

IMPROVING THE ORAL HEALTH OF ELDERLY LONG-TERM  
CARE RESIDENTS WITH SUPPORT OF AN ORAL HEALTH  
COORDINATOR

by

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## **Abstract**

**Objective:** The goal of this project was to determine whether an oral health coordinator (OHC) could improve the oral hygiene of residents in long term care facilities.

**Methods:** This prospective study utilized 4 LTCFs in Courtenay, Comox Valley on Vancouver Island and included 126 residents with natural teeth (66% female, age range 63–101 years, and 34% male age range 62 -108 years). Residents' oral hygiene was assessed at baseline and again at a 6-month using the Geriatrics Debris Index-Simplified (GDI-S) and Geriatrics Calculus Index-Simplified (GCI-S). The OHC provided in-service education & training of care aides and nursing staff with respect to daily mouth care over the six-months of the project.

**Results:** The mean number of teeth per resident was 18. At baseline, 73% did not receive help for their daily mouth care, and after examination, 95.2% were recommended to receive assistance with their daily mouth care. A paired-samples t-test revealed no statistically significant difference in (GDI-S) and (GCI-S) measurements between baseline and 6-month follow-up.

**Conclusion:** Although the OHC provided extensive training of care staff, the oral hygiene did not improve.

## **Preface**

This study was conducted under supervision of Dr. Chris Wyatt. The committee members included Drs. Chris Wyatt, Jolanta Aleksejuniene and Leeann Donnelly, from the Faculty of Dentistry. Research Ethics Board approval was obtained from the University of British Columbia (UBC) and the certificate number was H13-01940.

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## List of Abbreviations

OHC	Oral Health Coordinator
LTCF	Long-Term Care Facility
BPC	Best Practice Coordinator
CHMS	Canadian Health Measure Survey
OHI-S	Simplified Oral Hygiene Index
GDI-S	Geriatrics Debris Index-Simplified
GCI-S	Geriatrics Calculus Index-Simplified
CVSV	Comox Valley Seniors Village
NIDCR	National Institute of Dental and Craniofacial Research
OCA	Oral Care Aides
OCLN	Oral Care Link Nurse
PI	Plaque Index
GI	Gingival Index
WHO	World Health Organization
NOK	Next of Kin
RPD	Removable Partial Denture
RN	Registered Nurse
LPN	Licensed Practice Nurse
SD	Standard Deviation
UBC	University of British Columbia



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## **Dedication**

This dissertation is dedicated to my beloved husband, Reza. I can never thank you enough for your love, endless support, and numerous sacrifices throughout my academic career. This thesis and the pursuit of my goals would not have been possible without you.

## **CHAPTER ONE: INTRODUCTION**

Throughout the world, a demographic revolution is underway; the global population is increasing by 1.2% annually, however the elderly population (over the age of 65 years) is increasing by 2.3%. It is projected that the number of people aged 65 year-old or older will increase from 524 million in 2010 to approximately 1.5 billion in 2050. (WHO, 2010). By 2050, the number of people aged 60 years and over living in developing countries is predicted to be 2 billion (WHO, 2002). This demographic shift will have important implications for healthcare services as an increasing number of frail elders will experience significant morbidity and care dependency. There are 1.6 million people residing in Long-Term Care Facilities (LTCFs) in the United States. Over 90% of these residents are older than 65 years (Jones, 2002), and many of these individuals are frail and will require some level of support with their daily mouth care (Arpin et al., 2008). In Canada, there are over 1,519 LTCFs housing more than 310,000 residents, with 90% of these residents being over 65 years old (Canadian Institute for Health Information, 2014). Statistics Canada reports that over the last decade the number of LTCFs offering 24-hour nursing care has increased by about thirty percent (McGregor et al., 2010).

Limited access to dental care, treatment costs, systemic disease, and fear of dental treatment all contribute to the oral neglect seen in the frail elder population (McEntee et al., 1985). This is further complicated by the fact that many older people seem unaware of oral disorders affecting their mouths (McEntee et al., 1987). An increasing number of older adults are entering LTCFs with some or all of their natural teeth. If their dental needs are not met, their oral health will deteriorate further

due to increasing care dependency (De Visschere et al, 2012). Another barrier to care is the lack of insurance to cover dental treatment (Manski et al., 2004). The Canadian Health Measure Survey (CHMS) found that 53% of Canadian adults between 60 and 79 years of age reported that they do not have any dental insurance (Health Canada, 2010).

Dentists are reluctant to work in unfamiliar environments such as LTCFs (Kiyak et al., 1982), and only 19% of surveyed Vancouver dentists had attended a LTCFs, mainly to provide emergency services, and 37% were willing to provide this service only if asked (McEntee et al., 1987).

Younger dentists who were not busy in practice, and dentists who had worked previously in institutions mentioned that they enjoyed treating elderly patients. A large proportion of the dentists mentioned busyness as a reason for not providing care in LTCFs (McEntee et al., 1987). In addition, care-aides do not always consider the mouth and teeth as their responsibility or may believe that mandatory examination of the residents' mouths is an invasion of privacy (Rabbo et al., 2012).

### **1.1 Oral Health in Long-Term Care Facilities**

Oral health is a critical component of overall health and affects how someone speaks, masticates foods, and interacts with others (Sheiham, 2005). Oral health has implications beyond the absence of tooth decay; it influences general health, comfort, and wellbeing. Poor oral health can lead to life threatening conditions including pneumonia and malnutrition (Pino et al., 2003). Poor oral health and untreated oral diseases and conditions can have a significant impact on quality of life (MacEntee et al., 2007).

Over the last three decades, there has been a significant decrease in the rate of edentulism (Bots-VantSpijker et al., 2014; Jokstad et al., 1996), with more partially dentate elders being admitted to LTCFs. However, poor oral hygiene of older adults living in LTCFs results in an increased incidence of dental caries and gingivitis and consequently poor oral health (Wyatt 2002; Chalmers et al. 1996).

