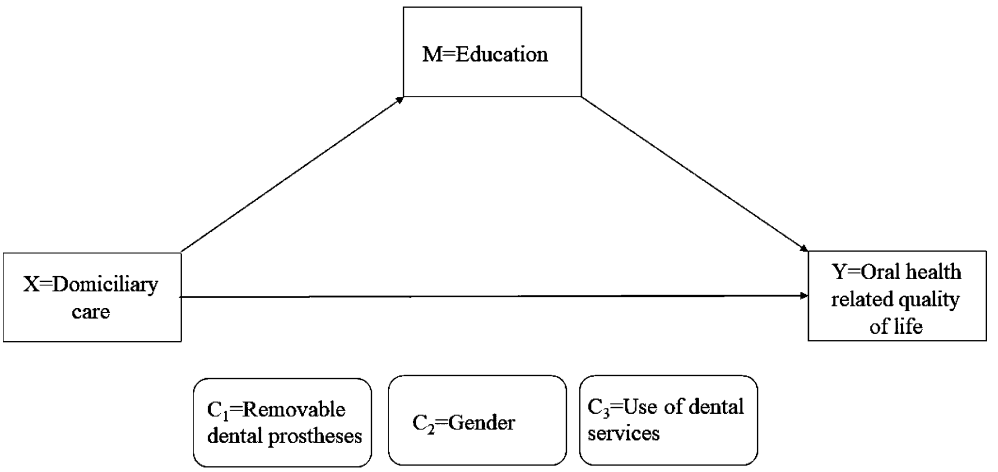

Figure 6. Picture from original Publication II. The mediation model used where X is exposure, M is mediator, Y is outcome and C is confouder.

Two parallel adjusted models were also used in the study concerning OHRQoL where gender and use of oral health services were adjusted. In the first model, educational background was added, and in the following model use of RDP was applied. Spearman correlation coefficients were used in the evaluation of the relationship between two variables. (Publication II)

Descriptive statistics were used for describing the sample and study variables for the consideration OHRIs during domiciliary care service planning. Age (under or over 40 years old) and educational background (social service or health care) defined dichotomized grouping. The Mantel-Haenszel χ^2 test was used comparing differences between dichotomized groups. Gender was excluded from the comparison as all but one respondent (gender was not reported) were women. (Publication III)

The samples and study variables were described with frequencies, percentages, means and standard deviations in the analysation of knowledge, perceived skills, and activities of nursing personnel. According to age (under or over 40 years old) and working experience (less or more than 5 years), the respondents were categorised into two groups. χ^2 test was used for comparing differences between the two groups. The majority of respondents were women (97%), which is why gender was not considered in the comparison. (Publication IV)

For statistical analyses IBM SPSS from 22 to 26 software (IBM Corporation Chicago, IL, USA) or SAS statistical software 9.4 were used. For the samples and study variables descriptive statistics were calculated. Oversampling in older age groups and non-response was corrected with the survey-specific weighting coefficients in the secondary analyses of Health 2000 and 2011 Surveys (Heistaro 2008, Lundqvist & Mäki-Opas 2016) (Publication I&II). The statistical significance level was considered as $P < 0.05$ in all published studies I-IV.

4.4 Ethical perspectives

Permission to use the Health 2000 and Health 2011 Survey data was granted by the Finnish Institute for Health and Welfare, THL (research 7.3.021, agreed in December 2017). Original approval for the Health 2000 and Health 2011 Surveys was granted by the Ethical Committee for Research in Epidemiology and Public Health at the Hospital District of Helsinki and Uusimaa (HUS). All participants of the Health 2000 and Health 2011 provided informed and signed consent. A family member or a relative signed the oral consent of a participant in the case of health-related or cognitive limitation. (Heistaro 2008, Lundqvist 2016, Aromaa & Koskinen 2004, Koskinen et al. 2012).

The conglomerate administration of Tampere gave the permission for the study in domiciliary care in April 2013. Participants were informed about the study. Voluntary responding to the questionnaire was considered as informed consent.

5 Results

5.1 Perceived oral health, oral health-related quality of life and oral health behaviours of older people with or without domiciliary care (Publication I & II)

5.1.1 Participants

Of the participants (n= 1298) 20.3% received domiciliary care service in 2000. In 2011, 8.4% of the participants were domiciliary care clients in the study about perceived oral health and oral health behaviours. Respectively in 2011, 4.9% received domiciliary care due to different inclusion criteria in the study about OHRQoL (Figure 1). In the studies, mean age of domiciliary care clients was higher than non-clients. Most of the domiciliary care clients were women, the same was with non-clients. Majority of the participants had low educational background in both study years. Domiciliary care clients were more often edentulous and used more often RDP than non-clients in 2000 and 2011. Non-clients had used more recently oral healthcare services than domiciliary care clients who had more often lack of dental care utilization. (**Table 1**)

Table 1. Characteristics of the participants by perceived oral health, oral health behaviours, and oral health-related quality of life. Modified from Publication I and II.

	Perceived oral heath and oral health behaviours				OHRQoL		
	In 2000		In 2011			In 2011	
All (n)	1298		1027			758	
	Domiciliary care client (n=264)	**Non-client (n=1034)**	**Domiciliary care client (n=86)**	**Non-client (n=941)**		**Domiciliary care client (n=37)**	**Non-client (n=721)**
Age: mean (range)	83 (70-95)	74 (70-99)	83 (70-97)	75 (70-100)		83 (70-97)	76 (70-97)
Gender							
Men	25.1%	38.3%	15.9%	41.2%		22.0%	42.5%
Women	74.9%	61.2%	84.1%	58.8%		78.0%	57.5%
Education					**Education**		
Low	75.7%	59.7%	77.5%	63.0%	Low	72.0%	59.1%
Middle/high	23.8%	39.4%	22.5%	37.0%	Middle	19.1%	22.2%
					High	8.9%	19 %
Use of removabel dental prosthesis					**Use of removabel dental prosthesis**		
Edentulous (with or without complete dentures)	71.8%	50.5%	45.2%	33.0%	Edentulous, and dentate with RDP	72.2%	59.8%
Dentate (with removable dentures)	14.9%	26.1%	31.5%	28.5%	Dentate (no RDP)	27.8%	40.1%
Dentate (without removable dentures)	13.2%	23.4%	23.3%	38.5%			
Use of dental services					**Use of dental services**		
Less than 12 months ago	23.5%	39.1%	38.8%	53.4%	1-2 years ago	44.8%	56.9%
1-2 years ago	11.4%	10.8%	12.9%	16.7%	3-5 years ago	9.4%	17.6%
3-5 years ago	6.6%	10.1%	14.1%	9.4%	Over 5 years ago or never	43.2%	25.2%
Over 5 years ago or never	58.4%	40.0%	34.1%	20.5%			

5.1.2 Perceived oral health of older people with and without domiciliary care (Publication I)

Domiciliary care clients reported more often being edentulous and using RDP than non-clients (**Table 1**). Both women and men with domiciliary care clients reported significantly more often edentulousness in 2000 than non-clients (**Table 2**).

Poorer condition of teeth and mouth was significantly more often reported by domiciliary care clients (40.3%) than non-clients (28.9%) in 2011. In the same year, poorer condition of oral health was also more often reported by women with domiciliary care than those without. In 2000, male domiciliary care clients experienced less frequently oral health related problems (toothache or troubles with teeth or RDP) than non-clients. (**Table 2**)

Domiciliary care clients reported more chewing difficulties in both study years (2000: 50.6% vs. 34% and 2011: 38.4% vs. 20.7%) Similar difference according to use of domiciliary care was found among women in 2000 and men in 2011. In 2000, difficulties eating dry food without drinking was also more often experienced by domiciliary care clients than non-clients. Respectively, similar difference was noted among women according to the use of domiciliary care. (**Table 2**)

Table 2. Percentages of women and men with or without domiciliary care, and their perceived oral health and unmet treatment need, use of dental services and oral health behaviours. Modified from Publication I.

	IN 2000				IN 2011			
	WOMEN		MEN		WOMEN		MEN	
	Domiciliary care				Domiciliary care			
	Yes (n=204)	No (n=658)	Yes (n=60)	No (n=376)	Yes (n=69)	No (n=534)	Yes (n=17)	No (n=407)
Is the condition of your teeth and the health of your mouth at present?								
Good/Rather good	54.8	55.6	42.5	54.3	58.3	74.6	66.7	66.3
Satisfying/ Rather poor/Poor	45.2	44.4	57.3	45.7	**41.7**	**25.4****	33.3	33.7
Do you have removable dentures?								
Edentulous with or without complete dentures	**73.8**	**53.9*****	**65.9**	**45.3***	45.9	37.1	41.7	27.5
Dentate with removable dentures	13.1	25.7	18.2	26.8	32.8	26.5	25.0	31.4
Dentate without removable dentures	13.1	20.4	15.9	27.9	21.3	36.4	33.3	41.2
Have you during the past 12 months had toothache or other trouble related to your teeth or dentures?								
Yes	22.2	19.8	**13.6**	**27.9***	27.9	26.7	16.7	30.9
No	80.2	77.8	86.7	72.1	72.1	73.3	83.3	69.1
Are you able to chew hard or tough food, such as rye bread, meat or apple?								
No difficulties	49.2	66.7	50.0	64.9	62.9	79.9	53.8	78.5
Some difficulties or cannot chew	**50.8**	**33.3*****	50.0	35.1	**37.1**	**20.1****	**46.2**	**21.5***
Are you able to eat dry bread or biscuits without drinking liquid at the same time?								
Yes	58.8	79.3	76.8	65.1				
No	**41.2**	**20.7*****	34.9	23.2				
Do you think you need dental treatment now?								
Yes	25.8	34.6	32.6	33.8	31.1	37.9	35.7	41.4
No	74.2	65.4	67.4	66.2	68.9	62.1	64.3	58.6
When did you last visit a dentist in 2000/visited dental care in 2011?								
Less than 12 months ago	24.2	38.2	22.7	40.4	39.4	52.5	33.3	54.9
1-2 years ago	10.5	11.0	13.6	10.2	15.5	15.6	0	17.9
3-5 years ago	6.5	8.7	9.1	12.5	14.1	10.8	20.0	7.5
Over 5 years ago or never	**58.9**	**42.1****	54.5	36.8	31.0	21.1	**46.7**	**19.7****
How often do you usually brush your teeth? (Among dentate only)								
At least twice a day	52.9	64.1	20.0	41.4	56.5	76.3	25.0	45.4
Once a day or less often	47.1	35.9	80.0	58.6	**43.5**	**23.7****	75.0	54.6

*p<0.05, ** p<0.01 and ***p<0.001, p=χ^2 test

5.1.3 Oral health-related quality of life of older people with and without domiciliary care (Publication II)

Tendency for poorer OHRQoL in terms of reporting at least one problem related to mouth, teeth or RDP at least occasionally during last month, domiciliary care clients had higher proportion of OFoVo (OHIP-prevalence) responses and higher mean severity scores than non-clients to OHIP- 14 items. Statistically significant differences were only noted among those with high level of education (prevalence/severity), those with last dental visit 1-2 years ago (prevalence), in men and in dentate (severity) (Table 3).

Table 3. Oral health-related quality of life with a prevalence of at least one oral impact occasionally, fairly often, very often (OFoVo), and sum of all impacts (severity mean) between domiciliary care clients according to gender, education, use of dental services and use of RDP (n=758). Frequencies presented as unweighted and percentages as weighted. Modified from Publication II

	Domiciliary care			
	Yes n=37	No n=721	Yes n=37	No n=679
	OFoVo%	OFoVo%	Severity mean (SD[a])	Severity mean (SD[a])
All	41.7	33.8	4.3 (6.4)	4.1 (8.0)
Gender				
Men	62.5	35.0	**6.7 (7.3)**	**4.2 (7.6)*[c]**
Women	39.3	32.8	3.8 (6.2)	4.1 (8.3)
Education				
Low	38.5	38.4	3.6 (6.7)	4.8 (8.9)
Middle	33.3	26.6	3.1 (3.0)	3.4 (6.8)
High	**100.0**	**27.4*[d]**	**11.5 (6.3)**	**2.9 (6.1)**[c]**
Use of dental services				
1-2 years ago	**56.3**	**32.2*[b]**	4.6 (6.8)	3.9 (8.3)
3-5 years ago	50.0	33.6	9.0 (8.9)	3.8 (6.6)
Over 5 years ago or never	31.3	38.0	3.1 (5.3)	4.9 (8.4)
Use of removable dental prosthesis				
Dentate (no prostheses)	40.0	21.0	**2.8 (2.4)**	**1.9 (5.3)**[c]**
Removable dental prosthesis	44.4	42.1	4.9 (7.3)	5.7 (9.2)

*p<0.05 and ** p<0.01 for the difference between domiciliary care clients and non-clients

[a] Standard deviation

[b] Chi-square test

[c] Mann-Whitney U-test

[d] Fisher exact test

Domiciliary care clients reported more often about functional limitations, physical pain, and psychological discomfort (only statistically significant difference) of the OHIP-14 dimensions than non-clients. While the other dimensions for domiciliary care clients indicated for better OHRQoL. (**Figure 7**)

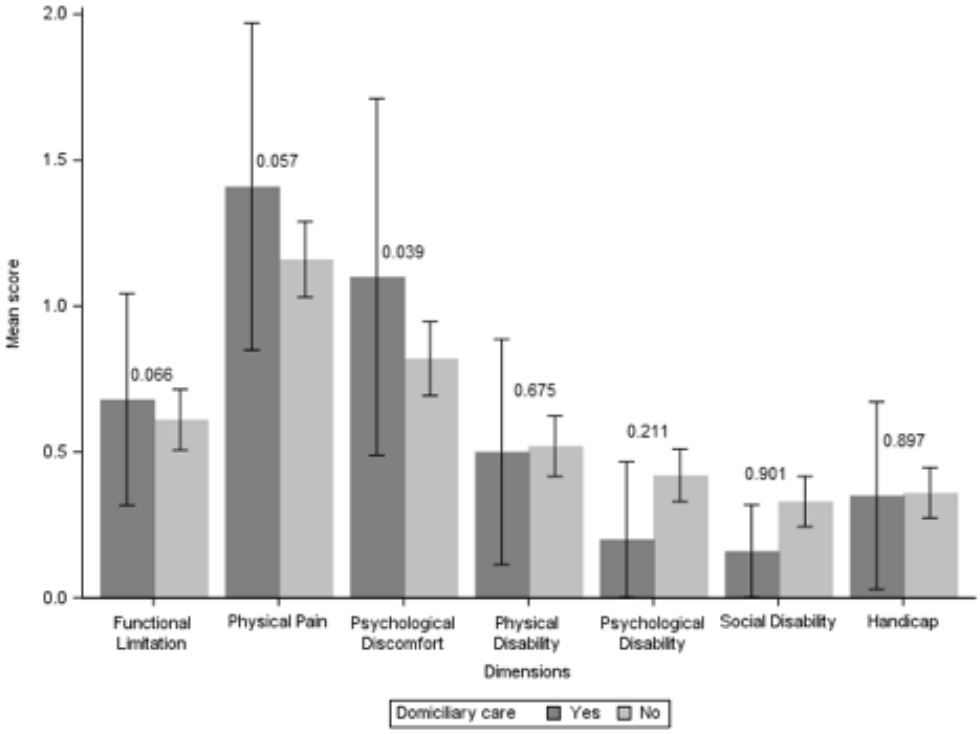

Figure 7. Mean scores, confidence interval of standard error of mean and p-values (Mann-Whitney U-test) for the seven dimensions of OHIP-14 between domiciliary care clients and non-clients (n=758). Picture from original Publication II.