A survey of 31 nursing homes in Washington State was performed to evaluate the oral health status of 1,063 nursing home residents (Kiyak et al., 1993). The screening results have shown that 35% of residents were completely edentulous and had dentures and 42% of residents had a combination of natural teeth and dentures (Kiyak et al., 1993). Among residents who had their natural teeth, 43% suffered from gingivitis, 36% from root caries, 26% from coronal caries, and 24% had retained fractured teeth and roots (Kiyak et al., 1993).

A study in Vancouver, British Columbia, evaluated the dental needs of 653 residents of 41 LTCFs showed that more than a third of the sample had denture stomatitis or other mucosal lesions associated with dentures that had been used for more than 15 years (McEntee et al., 1987). Fifty percent of edentulous residents had poor denture hygiene, and 20% were wearing dentures with structural defects. Fifty-five percent of the dentate subjects had dental caries, and 11% had severe periodontal disease (McEntee et al., 1987).

More recently, Wyatt evaluated the oral hygiene status of 369 Canadian elderly residents of 39

long-term care (LTC) facilities located in Vancouver area. The mean age of the residents was 83.9 years. The mean number of teeth per resident was 16.4 (7.0 in the maxilla and 9.4 in the mandible). Seventy four percent of dentate residents had poor oral hygiene with significant plaque accumulations (Wyatt, 2002). Sixty-one percent of those examined needed some form of dental care and among those, 54% needed urgent care (Wyatt, 2006).

A survey of oral health problems of elderly LTCF residents in Quebec revealed that almost 90.0% of the residents brushed their teeth daily, however 104 out of 152 residents (69%) stated that they did not get assistance with their daily mouth care (Arpin et al., 2008). Clinical examinations showed that almost half of the residents had periodontal conditions such as gingivitis, calculus deposits and/or deep periodontal pockets (Arpin et al., 2008). Eighty-seven percent required dental treatment, mostly extraction, restorative, and prosthetic services (Arpin et al., 2008).

## **1.2 Factors Affecting Oral Health in Long-Term Care Facilities**

The oral health of older people in LTCFs is poor and has been attributed to poor oral hygiene (Weening-Verbree et al., 2013; Wyatt, 2002). Poor oral hygiene results from the accumulation of bacterial plaque, as a result of neglected self-care and/or professional care (Van der Putten et al., 2013). In most LTCFs, the nursing staff obligation to provide daily mouth care is unmet (De Mello & Padilha, 2009). There are many barriers to the provision of daily mouth care including lack of oral health care awareness, lack of knowledge about oral health, limited oral health care training and education, lack of supplies and repeated non-cooperativeness of residents are frequently cited

by caregivers as major reasons why they are not performing daily mouth care (Chalmers et al., 1996; Frenkel et al., 2002). The provision of daily mouth care is often given low priority compared to other tasks by health care providers and considered as unrewarding task (Eadie & Schou, 1992)

Lack of a supported daily mouth care routine for residents of LTCF is prevalent (De Mello & Padilha, 2009). It is also commonly claimed that the nursing home staff do not possess sufficient knowledge to accomplish this task (Young, 2008). In addition, there seems to be a need for a uniform accountability. Studies in the LTCF setting have documented a positive effect of various oral hygiene programs (Nicol et al., 2005; Peltola et al., 2007). However, there seems to be short-term positive effect rather than long-term impact (De Lugt-Lustig et al., 2014). The number of care staff allocated to provide daily mouth care is critical; a higher ratio of registered nurses (RN) and/or licensed practice nurses (LPN) staffing to residents was correlated with positive oral health outcomes such as reduction in the amount plaque accumulation on teeth and dentures of elderly LTCF residents (Linn et al., 1991; Cherry, 1991).

Nurses and care assistants reported their concerns about the provision of residents' mouth care due to time constraints, uncooperative behaviors, limited visibility, and lack of proper guidelines (Pronych et al., 2010). The importance of involving management before initiating any oral hygiene strategies has been shown to positively influence the provision of daily mouth care within LTCFs (Vanobbergen & De Visschere, 2005). A lack of in-service nursing staff training regarding daily mouth care may result in poor dental and denture hygiene for the care-dependent residents (Simon et al., 2000).

### **1.3 Role of an Oral Health Coordinator**

An Oral Health Coordinator (OHC) working with care staff of LTCFs has the roles of improving access to dental professionals, training LTCF nursing staff to provide oral assessments, and facilitating LTC nursing staff to provide effective daily mouth care (Pronych et al., 2010).

Identification and training of a caregiver as an Oral Health Coordinator responsible for overseeing LTCFs residents' daily mouth care and coordinating dental care has been shown to be effective in improving oral health (Wardh et al., 2003). An OHC was appointed as the primary contact for the dental clinic and was responsible to ensure that the 42 residents receive an oral health assessment by a dental hygienist and necessary dental care (Wardh & Wikstrom, 2014). The OHC was also responsible to report oral health care issues at nursing staff meetings (Wardh & Wikstrom, 2014). The residents' oral microbial flora and the amount of oral hygiene help provided by the nursing staff were documented at baseline and over the two-year study (Wardh & Wikstrom, 2014).