Tendency for poorer OHRQoL was related to receiving domiciliary care. Statistically significantly, use of RDP increased the risk (OR 2.84) more among domiciliary care clients than non-clients. The effect of domiciliary care on OHRQoL was mediated by education. However, the strength of direct effect was 0.98-fold to the total effect. Use of RDP, as a moderator, had very weak effect on the effect of education to domiciliary care.

Regression models showed no statistically significant differences in OHIP-14 dimensions between domiciliary care clients and non-clients, but a tendency for the negative effect of receiving domiciliary care on OHRQoL was noted in the dimension-wise analyses by the negative regression analyses. Psychological discomfort was related to a tendency for higher risk (OR 1.44) whereas psychological disability lowered the risk (OR 0.44) for poor OHRQoL.

5.1.4 Oral health behaviours of older people with and without domiciliary care (Publication I)

Domiciliary care clients reported having used oral health services less recently than non-clients in 2000 and 2011 (**Figure 8)**. Similar difference according to use of domiciliary care was found among women in 2000 and men in 2011. (**Table 2**)

Toothbrushing less often than twice a day was more often reported domiciliary care clients than non-clients in 2011 (**Figure 9**). Women domiciliary care clients brushed their teeth less often than twice a day compared to non-clients in 2011 (**Table 2**).

Impairment of the ability to clean teeth or mouth independently was significantly more often reported by domiciliary care clients than non-clients in 2000 (14.3% vs 1.1%, p<.001). According to use of domiciliary, similar difference was found among women and men. (**Table 2**) The ability to clean RDP independently did not differ between domiciliary care clients and non-clients in 2000.

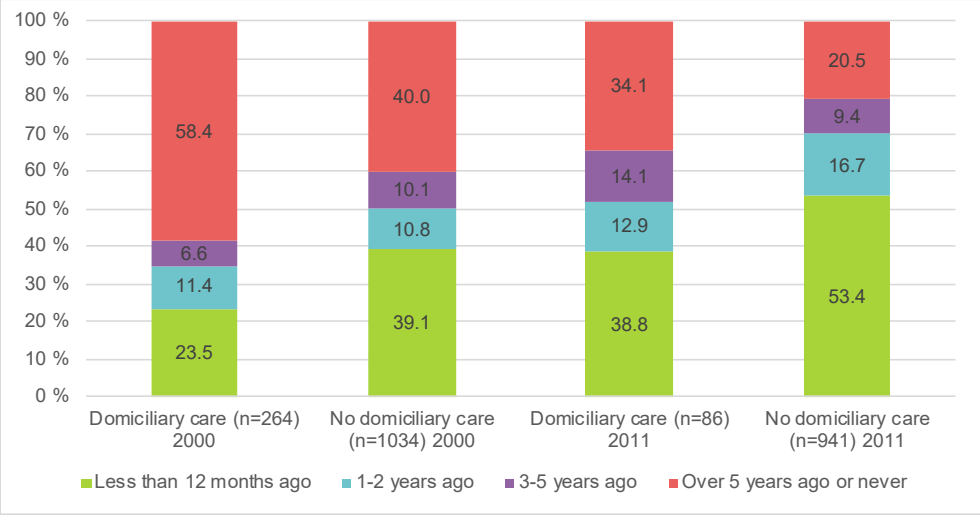

Figure 8. Percentages of responses to question of when participants last visited a dentist or received dental care by utilization of domiciliary care in 2000 and 2011.

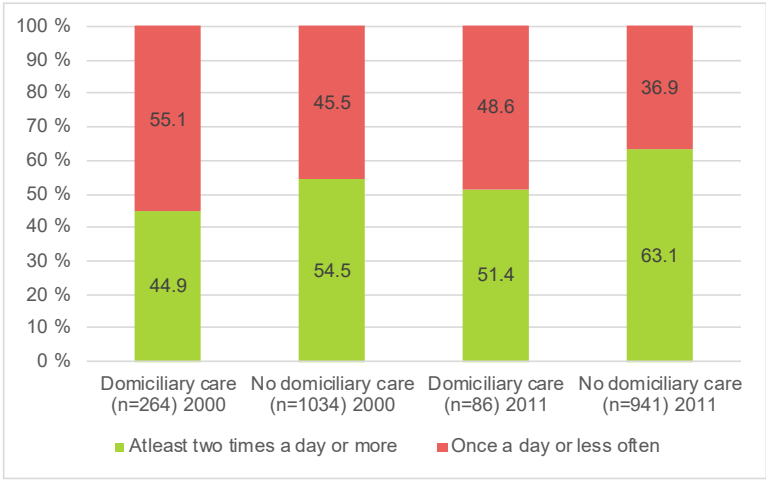

Figure 9. Percentages of responses to question of how often participant usually brush their teeth (asked only among dentate) by utilization of domiciliary care in 2000 and 2011.

5.2 Domiciliary care service planning and implementation of oral health aspects (Publication III&IV)

5.2.1 Participants

Of the CMs (n=22), 41% were Bachelor of Social Services (BBS) and the rest were public health nurses (PHN) 36%, registered nurses (RN) 9% and BSS with a certified degree for licensed practical nurse (LPN) 5% or other educational background 9%. Over half of the CMs had at least 3 years working experience. The most experienced CMs, by working years, had a health care background and were older than the CMs (73% ≤ 40 years) with a social service background.

Of the nursing personnel, 76% had LPN as an occupation. The rest of nursing employees were home aids 10%, PHN 5% and 8% healthcare students, RN or home helpers. Nursing employees who had worked for more than ten years were 47% of the nursing personnel.

5.2.2 Oral health-related issues during service planning (Publication III)

Most of the CMs reported that they seldom (68%) included OHRIs during domiciliary care service planning. As an exception, OHRIs were considered in most of the reported cases by the older CMs (age ≥ 40) when compared to the younger CMs (**Table 4**). OHRIs were seldom considered by an initiative of client or a

representative of client (**Figure 10**). However, the CMs with a background in health care were more active to consider OHRIs by the initiative of client or representative than the CMs with a social service background (**Table 4**). Mostly OHRIs were considered in special cases or after starting domiciliary care for the client (**Figure 10)**. Compared to the CMs with a health care educational background, the CMs with an educational background in social services did not routinely paid attention to OHRIs during domiciliary care service planning (**Table 4**). Furthermore, attention to OHRIs were paid if needed by half of the CMs and routine attention by 14% of the CMs.

Table 4. Responses (%) to questions related to oral health-related issues of the client according to age and education by case managers (n=22), modified from Publication III.

		Age		Education	
Questions with possible items	Answer	<40 n=11	40+ n=10	Social Welfare n=11	Health Care n=10
How client´s oral health related issues are considered in home care?					
Arises in the evaluation of the need for home care	Mostly	**9**	**50***	27	30
Arises only in special cases	Mostly/Always	82	50	64	70
Arises only when the care has already begun	Mostly/Always	82	60	64	80
Arises if client or relative contacts	Mostly/Always	18	40	**9**	**50***
How much attention is paid to oral health issues during the service planning?	Routinely	9	20	**0**	**30***
Are any guidelines regarding the oral health related issues used in the service planning?	Guidelines (general)	**0**	**20***	9	10
	No guidelines but self-awareness	27	60	18	70
	No guidelines	73	20	73	20
Should client's oral hygiene be supported by home care	Yes	55	50	64	40

*p<0.05.