Other studies have also reported positive oral health outcomes with oral health coordinators (Charteris & Kinsella, 2001; Pronych et al., 2010). Oral Care Link Nurses (OCLNs) trained by the dental team to assist with the promotion of daily mouth care and to aid communication regarding patient oral health within the multidisciplinary team has proven effective (Charteris & Kinsella, 2001). Patients' oral hygiene were categorized as excellent, good, satisfactory, poor, or unacceptable based on Loe and Silness gingival index (GI) numerical values 0-4 which will be



discussed in detail in the next section (Loe & Silness, 1963). The OCLNs had the opportunity to discuss with the dental team about concerns and difficulties that had arisen on their wards concerning providing daily mouth care. The OCLNs gave feedback about the result of the oral assessments of their residents at the peer review meetings with the nursing ward managers. Initially, the oral hygiene status was poor across the hospital and 39% of patients being designated as unsatisfactory. However, over time 95% of the patients improved their oral hygiene (Charteris & Kinsella, 2001). The OCLNs seemed to raise the staff's awareness of the importance of daily mouth care, and a comparison of the audits clearly showed improvement over time (Charteris & Kinsella, 2001).

Pronych et al. (2010) utilized an oral health coordinator (OHC) as a liaison for the facility and dental team and a resource for the nursing staff, who was responsible for ensuring that mouth care was provided daily. The OHC also participated at resident care plan meetings to ensure that daily mouth care plans were appropriate. Efficacy of the approach was determined by examining the oral hygiene status of residents participating in their study. After baseline data collection, the OHC became responsible for overseeing the daily mouth care component within the facility and educated new staff members. A trainer was available as an ongoing resource for the OHC during the course of the study and also provided additional education in daily mouth care practices. In this study, the Debris Index Simplified (DI-S) was as an outcome measurement utilized to assess plaque levels at baseline, and 2, 6 and 12-month follow-ups. By the 6-month follow-up, DI-S scores had increased slightly in all three LTC compared to the 2-month follow-up. The OHC was effective on the short term in decreasing plaque levels, but this diminished over time (Pronych et al., 2010).

McKeown et al. (2014) trained a registered nurse as a Best Practice Coordinator (BPC) to improve the daily mouth care for residents in rural LTCFs. In Ontario, the Long Term Care Homes Act (2007) requires that every resident have a care plan, including assessment of dental status and oral hygiene. Each resident must receive twice-daily mouth care and cleaning of dentures, and physical assistance to clean their own teeth if required. The Registered Nursing Association of Ontario developed oral care resources and registered nurses recruited as BPC within LTCFs across Ontario to support LTCF leaders and staff in creating a culture of evidence-based practice. BPC and a registered dental hygienist (RDH) partnered with the managers of LTCFs in rural Ontario to increase the consistency and quality of oral care provided to residents via enhancing the awareness and skills of care aides/staff. The “long-term care best practices program” was funded by the Provincial Government of Ontario. Oral health assessment focused primarily on identifying residents’ level of oral debris. Debris level categorized to none (no debris present), minimal (debris along gum line), moderate (debris not covering more than 1/3 of teeth or tissue surfaces), substantial (debris covering 1/3 to 2/3 of teeth and tissue surfaces), and abundant (debris covering greater than 2/3 of teeth and tissue surfaces). An educational intervention delivered to all care staff focused on mouth care skill instruction, with special emphasis on providing care to residents with dementia. After 1-year follow-up, 80% of residents still had poor oral hygiene, thus the educational intervention did not result in clinically meaningful improvement (McKeown et al., 2014).

#### **1.4 Oral Hygiene Indices for Older Adults**

Dental plaque is a collection of aerobic and anaerobic microorganisms that serves as the source of

infection affecting teeth and supporting hard & soft tissues, with the potential outcome being tooth loss (Wilkins, 1999). Plaque starts as a soft and sticky film of bacteria from food debris that forms on teeth and dentures. Calcified plaque is called calculus, which retains the bacteria on the teeth and can cause gingival inflammation and periodontal attachment loss. If periodontal disease is left untreated, it may lead to bone loss and loss of teeth. Plaque also causes dental caries and may lead to pulpal inflammation, infection, and oral pain (Wilkins, 1999),

Effectively removing plaque and oral debris decreases the bacterial load within the oral cavity and in turn, can help to reduce the risk of periodontal disease and dental caries. Establishing the extent of dental caries, oral debris and periodontal conditions is necessary in developing interventions to improve oral health in individuals (Locker, 1988). Clinical indices provide a means of converting observed clinical data into numerical data for statistical analysis. Various types of indices are available to evaluate plaque, periodontal health, and mucosal tissues (Hiremath, 2011). An index is a numerical value describing the relative status of the population on a scale with definite upper and lower limits (Russell, 1956). The use of indices permits comparison between different populations classified by the same criteria and methods (Russell, 1956).

#### **1.4.1 The Silness and Loe Plaque Index**

The Plaque Index was introduced by Silness and Loe (1964), and this index measures the amount of plaque on the coronal aspect of the facial or lingual aspect of teeth and is broken down into thirds, and based on four numerical value of 0 to 3:

0= No plaque in gingival area;

1= Film of plaque that can only be detected by running a probe across the tooth surface;

2= Moderate accumulation of soft deposits that can be seen with the naked eye;

3= Abundance of soft deposits in the gingival pocket and/or on tooth and gingival margin. The plaque values for facial and lingual surfaces of the teeth are added together, then divided by the number of scored teeth to create the overall score. (Silness & Loe, 1964)

The Plaque Index has been utilized to assess the effectiveness of a mouth care education program for nursing home caregivers (Frenkel et al, 2001). In another study, a plaque disclosing solution was utilized to increase the visibility of plaque and improve plaque-assessment accuracy (Munro, 2006). However, others have not recommended using plaque disclosing solutions due to residents' inability to rinse properly, or increased risk of aspiration (Le et al., 2012).

#### **1.4.2 Loe and Silness Gingival Index**

The Gingival Index (GI) scores the marginal and interproximal tissues separately on the basis of four values; 0 to 3 based on the characteristic signs of inflammation and redness (Loe & Silness, 1963):

0= Normal gingiva;

1= Mild inflammation – slight change in color and slight edema but no bleeding on probing;

2= Moderate inflammation – redness, edema and glazing, bleeding on probing;

3= Severe inflammation – marked edema and redness, ulceration with tendency to spontaneous

bleeding.

Bleeding is also assessed by gently running a probe along the wall of gingival sulcus. The scores of the four areas of the tooth can be summed and divided by four to give the GI for the tooth (Loe & Silness, 1963):

0 = Absence of inflammation;

1 = Mild inflammation or with slight changes in color and texture but not in all portions of gingival marginal or papillary;

2 = Mild inflammation, such as the preceding criteria, in all portions of gingival marginal or papillary;

3 = Moderate, bright surface inflammation, erythema, edema and/or hypertrophy of gingival marginal or papillary;

4 = Severe inflammation: erythema, edema and/or marginal gingival hypertrophy of the unit, spontaneous bleeding or ulceration. (Loe & Silness, 1963)

Le et al. (2012) assessed the efficacy of oral care education among nursing home staff to improve the oral health of residents. Nursing staffs' oral care knowledge was measured using a 20-item knowledge test at baseline, post-education, and at a 6-month follow-up. Residents' oral health was assessed at baseline and again after 6 months using the Plaque Index (PI) and Gingival Index (GI). Clinical measurements performed using World Health Organization (WHO) examination kit including a mouth mirror, a WHO explorer, and a WHO periodontal probe was used. Among residents in the study group, PI decreased at 6 months compared to baseline ( $p < 0.05$ ), but there was no statistically significant difference in their GI measurements between baseline and 6-month follow-up ( $p = 0.07$ ). (Le et al., 2012)

### **1.4.3 Oral Hygiene Index**

The Oral Hygiene Index (OHI) is composed of two components: a Debris Index and a Calculus Index (Green & Vermillion, 1960). Each index is based on 12 numerical determinations representing the amount of debris or calculus found on the buccal and lingual surfaces of each of the six segments of the mouth. The OHI was primarily developed to quantify the oral cleanliness in population studies (Green & Vermillion, 1960). The objective was to make the system as simple as possible yet comprehensive enough to yield clinically useful data.

There are three segments in each dental arch: 1) The segment distal to the right cuspid, 2) The segment distal to the left cuspid, 3) The segment mesial to the right and left first bicuspid. Separate recordings are made for the buccal and lingual surfaces in recognition of the differences in oral hygiene status that may exist between these surfaces. The individual indices are derived from scores based on the fraction of tooth surface area covered by debris or calculus. Only fully erupted permanent teeth are scored (a tooth considered fully erupted when the occlusal or incisal surface has reached the occlusal plane). Third molars and incompletely erupted teeth are not scored due to the wide variation in the height of clinical crowns (Green & Vermillion, 1960). The oral hygiene examination should proceed in the following way: first, the buccal, and second, the lingual surfaces of teeth in upper right posterior segment are inspected and scored; then the buccal, and the lingual surfaces of teeth in upper anterior segment as well as the buccal, and the lingual surfaces of teeth in upper left posterior segment are inspected and scored. The score ranges from 0 (no debris or stain) to 3 (soft debris covering more than 2/3 of the exposed tooth surface). After the individual scores

are recorded, the index values are calculated. For each individual, the debris scores for individual teeth are totaled and divided by the number of segments scored. The calculus index has similar scoring, ranging from 0 (no calculus present) to 3 (calculus covering more than 2/3 of the exposed tooth surface).

**Debris Index** = (The total of the upper and lower buccal scores) + (The total of the upper and lower lingual scores) / (The number of segments scored).

**Calculus Index** = (The total of the upper and lower buccal scores) + (The total of the upper and lower lingual scores) / (The number of segments scored).

OHI= Debris Index + Calculus Index

A subjective assignment of the terms "good," "fair," and "poor" applied by Greene to correspond to selected levels of debris as: OHI 0.0 to 0.6 (good); OHI 0.7 to 1.8 (fair); OHI 1.9 to 3.0 (poor) (Greene, 1967).

In a recent study by Khangar et al. (2015), the OHI index was used to assess the oral hygiene status of institutionalized dependent elderly in Bangalore City, India. They considered OHI score range of 0.0–0.6 as good oral hygiene (OH), 0.7–1.8 as fair OH, and 1.9–3.0 as poor OH (Khanagar et al., 2015). The mean score of debris in this population was  $2.87 \pm 0.22$  which shows the high levels of oral debris among the elderly residents in this study who could not, or did not, brush their teeth, and who did not receive daily mouth care (Khanagar et al., 2015).

#### **1.4.4 Simplified Oral Hygiene Index**

The Simplified Oral Hygiene Index (OHI-S) was developed by Greene & Vermillion (1964) to reduce the number of decisions to be made in terms of the tooth with highest value in each segment as well as reducing the overall time needed for assessment. This index scores the amount of debris and calculus for the facial and lingual surfaces separately and then combines them together. It differs from the original OHI in the number of tooth surfaces scored (6 rather than 12) and the method of selecting the surfaces to be scored. The six preselected surfaces for the OHI-S are located in four posterior and two anterior segments. The posterior surfaces are located on the first fully erupted tooth distal to the second bicuspid on each side of each arch. The buccal surfaces of the selected upper molars and the lingual surfaces of the lower molars are examined. In the anterior segments, the labial surfaces of the upper right central incisor and the lower left central incisor are examined. In the absence of either of anterior teeth, the central incisor (21 or 41 respectively) on the opposite side of the midline is substitute. This index requires less time to complete compared to original OHI; however it may lead to underestimation of oral hygiene status of individuals (Hiremath, 2011).

Both the OHI and OHI-S have been used for more than 30 years in studies worldwide (Rebelo, 2011). The intra-operator reliability of the OHI index among independent examiners varied from 0.72 to 0.94 (Munro, 2006).