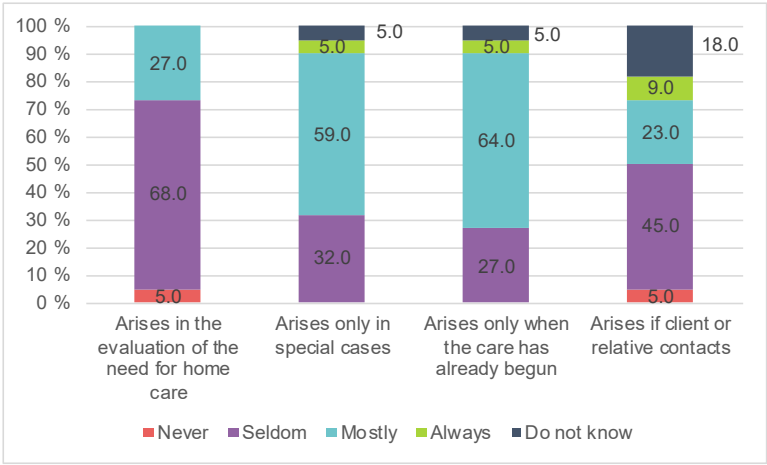

Figure 10. Percentages of responses with response alternatives to how oral health-related issues of domiciliary care clients are considered in domiciliary care by the case managers.

The ability or need to maintain oral self-care by the client were the most often reported OHRIs during service planning. Issues related to RDP or diet, and other oral health problems (oral pain, poor oral health, eating difficulties) and client´s memory problems were also reported by some participants.

Domiciliary care service planning was lacking available guidelines related to OHRIs, but 41% of the CMs did report to have self-awareness about OHRIs despite of lacking guidelines (**Figure 11**). The older CMs (**Table 4**) applied mostly general guidelines about oral health during service planning. Guidelines provided by the city were not available.

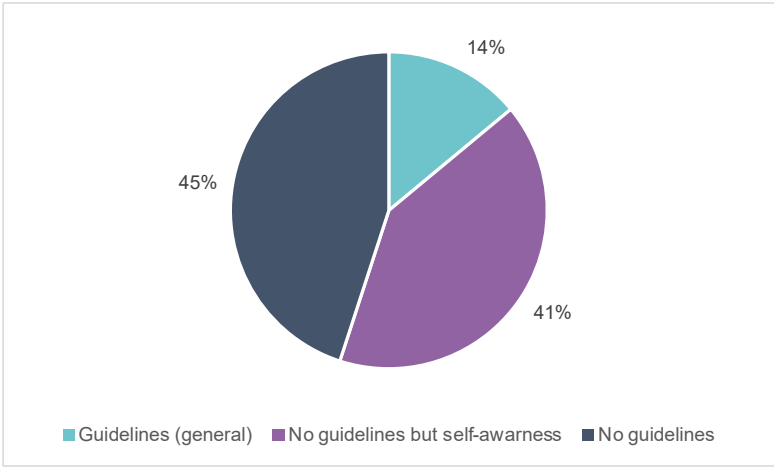

Figure 11. Availability of guidelines during service planning as reported by the CMs.

OHRIs were considered important as all CMs supported the routine consideration of OHRIs by domiciliary care. Client-oriented support of oral self-care was supported by 45% of the CMs, and uniform support for all clients was supported by 55% of the CMs.

5.2.3 Oral health aspects in domiciliary care implementation by nursing personnel (Publication IV)

In domiciliary care implementation, nursing personnel had mainly good knowledge about OHRIs. Knowledge of how RDP are cleaned and stored was mostly ensured by nursing personnel, though using a soft toothbrush or liquid soap was less often known for cleaning the RDP. The comparison by age showed that storing the RDP in dry conditions (age <40: 84%, >40: 68%, p =0.059) and immersing them in cleaning solution (age <40: 73%, >40: 53%, p =0.026) was more often preferred by younger nursing personnel. Nursing personnel had moderate knowledge about the poor suitability of toothpaste for cleaning RDP. (**Figure 12)**

Nursing personnel had correct knowledge to recommend suitable options for treating dry mouth, to quench thirst and perform oral hygiene practices. However, only 40% of the participants would recommend a visit to a doctor and fewer recommended to use chewing gum. Most of uncertainty was related to cleaning oral surfaces under the RDP. (**Figure 12)** However, the need to clean oral mucosa under the RDP was well acknowledged among older nursing personnel (age <40: 86%, ≥40: 96%, p =0.009) and those with less work experience (years of work <5: 95%, ≥5: 81%, p =0.037). Similarly, cleaning the oral surfaces under RDP routinely with mouthwash was less often reported by older nursing employees (years of work <5: 5%, ≥5: 18%, p =0.053).