#### **1.4.5 Geriatric Simplified Debris Index (GDI-S)**

As elderly subjects often have difficulty opening their mouths for a long time and may be



uncooperative, the Geriatrics OHI-S was created to evaluate oral hygiene status (MacEntee et al., 2007). This modified version of OHI-S scores only the buccal surfaces of the teeth. This makes it easier, quicker to record the OH status of frail elderly residents.

The GDI-S is based on a four-point scale from 0 to 3 to reflect the amount of debris on the buccal surface of each tooth: 0 = No debris or stain present; 1= Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered; 2= Soft debris covering more than one-third, but not more than two-thirds, of the exposed tooth surface and 3 = Soft debris covering more than two thirds of the exposed tooth surface (MacEntee et al., 2007).

In a randomized clinical trial by MacEntee et al. (2007), the GDI-S was applied to evaluate the efficacy of an educational intervention for improving the oral hygiene of elderly population in LTCFs. Fourteen facilities in metropolitan Vancouver matched for size were assigned randomly to an active or control group. At baseline in each facility, care-aides in the active group participated with a full-time nurse educator in a seminar about oral health care, and had unlimited access to the educator for oral health-related advice during a 3-month trial period. Care-aides in the control group participated in a similar seminar with a dental hygienist but they did not receive any additional advice. The residents in the facilities were examined clinically at baseline and after 3 months to measure their oral hygiene and gingival health. Unfortunately, the OHI measurements after 3 months were not significantly different from baseline in either group, indicating that the educational intervention did not have any impact on oral health of elderly residents in these LTCFs (MacEntee et al., 2007).

## 1.5 Research Rationale, Hypothesis and Specific Aim

The majority of elderly nursing home residents have diminished mouth care abilities resulting in increased dental plaque accumulation and poor oral health (Frenkel, 2000; Vigilid 1993). Attempts at improving daily mouth care for LTCF residents have often failed (Gammack & Pulisetty, 2009), however, a pilot study using an Oral Health Coordinator (Pronych et al., 2010) showed particular promise in improving oral health. One of the roles of the OHC was the education of care staff concerning daily mouth care. The OHC provided in-service hands-on training for the nursing staff, the residents themselves and the next of kin (NOK) concerning mouth care. The OHC made recommendations specific to each resident's mouth care, and provided each facility with oral hygiene products (toothbrushes, toothpaste, and floss). This study was developed to explore whether an OHC could improve oral hygiene for dependent older adults in multiple LTCFs after six-months.

The **null hypothesis (H<sub>0</sub>)** of this study is that there will be no difference between the baseline oral hygiene scores and the scores after 6-months.

The **alternative hypothesis (H<sub>1</sub>)** of this study is that there will be a significant improvement in the oral hygiene score after 6-months compared to baseline.

The **specific aim** of this study is to determine whether an oral health coordinator providing six-months of daily mouth care educational support would lead to an improvement in the oral hygiene of elderly Long Term Care Facility residents.

## **CHAPTER TWO: MATERIALS AND METHODS**

### **2.1 Oral Health Coordinator**

The Oral Health Coordinator (a certified dental assistant) was hired four days per week to support a dental program serving elderly residential care residents in the Courtney/Comox on Vancouver Island. Her role was to support nursing staff (nurses & care aides) in delivering daily mouth care, conducting oral health assessments, and referring patients in need for dental care. She facilitated consent for dental examinations, communication of dental treatment plans to family and power of attorneys, facilitation of transfer of patients to dental offices for dental care. The dental coordinator acted as the contact person for dentistry within the LTCF to enhance residents' access to professional dental care services (daily mouth care and professional dental services). She scheduled all dental examination appointments with RCF staff, dentist, and residents. She assisted the dentist with the dental examinations, and provided quality assurance concerning all documentation. She ensured that the dental professionals had appropriate access to each resident's medical file and that dental information was recorded in the resident's medical chart.

The Oral Health Coordinator collected and tabulated all research data including baseline & six-month oral health assessment plaque/debris scores, and treatment provided to patients participating in the program.

The Oral Health Coordinator split her time between the 4 participating LTCFs, spending on average 1–2 days per week in each. She provided in-service education sessions for facility care staff concerning daily mouth care and was available to provide hands-on support for challenging

residents using the British Columbia Dental Association mouth care educational materials. These sessions served to outline the basic daily mouth care required while addressing individual needs for each resident. After each in-service, toothbrushes were given to all the attendees, and daily mouth care supplies provided were given to the nurse administrators. The Oral Health Coordinator used customized Mouth Care Cards placed in the resident's bathroom to facilitate the provision of daily mouth care by care staff. Multiple oral hygiene in-services were provided in the 4 LTCFs: 4 in-services for "Comox Valley Seniors Village", 8 for "The Views", 7 for the " Glacier View", and 10 for " Cumberland". She also supported nursing staff with nursing oral health assessments of residents (upon admission to the facility and as needed) to identify oral concerns and create daily mouth care plans.

## **2.2 Long-Term Care Facilities Participating in the Study**

### **2.2.1 Glacier View Lodge**

Glacier View Lodge Society was incorporated in 1979 and opened a new 75-bed intermediate care facility in 1982. The new LTCF was designed with all private rooms because the board of directors at the time insisted on privacy and comfort for the residents. In 1991, a 27-bed special care unit addition was opened with the express purpose of caring for the special needs of those residents with dementia. Over the years, Glacier View Lodge has evolved into the complex care facility it is today. This LTCF currently has almost 200 people employed and is governed by a board of directors who contract selected administrative services from St. Joseph's General Hospital ("History of Glacier View Lodge society", 2015). There are 4.5 Registered Nurses (RN) on day shift, three RNs on

evenings shift and one RN on night shift. In terms of the number of Care Aides (CA) in this LTCF, there were 16, 11 and 4 care aides on day, evening and night shift respectively.

### **2.2.2 Comox Valley Seniors Village (CVSV)**

Comox Valley Seniors Village has 136 residential care suites/beds that opened in 2009 and has 90 publicly subsidized units and 46 private units (“Comox Valley Senior Village”, 2015). The residential care wing also offers respite care for stays of 2 weeks or more. To ensure intimate, home-like surroundings, each mini-community has 15 rooms and its own dining area. In terms of the staffing, there is one registered nurse (RN) and 4 Licensed Practice Nurses (LPN) on day shift, one RN and three LPNs on evening shift as well as one RN on night shift. Number of care aides (CA) in this LTCF for day, evening and night shift were 18, 17 and 4 respectively.

### **2.2.3 Cumberland Lodge**

The Cumberland Health Centre was built in 1977 and has 66 publicly subsidized units including 26 special care units (“Cumberland Lodge”, 2015). There were 1 RN and 3 LPNs on day shift, 1 RN and 2 LPNs on evening shift and 1 RN on night shift. During the day, evening and night there were 12, 6 and 2 care aides available in this facility.

### **2.2.4 The Views**

The Views was built in 1982 adjacent to St. Joseph’s General Hospital in Comox with 125 beds with some private, semi-private and standard four-bed rooms, and one respite room available for

short-term stays (“St. Joseph's General Hospital - The Views”, 2015). There were three RNs and five LPNs on day shift, one RN and four LPNs on evening shift and on the night shift there were one RN and one LPN available. In terms of the number of care aides, there were 12, 10 and 4 care aides available on day, evening and night shift in this facility.

### **2.3 Oral Health Assessment**

The Oral Health Coordinator obtained consent from 126 residents to participate in the study. Only 25% of the residents were able to provide consent, with next of kin or power of attorney providing 75% of the consents. Residents who participated in this study received an examination by a dentist at baseline and 6 months later. Four trained dentists provided the Oral Health Assessments, one in each of the four LTCFs. Prior to the study all four dentists participated in a training session and were calibrated by a single expert clinician. Each dentist underwent a 3-hour hands-on clinical training session with the principle investigator to perform the oral health assessment including the Geriatric OHI-S.

The dentist examiner reviewed each resident’s medical records with those not requiring prophylactic antibiotic coverage receiving an oral health assessment. The dentists examined participants seated in a chair or in their wheelchair or lying down in their bed. The dentist used an illuminated dental mirror to aid in visually examining the teeth and mouth, but no radiographs were taken. Any dentures, fixed partial dentures, implants, and/or missing teeth were charted. Any teeth with dental caries, fractured teeth/roots requiring extraction, mobile teeth, ulcers and sore spots were identified and those patients recommended to follow-up with dental treatment. For many of the residents, this was the first oral health assessment that they had received since entering the

facility. If needed, at the end of the examination a referral was made to a dental hygienist, a dentist, or both for care.

The Oral Health Coordinator maintained the hard copies of the oral health assessments. The records were duplicated excluding the patient's name, allocated a sequential number to ensure confidentiality, before being forwarded to UBC for analysis by the study investigator.

## **2.4 Clinical Outcome Measurements**

All residents received an oral health assessment at baseline and six-months later using the Geriatric Debris Index Simplified (GDI-S) and the novel that included novel Geriatric Calculus Index Simplified (GCI-S).

**The Geriatric Debris Index Simplified (GDI-S)** (MacEntee et al., 2007) was based on a four-point scale from 0 to 3 to reflect the amount of debris on the facial surface of each tooth. 0 = No debris or stain present; 1= Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered; 2 = Soft debris covering more than one-third, but not more than two-thirds, of the exposed tooth surface and 3 = Soft debris covering more than two thirds of the exposed tooth surface.

**The Geriatric Calculus Index Simplified (GCI-S)** was based on a four-point scale, ranging from 0 = No calculus present; 1= Supragingival calculus covering not more than one third of the exposed facial tooth surface; 2 = Supragingival calculus covering more than one third, but no more than two

thirds of the exposed facial tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth, or both; 3 = Supragingival calculus covering more than two thirds of the exposed facial tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth, or both. Fractured teeth and roots were excluded from both the GDI-S and GCI-S scores.

All removable dental prostheses (Dentures) were examined for cleanliness and underlying mucosa presence of denture stomatitis. Denture stomatitis was measured based on Newton classification using a four-point scale from 0 to 3. In this classification, 0 = No visible inflammation; 1= Localized simple inflammation or pinpoint hyperemia; 2= Erythematous or generalized simple type presenting a more diffuse erythema involving a part or the entire denture-covered mucosa; 3= Granular type (inflammatory papillary hyperplasia) commonly involving the central of the hard palate and alveolar ridges, and is often seen in association with Types I and II. (Newton, 1962)

After completion of baseline data collection at each LTCF, the OHC became responsible for overseeing the daily mouth care for the residents and educated staff members to provide this care. After a 6-month follow up period, the same dentists provided a repeat oral health assessment including the GDI-S and GCI-S.

## **2.5 Sample Size Calculation**

Frenkel et al. (2001) estimated that a 20% improvement of DI-S level would be clinically



beneficial. Using the before mentioned study, which had a DI-S standard deviation (SD) of 0.6, with a desired study power of 90%, the minimum number of subjects required as sample size would be 51. The convenience sample of 126 consenting participants utilized within this study is well beyond this minimal sample size.

## **2.6 Statistical Analysis**

Microsoft Office Excel software was used to tabulate the data and analyses performed using SPSS 20.00 statistical software. Frequency distributions, means/standard deviation (SD) were calculated for all variables. Comparison of average debris and calculus within the groups at baseline and 6 month follow-up was analyzed using a paired t-test. Probability of 5% was chosen for statistical significance in this study.