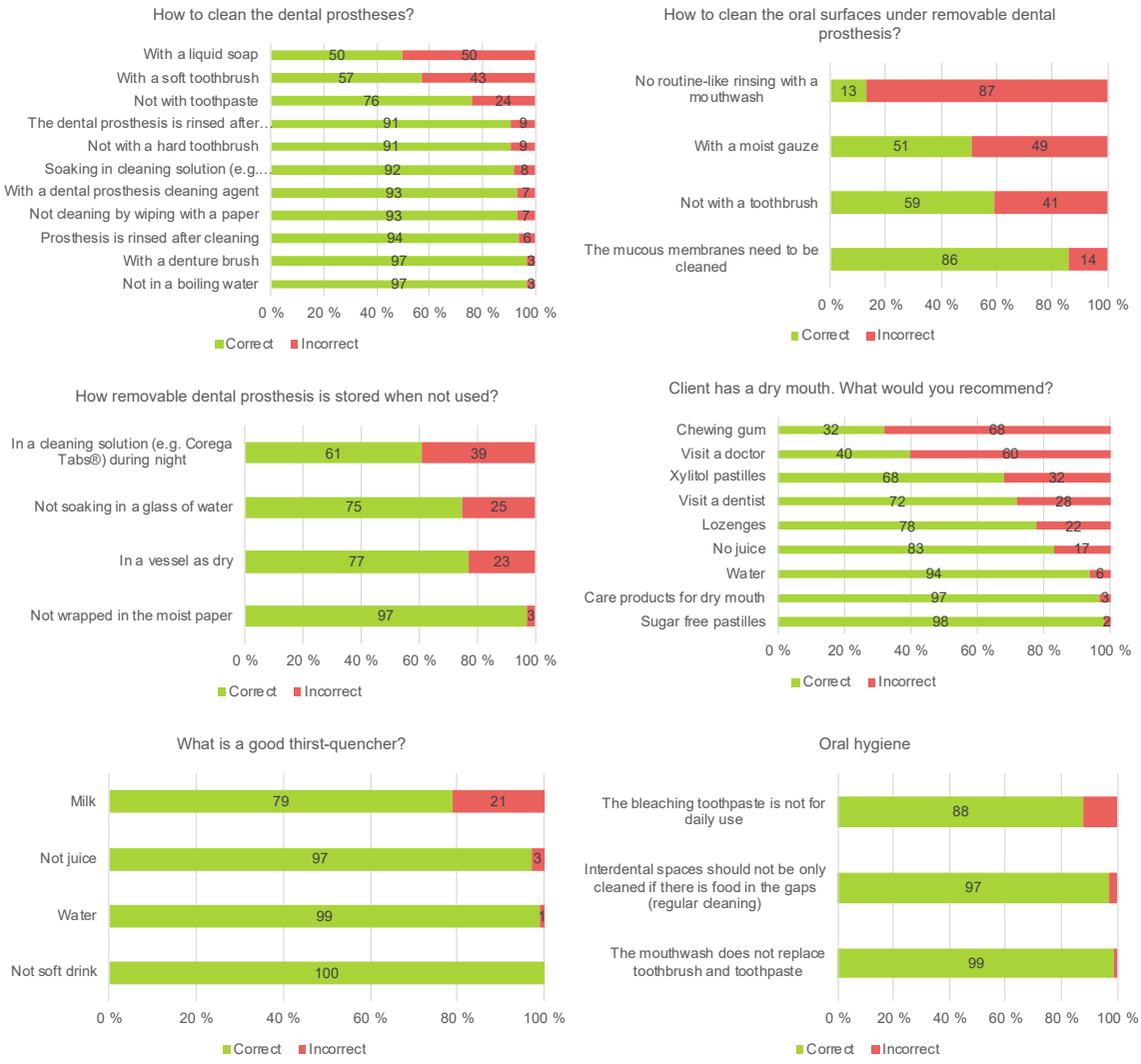

Figure 12. Percentages (%) of nursing personnel (n=115) with correct and incorrect knowledge, according to recommendations on taking care of removable dental prosthesis hygiene, dry mouth, thirst, and oral hygiene practices.

Oral health-related topics were included in nursing personnel education generally (67%) or specified for older people (63%). However, oral health-related studies were considered incomplete (18%) or had not been provided at all (15%) during nursing education. Difficulties in applying oral health education in practical work were reported by 43% of the nursing personnel. Need for continuing oral health-related education was reported over half of the nursing personnel. Especially, younger nursing personnel requested guidelines prescribed by domiciliary care to refer clients to a visit of dentist if necessary (age<40: 53%, ≥40: 26%, p =0.003).

Perceived skills in guiding domiciliary care clients with maintaining oral hygiene were mostly assessed as moderate. Guiding the client in cleaning interdental spaces was perceived as the poorest perceived skills by majority of nursing personnel. (**Figure 13**) However, younger nursing employees (age<40: 63%, ≥40: 39%, p =0.011) and nursing employee with less of working experience (years of work <5: 68%, ≥5: 39%, p =0.003) reported better perceived skills in guiding cleaning interdental spaces. Well over half of the nursing personnel also considered guidance as poor or fair if client had oral pain, eating difficulties or dry mouth problems.

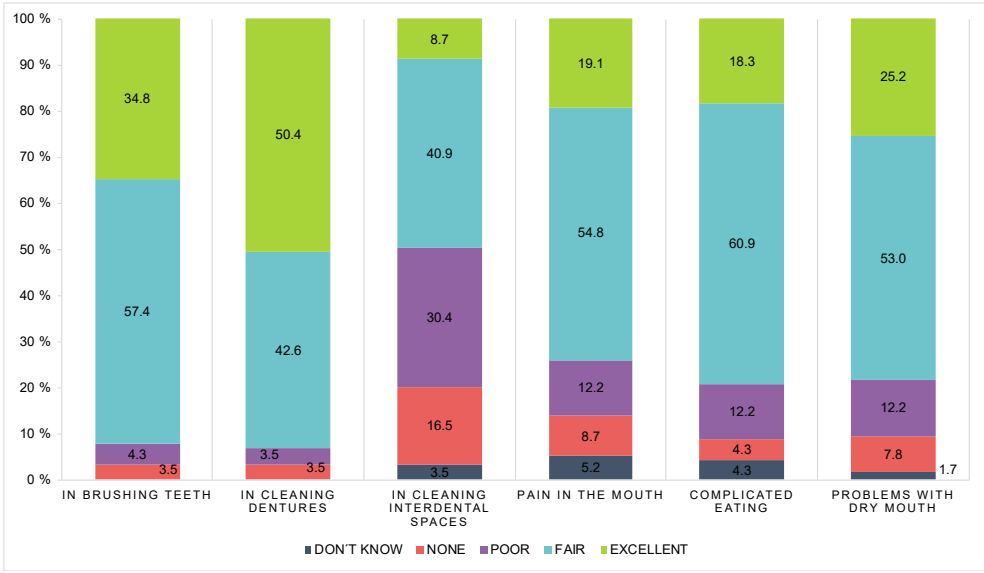

Figure 13. Responses (%) of questions abouts perceived skills of nursing personnel (n=115) for guiding domiciliary care clients in oral health-related issues.

From activities to support oral care, most oral and prosthesis hygiene practices of domiciliary care clients, except guiding to toothbrushing, were actively supported by nursing personnel. Nursing personnel were more active in assisting the client in brushing their teeth than just directing to brushing their teeth. (**Figure 14)** The client was more actively guided in brushing their teeth by older nursing personnel (age<40: 40%, ≥40: 56%, p =0.067).

In care implementation, during morning (52%) and evening (55%) visits, toothbrushing of client was often or always paid attention by nursing personnel. Participants reported checking following issues often or always; oral hygiene tools of client, such as fluoride toothpaste (55%), a proper toothbrush (45%), regularly changed toothbrush (22%) and tools for interdental cleaning (18%). Availability of xylitol products was not actively checked (13%). Less experienced nursing personnel

were less active to check that the client had a decent toothbrush available (years of work <5: 32%, ≥5: 53%, p =0.030).

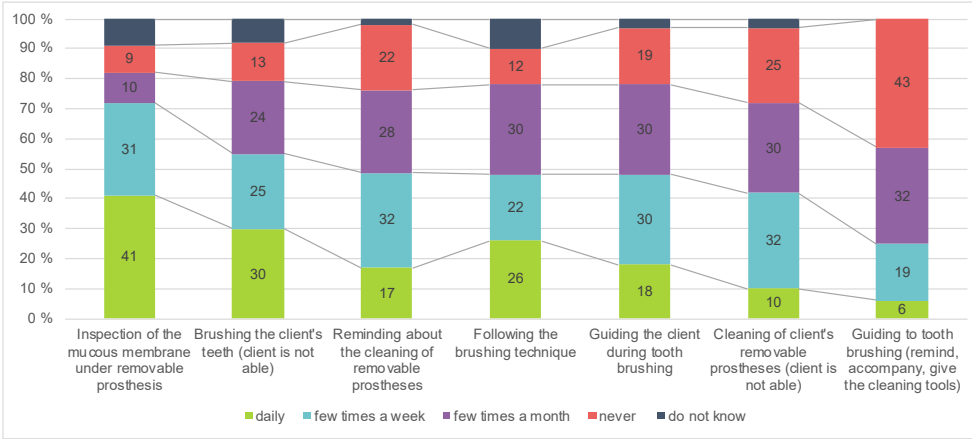

Figure 14. Percentages of nursing personnel reported activities in supporting oral health-related issues of domiciliary care clients.

6 Discussion

6.1 Main results

The main aim was to examine perceived oral health of older people in domiciliary care from the perspective of the domiciliary care clients, and domiciliary care personnel who are involved in the planning and implementation of domiciliary care.

Domiciliary care clients reported more often having poorer overall oral health than non-clients. Similarly, difficulties to chew hard food and eat dry food without drinking simultaneously were more often reported by domiciliary care clients. The differences between domiciliary care clients and non-clients were less notable in 2011. Edentulousness was more common in domiciliary care clients than non-clients, especially among women who had also more often chewing difficulties. Although, domiciliary care clients tended to report about poorer OHRQoL, especially by men, regression models did not show statistically significant differences in the OHIP-14 dimensions. This is mainly due to relatively small number of domiciliary care clients. The strongest predictor of poor OHRQoL was the use of RDP while mediating the effect of education on OHRQoL. Poorer oral health behaviours (less recent use of oral healthcare services and brushing teeth), and poorer ability to independently maintain oral hygiene were more often reported by domiciliary care clients than non-clients.