All four dentists were calibrated to perform the Geriatric OHI-S, and their consistency assessed using Cohen kappa statistics. At baseline and 6-months, each dentist performed repeat measurements of the Geriatric OHI-S for 10 subjects. Comparison of the scores recorded from each subject produced kappa statistic of 0.87.

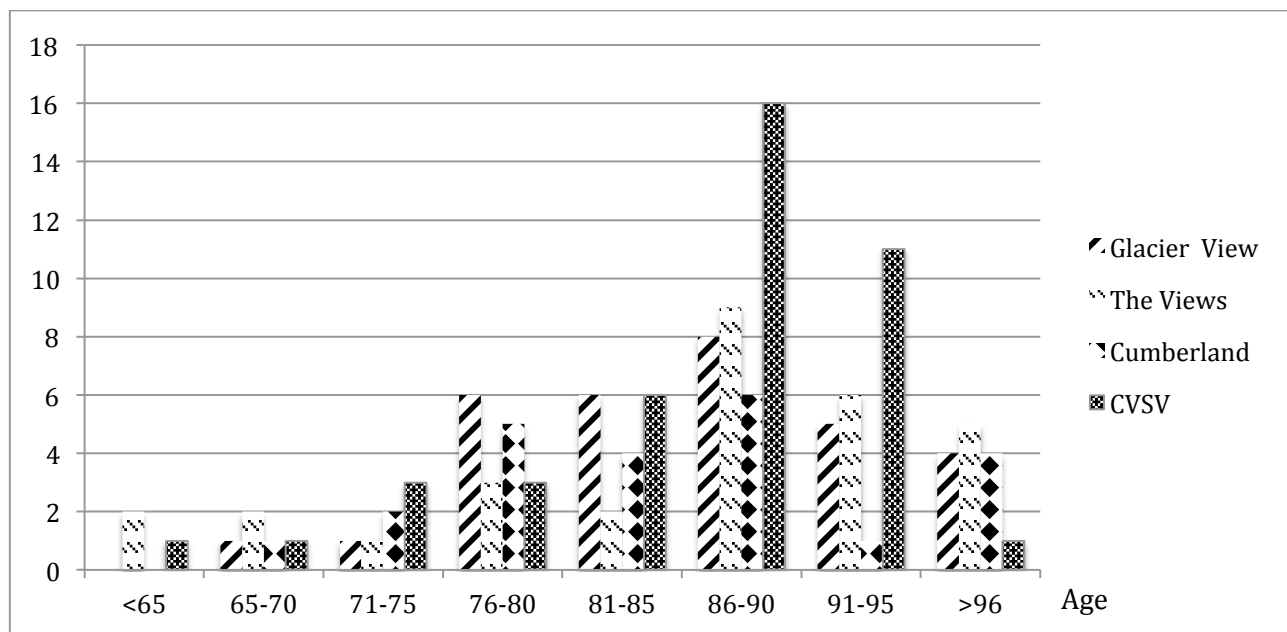
## CHAPTER THREE: RESULTS

### 3.1 Study Population

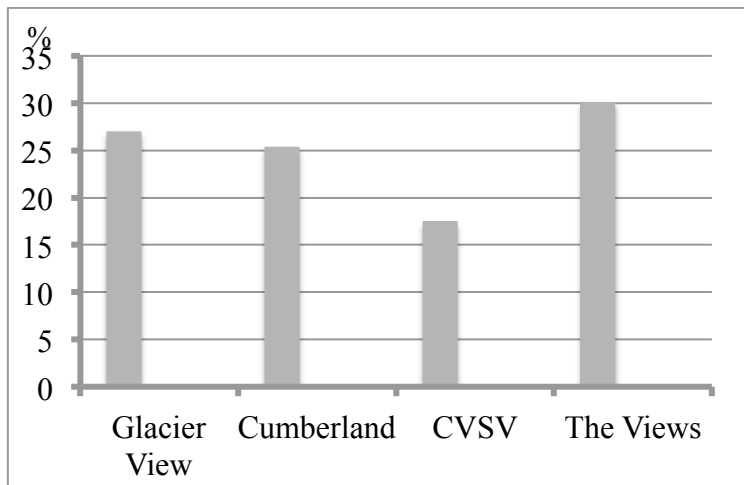
The total number of residents within the four LTCF available to participate in this study was 455; with 193 residents consented to participate, and 67 edentulous residents excluded. The remaining 126 residents consisted of 44 males (34%) and 82 females (66%). The age range of the residents varied from 63 to 108 years, with the mean age being 85.8 (SD 9.1) years (Figure 1). In terms of mobility, more than half of the participants were wheelchair users (57%), 16% were ambulatory and 26.0 % were bedridden. Of the total of 126 residents in four facilities 27% resided in Glacier View lodge, 25%, 18% and 30% The Views, Cumberland and CVSV respectively (Figure 2).