During the assessment of need for domiciliary care, oral health aspects were not routinely considered by the CMs. Nonetheless, the CMs perceived OHRIs as an important part of the assessment of the need for domiciliary care. Nursing personnel had mainly a high level of knowledge about OHRIs. The received education of nursing personnel had shortcomings regarding oral health. Applying given oral health education in practical work was also regarded difficult. Furthermore, not all activities to support oral home care were mastered or as part of regular daily routine. Further education was anticipated among nursing personnel.

6.2 Results of the study in relation to previous research

6.2.1 The perceived oral health, oral health-related quality of life and oral health behaviours of older people with or without domiciliary care

Perceived oral health

The fact that poor perceived oral health was more often reported by domiciliary care clients, who also used oral health services less frequently than non-clients is consistent with previous findings of irregular use of oral health services leading to poorer perceived oral health (Torppa-Saarinen et al. 2019). However, perceived oral health of Finnish older people has improved along the years (Torppa-Saarinen et al. 2018), even though after 2011 poorer perceived oral health among older people has been again more reported (Koponen et al. 2018). In this study, the use of oral health services was shown to be more frequent in 2011. However, perhaps the improvement was due to reduction of barriers of using oral health services, like better availability and accessibility (Gregory et al. 2012). However, frailty and care-dependency (Niesten et al. 2017) still might have affected to the use of oral health services among domiciliary care clients in 2011. As domiciliary care clients are more prone to impaired health, functional disability, and frailty (Miettinen et al. 2017) which also predicts poorer oral health (de Almeida Mello et al. 2019).

The results of this study are in agreement with previous studies which have found that chewing difficulties (Salmi et al. 2022) and dry mouth problems (Saunders & Friedman 2007, Viljakainen et al. 2016) are prevalent among older people with domiciliary care. Poorer health and impaired functional capacity (Miettinen et al. 2017) along with poorer oral health (de Almeida Mello et al. 2019), and more frequent edentulousness and use of RDP of domiciliary care clients (Salmi et al. 2022, Saunders & Friedman 2007) were most likely explaining factors to the more frequent chewing difficulties reported by domiciliary care clients. Again, polypharmacy and depression of domiciliary care clients (Saunders & Friedman 2007, Viljakainen et al. 2016), with other health complications can explain why domiciliary care clients in this study, especially women, reported dry mouth problems more often. Polypharmacy increases anticholinergic burden and sedative load which has been related with increased risk of hyposalivation, impaired oral health and poor oral health behaviour (Tiisanoja et al. 2016, 2017 & 2018). It also underlines the risk for malnutrition among domiciliary care clients (Soini et al. 2003 & 2004) due to tooth loss, eating difficulties and dry mouth problems.

Domiciliary care clients did not only report about chewing difficulties but also had less teeth than non-clients. This is line with other reports about prevalent edentulousness and use of RDP among domiciliary care clients (Henni et al. 2022, Hoeksema et al. 2018, Nihtilä et al. 2017, Saunders & Friedman 2007, Soini et al. 2003, Strömberg et al. 2012, Tuuliainen et al. 2020). However, declining edentulousness has shown to be a global trend among older people (Kassebaum et al. 2014, Müller et al. 2007, Suominen et al. 2018).

Oral health-related quality of life

Domiciliary care clients tended to have poorer OHRQoL and the psychological discomfort was emphasized from the dimensions of OHRQoL Tendency to poorer OHRQoL is further supported by available evidence of how care-dependency (Henni et al. 2022, Niesten 2016, Strömberg et al. 2013), poor oral health (Koistinen et al. 2020), tooth loss (Hoeksema et al. 2018, Massood et al. 2017), use of RDP (Lahti et al. 2008, Massood et al. 2017), impaired oral hygiene (Willumsen et al. 2010), xerostomia (Willumsen et al. 2010) and less frequent use of oral health services (Gluzman et al. 2013) negatively affect to OHRQoL.

The use of RDP has been reported to have negative effect on OHRQoL among older people (Masood et al. 2017), which is consistent finding with this study. However, condition and fit of RDP is rarely evaluated while data is usually driven from questionnaire studies. Well-functioning removable prostheses may even have positive impact on OHRQoL in individual level. The concept of shortened dental arch (Steele et al. 2004), and both functional RDP and stable occlusal contacts of remaining teeth are important to preserve adequate chewing ability without a negative impact on OHRQoL (Hassel et al. 2009, Cho & Kim 2018).

In contrast to previous findings, that lower educational background negatively affects to OHRQoL in older people (Massood et al. 2017, Tsakos et al. 2009), OHRQoL was found to be poorer among highly educated domiciliary care clients in this study. The difference might be due to different study populations (Niesten et al. 2016), as the previous study population included care-independent older people and this study population included also care-dependent older people. Furthermore, increased requirements for dental treatment among domiciliary care clients with higher educational background can be a factor for poorer OHRQoL among those with higher educational background (Steele et al. 2004).

In addition, more care-dependent older people in domiciliary care might even have had poorer OHRQoL than less care-dependent older people (Henni et al. 2022, Strömberg et al. 2013). However, the small difference between domiciliary care clients and non-clients can also be due to a coping mechanism among older people with health complications, as they can adapt to deal and live with health and oral

health-related conditions (Egelstad-Sttjernfeldt et al. 2021, MacEntee et al. 1997, Gregory et al. 2012, Tkatch et al. 2017).

Oral health behaviours

Cognitive and functional limitations, frailty, and care-dependency (Coker et al. 2014, McNally et al. 2014, Nangle et al. 2019, Niesten et al. 2017, Nihtilä et al. 2017, Tuuliainen et al. 2020) are most likely related to the poorer oral health behaviours of domiciliary care clients. Furthermore, as lower educational background was more common among domiciliary care clients, this fact might have been related to the less frequent use of dental care services among them (Tickle & Worthington 1997). Other related factors, that can explain the less frequent use of dental care services among older people are already previously mentioned availability, accessibility, and cost of dental care services (Gregory et al. 2012).

The need of oral hygiene support (Lee et al. 2020) can also explain why domiciliary care clients reported more often irregular toothbrushing (in 2011) and impairment of the ability to maintain oral hygiene independently (in 2000), as home-dwelling, care-dependent older people confront more often difficulties with oral hygiene maintenance than care-independent older people (Henni et al. 2022, Strömberg et al. 2012). This fact can also be related to the reason why women with domiciliary care brushed their teeth less often than twice a day in 2000, even though, older women have been usually active with maintaining oral hygiene (Wiener et al. 2012). However, the brushing result with a lower amount of plaque was better among older Finnish women than men (Suominen-Taipale et al. 2004). Other studies also support that oral hygiene is poor among older people with domiciliary care (Nihtilä et al. 2017, Tuuliainen et al. 2020).

6.2.2 Domiciliary care service - planning and implementation from oral health aspects

Oral health-related issues during domiciliary care planning

The CMs considered OHRIs as an important part of domiciliary care assessment, even though, OHRIs were not routinely considered during the care need assessment of domiciliary care client. The previous studies have also shown that oral health is positively recognized and considered as a part of health and wellbeing, and the negative effect of poor oral health on health and well-being is also recognized by nursing personnel (Lindqvist et al. 2013, Jablonski et al. 2009, Pihjalamäki et al. 2016, Wårdh et al. 1997). The consideration of oral care and oral health as a separate part of nursing care and not being in the responsibility of nursing personnel

(Lindqvist et al. 2013, Nicol et al. 2005, Reed et al. 2006) might be related to less frequent consideration of OHRIs during care assessment.

The lack of guidelines can also explain why OHRIs were not included in the evaluation of individual care need, as a lack of guidelines and daily oral care routines is rather typical in the nursing field in general (Jablonski et al. 2009, Unfer et al. 2012, Visschere et al. 2015, Wårdh et al. 2000). Level of knowledge about OHRIs (Catteu et al. 2016, Sjögren et al. 2010), ability to assess OHRIs (Gerritsen et al. 2014, Wårdh et al. 2005) and use of available oral health guidelines in care planning and attitudes toward OHRIs (Pihlajamäki et al. 2016, Wårdh et al. 1997) could have determined to what extent OHRIs were considered in care need assessment. Therefore, better knowledge of oral health may have explained why the older CMs reported more often availability of guidelines and paid attention to oral health than the younger CMs. Besides, the younger CMs particularly reported poor availability of guidelines and a lack of knowledge to assess OHRIs in care planning. The CMs with a health care educational background might also had an advantage from a wider health-related knowledge, which could have increased the awareness of the effects of poor oral health to health (Beck et al. 1996, Kudiyrickal & Pappachan 2015, van der Maarel-Wierink et al. 2013, Meurman & Hämäläinen 2006)

Considering that oral health is an essential precondition of health among older people (van der Putten et al. 2014) and misdirecting oral care to the responsibility of a domiciliary care client (Lindqvist et al. 2013, Nicol et al. 2005, Wårdh et al. 2000) can have a negative effect to health. This may be true especially, among domiciliary care clients who have already an increased risk of negative health implications due to poor oral health (de Almeida Mello et al. 2019).

Organizing, financing, providing, and assessing strategies of domiciliary care vary in the Europe, as do also regulations and policies about domiciliary care (Genet et al. 2012, Rostgaard et al. 2011). However, most strategies are based on a health perspective, leaving oral health for less attention. Oral care is also most often neglected in nursing care for various reasons (Hobien et al. 2017, Lindqvist et al. 2013, Reed et al. 2006, Sonde et al. 2011, Wårdh et al. 2000). Fortunately, policies and programs are more including oral health promoting for older adults in Finland (Ikälaki 980/2012, STM 2020, Health Care Act 1326/2010).

Oral health-related issues during domiciliary care implementation

The level of knowledge about oral health was generally high among nursing personnel. Yet, some of the nursing employees seemed to have deficiencies in oral health topics in their given education. The need for additional education about oral health among nursing personnel is evident, as insufficient oral health knowledge is also reported in other studies (Hasson & Arnetz 2008, Lindqvist et al. 2013, Nicol et

al. 2005, Paulsson et al. 2002, Pihjalamäki et al. 2016, Sonde et al. 2011). Oral health knowledge has also been found to vary between domiciliary care nursing employees and nursing employees (Hasson & Arnetz 2008).

Shortcomings in the given education had a negative impact on practical work, which can weaken the given aid on oral care, especially, among care-dependent older people with impaired health, functional and cognitive limitations, and frailty whose oral hygiene most often depends on the nursing personnel (Coker et al. 2014, Nangle et al. 2019, Niesten et al. 2017, Rantzow et al. 2018). Studies have shown that the difficulties regarding oral care of care dependent older people are acknowledged by nursing personnel, but without a specific training and education, the practical actions to support oral care is challenged (Nicol et al. 2005, Sonde et al. 2011).

However, the nursing personnel in this study were generally active in supporting oral care. Yet, general challenges in the nursing field with time limits, workload, lack of guidelines and daily oral routines (Hobien et al. 2017, Jablonski et al. 2009, Lindqvist et al. 2013, Reed et al. 2006, Visschere et al. 2015, Unfer et al. 2012, Wårdh et al. 2000) had possibly had an influence on oral care support. To make oral care support a daily routine in all fields for maintaining oral hygiene could be improved with the existing and additional education (Lindqvist et al. 2013, Nicol et al. 2005, Paulsson et al. 2002, Pihjalamäki et al. 2016). As in this study, cleaning of the oral surfaces under RDP was not routine oral care practice.

The need for additional education among the nursing personnel was indicated by the results. According to a previous study, oral health knowledge and practical competence of nursing personnel is related to the received oral health education during their initial training (Lindqvist et al. 2013). In this study, working experience of the older nursing personnel showed also better skills in supporting oral care of domiciliary care clients. Even though, the recent education of the younger nursing personnel might have given better knowledge about oral care but the need of instructions in practical work was more significant among them.

6.3 Strengths and weaknesses of the study

The use of a nationally representative survey data, for the perceived oral health, OHRQoL and oral health habits of home-dwelling older people with and without domiciliary care, is a considerable strength for the study. The additional strength of the study is based on the two cross-sectional survey data of domiciliary care, which included personnel responsible for the planning and implementation of domiciliary care. The combination of the studies provided the overall picture of oral health care in domiciliary from both perspectives, representing both the client and the domiciliary care personnel.

Yet, some limitations are related to the study sample of older people with or without domiciliary care in terms of missing information about domiciliary care and the drop-out of participants between Health 2000 and 2011 surveys. In 2011, both the number of domiciliary care clients and the proportion of male domiciliary care clients were lower.

The lower proportion of male domiciliary care clients is likely due to the lower life expectancy of men. However, the reason for reduction in the domiciliary care clients between 2000 and 2011 is uncertain. The number of domiciliary care clients (aged 75 or older) was overall reduced between 2000 and 2011. Furthermore, in this study the proportion of domiciliary care clients was lower than the national level of domiciliary care clients in 2011 (Väyrynen & Kuronen 2013). Although, the percentage of domiciliary care clients (aged 70 or older) in 2011 was 16.8% which is closer to the national percentage of regular domiciliary care clients aged 75 or older (12.2%) in 2011 (THL 2011). The reduced number of domiciliary clients in 2011 could also be explained with some participants moving to a long-term care facility, better health condition of "new" participants (aged from 70 to 81 years) and changed criteria for domiciliary care (Rostgaard et al. 2011). However, it should be also noted that over 500 participants were excluded due to missing information about their use of domiciliary care in 2011. In 95-99% of these cases information about oral health variables was also missing. The small number of domiciliary care clients in 2011 was likely a cause for that the differences of OHRQoL between domiciliary care clients and non-clients did not reach statistical significance. For example, functional limitation and physical pain were not statistically significant but the over 2.5-unit difference in OHIP-14 severity score has been suggested to have clinical significance (Slade et al. 2005).

The participation rate of CMs was positively high of all CMs in city of Tampere where the study was conducted. However, the generalization of the results would require a nationwide study as the planning of domiciliary care services most often vary between different cities, communities, or organizations.

On the contrary, the response rate of nursing personnel was low despite active promotion. Due to the privacy policy of the city organization, the Webropol links were made in a public format and sending the links directly via Webropol was not an option. The survey links were sent by the head of domiciliary care to three regional managers who were responsible for forwarding the links to the participants. The delivery data of the links were not available through Webropol as direct sending via Webropol was not possible. Total of 302 links were verified as sent to nursing personnel by the two regions. The third region did not confirm the sending of links to 163 nursing personnel, which left uncertainty if these links were never received at all. If 163 links were not sent, according to tracking of activated links (115 completed surveys out of 245 opened links), the response rate was 38% (verified 302 links from

the two regions). Other factors, like absences of nursing employees and the nature of domiciliary care work (moving from client to client), could also reduce the response rate. Yet, the distribution of background of the participants represented the domiciliary care nursing personnel in Finland.

Another limitation to the study is related to response bias that is prevalent to studies with surveys as self-reporting might cause some inaccuracy. Furthermore, more favorable answering to the questions related to perceived skills or oral health, knowledge, oral health behaviours or OHRQoL can cause social desirability bias for the study.

6.4 Practical implications, recommendations for actions and further research

Oral health-conscious domiciliary care planning, including daily routine and structured oral health assessment as a part of overall domiciliary care, would improve the oral health care of older people in domiciliary care. The terms of oral care support would be improved if oral health care entries, client-specific information about current clinical oral health situation and oral self-care instructions, would serve as a practical guide for the domiciliary care personnel. However, the collaboration of dental care professionel and domiciliary care personnel should be considered to ensure that OHRIs are noted for the special characteristics of the care-dependent elderly in domiciliary care. Clear guidelines for both CMs and nursing personnel can facilitate actions to consider and support oral care in domiciliary care as a daily routine.

Poorer perceived oral health of domiciliary care clients predicts an increased need for regular utilization of dental care services (Torppa-Saarinen et al. 2019). Based on this, guidance for a dental check-up already at the start of domiciliary care should be offered to all future clients. Furthermore, during domiciliary care, clients should be guided to dental care, and domiciliary care personnel should have a contact person for oral health care in need of consultation, if oral health-related problems arise.

Self-reported edentulousness, chewing difficulties and dry mouth are generally reported concerns among domiciliary care clients, which should be considered in domiciliary care to reduce risk for malnutrition among clients (Soini et al. 2003 & 2004). Attention to the functionality and condition of the RDP should be also paid if domiciliary clients have difficulties related to eating or their diet has deteriorated (Salmi et al. 2022). Clients with these concerns should be directed to dental care. Respectively, dental care professionals ought to consider the health status of domiciliary care clients with possible functional or cognitive limitations and frailty when planning the dental care treatment plan. However, further information is

needed from a clinical, nationally representative study among domiciliary care clients that would compare perceived oral health with their oral health status.

Tendency to poorer OHRQoL among domiciliary care clients should be also acknowledged. Domiciliary care clients should be readily directed to dental care if oral health-related problems are encountered during home visits. More frequent home visits can be beneficial, as problems could be more easily noticed and addressed. However, without oral health education, especially regarding the elderly, problem identification and care can be difficult. Co-operation with dental care professionals and home visits by dental care professionals are important to domiciliary care clients who are in significantly poor health and whose access to dental care is limited. Further research about possible cross-relation of general and oral health status with HRQoL and OHRQoL among older people receiving domiciliary care would provide useful information, as functional and cognitive limitations due to impaired health are typical for those receiving domiciliary care.

Difficulties in oral hygiene among domiciliary care clients should be emphasized in the education of nursing personnel and CMs. Education that considers challenging and age-specific issues in terms of practical work could improve the consideration and support of oral health care in domiciliary care. Poorer ability to maintain oral hygiene independently requires active and routine-like support of oral home care among those in need. Further research about oral health knowledge and activity in practical work of domiciliary care personnel on national and international levels could provide important findings even if domiciliary care services might be organized in different ways.

As the Health care reform takes place, change will be seen since cities and smaller communities are no longer setting frames for domiciliary care. The responsibility for organizing domiciliary care service will be transferred to the well-being service counties. The influence of domiciliary care on oral health ought to be followed in the new well-being service counties. There is possibility to increased co-operation with oral health and domiciliary care services, for example due to potential integrations between health information systems.

7 Conclusions

From the perspective of domiciliary care clients, this study showed that edentulousness, difficulties to chew hard food and eat dry food without drinking simultaneously are oral health problems which were more often reported by domiciliary care clients than non-clients and therefore should be more carefully identified. Furthermore, this study indicated a tendency for poor OHRQoL among domiciliary care clients, especially regarding the psychological discomfort dimension. Poorer perceived oral health and impaired oral health behaviours of domiciliary care clients highlight the importance and consideration of oral health care in domiciliary care. After all, frailty, functional and cognitive limitations due to impaired health are typical for those receiving domiciliary care. Care-dependency among clients extends also to oral health care, as the need for oral care support is evident when the ability to maintain oral hygiene is impaired. This implies that oral health should be prioritized higher and included in the evaluation, care plan and implementation. In addition, the regular use of oral health services should be included in domiciliary care to improve OHRQoL.

From the perspective of domiciliary care personnel, this study showed that oral health aspects were not routinely considered during domiciliary care planning and applying given oral health education in practical care implementation was regarded as difficult. This highlights that oral health-related education and structured guidelines are needed in the assessment and implementation of domiciliary care. Although, oral health-related knowledge of the nursing personnel was generally on good level, specified oral health education focusing on the elderly and the challenges of practical work was needed by the nursing personnel. Practical oral care support may be enhanced by including oral health assessment and oral health entries in the service planning. However, collaboration with oral health personnel is also needed for assessing the required support for oral health care. Overall, the oral care needs of client should be systematically assessed and identified in the planning of domiciliary care.

Acknowledgements

This research work was carried out in the Department of Prosthetic Dentistry and Stomatognathic Physiology at the University of Turku from 2017 to 2022. The idea for the research started from a summer job in a domiciliary care, and the first two studies started in 2013 alongside with my DDS studies. I want to thank the City of Tampere for giving the permission for the study in the domiciliary care. In addition, I want to thank the Finnish Institute for Health and Welfare and the Research Communities of Health 2000 and 2011 surveys for the permission to use the Health 2000 and 2011 data starting from 2017.

I am sincerely grateful to my supervisors Professor Timo Närhi and Professor Satu Lahti whose expertise and proficiency are greatly admirable. I wish to express my gratitude to Timo who saw potential in me as a researcher and guiding towards this thesis project and mentored along the way. Both my supervisors have taught, encouraged, supported, and guided me along this project, without their help the path would have been a lot bumpier. I owe my gratitude also to Satu whose enthusiasm and dedication as a researcher has inspired me along this way.

I owe my sincerest gratitude to MSc Auli Suominen, a very skilful and knowledgeable biostatistician who taught me greatly about statistics, and she patiently helped me with data management. I also want to thank Docent Mimmi Tolvanen who was also supporting with statistics in the beginning of this thesis project.

I would like to sincerely thank the pre-examiners, Docent Anna-Maija Syrjälä and Docent Helena Soini from their valuable and essential comments and recommendations for improving this thesis. Thank you for giving your time for reviewing this thesis. I also want to greatly thank my opponent Professor Päivi Mäntylä for examining my research work in a public defence.

My deepest gratitude is also for to all my co-authors, Professor Riitta Suhonen and Professor Liisa Suominen for their contribution along this research project. Expertise in nursing science of Riitta was valuable and greatly needed in improving the study from an interdisciplinary point-of-view. Solid experience from the population-based studies of Liisa was irreplaceable to the research accuracy.

My dearest gratitude is for my beloved husband Jussi, who has supported me with this project all the time and he has given me strength and courage along this journey. He has helped me to improve my English writing skills and he is devoted to technical support. He has also admirably got a hang of dental research. We have also laughed together on how many browser windows and tabs can be open at the same time without breaking the computer. I want to also thank our beloved son who was accompanying me in the end of this thesis writing process. His good gifts in sleeping have helped me with my writing. I want to also thank my parents Riitta and Jarmo for supporting me with this thesis project. My parents have always believed in and encouraged me.

I want to thank my employer for being flexible in fitting my research work and doctoral studies with work. I want to thank the Finnish Dental Society Apollonia for financial support in this research project.

19.11.2022
Riikka Salmi

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TURUN
YLIOPISTO
UNIVERSITY
OF TURKU

Painosalama, Turku, Finland 2022

ISBN 978-951-29-9122-8 (PRINT)
ISBN 978-951-29-9123-5 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)