**Figure 1. Age distribution of residents in four LTCFs**

Number of residents



**Figure 2. Distribution of dentate residents in four LTCFs**

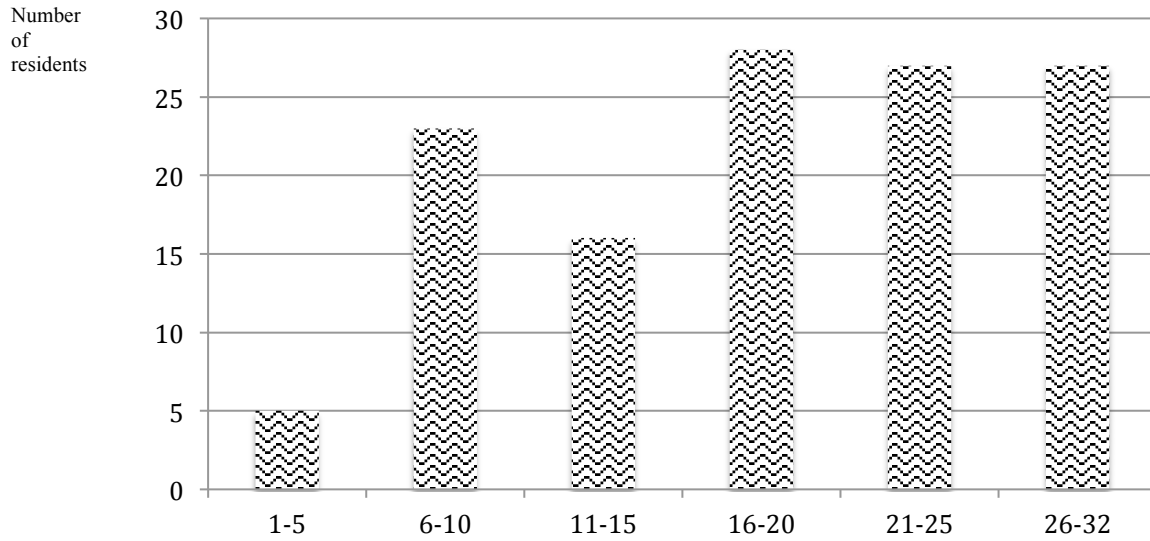


### **3.2 Findings from the Oral Health Assessments**

#### **3.2.1 Dentition**

Of the 126 subjects examined, 77% (n= 97) were partially dentate in both arches and 23% (n=29) were dentate in mandible only, and no resident was partially dentate in maxilla only. The minimum number of remaining teeth was 2 and the maximum was 29 (Figure 3). The mean number of the retained teeth per subject was 18.1 (SD 7.6). Within the fully dentate subjects, 32% (n=41) had at least one tooth affected by dental caries.

**Figure 3. Number of retained teeth per dentate residents**



**3.2.2 Removable Dental Prostheses**

Most of the dentate residents (82.5%) were not wearing removable dental prostheses (RDPs). Only 3 residents (2.4%) had RDPs in both arches. 7.1% of the residents had maxillary RDPs only and 7.9% had mandibular RDPs only (Table 1).

**Table 1. Dental status of the 126 dentate subjects**

Oral health status	Number of residents (%)
<b>Dentition</b>	
• Dentate in both arches	97 (77)
• Dentate only in the Mandible	29 (23)
<b>Removable Dental Prostheses</b>	
• None	104 (82.5)
• Maxilla	9 (7.1)
• Mandible	10 (7.9)
• Both arches	3 (2.4)

### 3.2.3 Denture Stomatitis

Of the 22 residents who had RPDs, 85.3% of the residents did not show any signs of visible inflammation in maxilla, 5.9% showed type I denture stomatitis, and 8.8% showed type II in the maxilla. No denture stomatitis was noted for any mandibular arch (Table 2)

**Table 2. Maxillary and mandibular denture stomatitis among LTCF residents**

<b>Denture Stomatitis</b>	<b>Number of residents (%)</b>
<b>Maxillary Denture Stomatitis</b>	
• No visible mucosal inflammation	29 (85)
• Type I	2 (5.9)
• Type II	3 (8.8)
• Type III	----
<b>Mandibular Denture Stomatitis</b>	
• No visible mucosal inflammation	29 (100)
• Type I	----
• Type II	----
• Type III	----

### 3.2.4 Removable Dental Prostheses Hygiene

The amount of dental plaque and food debris on removable dental prostheses (RDP) was scored for the 22 partially edentulous subjects (Table 3). A denture with debris covering no more than 25% of its surface area was considered to be relatively clean. In more than half (60.6%) of the residents who had maxillary RDP, the prosthesis was covered more than 25% with food debris. Only twelve residents (33%) who were wearing RDPs had prostheses that were free of plaque and food debris.

**Table 3. Removable dental prostheses hygiene**

<b>Number of residents (%)</b>	
<b>Maxillary Removable Dental Prostheses</b>	
• Prosthesis is free of plaque and food debris	13 (39.4)
• Prosthesis has plaque and food debris	20 (60.6)
<b>Mandibular Removable Dental Prostheses</b>	
• Prosthesis is free of plaque and food debris	4 (33.3)
• Prosthesis has plaque and food debris	8 (66.7)

### **3.3 Daily Mouth Care**

The majority of the residents (73%) did not receive any assistance for their daily mouth-care (Table 4). Only 27% (n=34) received help for their daily mouth care according to the nursing staff.

Assistance with daily mouth care was recommended for 95.2% (n=120) of the residents (Table 3).

When nursing staff were asked about the resident's daily mouth care, 94.4% of residents were brushing their teeth with fluoride toothpaste and 4% (n=5) did not use toothpaste at all. The use of mouth rinse was extremely low (less than 1%).

**Table 4. Daily mouth care assistance and breakdown of care**

<b>Daily Mouth Care</b>	<b>Number of residents (%)</b>
<b>Received assistance with daily mouth care</b>	
• Yes	34 (27)
• No	92 (73)
<b>Mouth-Care</b>	
• Brush	101 (80.2)
• Rinse	1 (0.8)
• Brush+ rinse	5 (4)
• Brush+ floss	12 (9.5)
• Brush+ floss + rinse	5 (4)
• None	2 (1.6)

### 3.4 Referral for Dental & Oral Hygiene Care

Only 46.8% of the partially dentate residents participating in this study were referred to a dental hygienist for professional cleaning, with 37.6% referred to a dentist for dental treatment. Thirty-five residents were referred for restorative treatment mostly due to caries with only 3% having an acute infection requiring extraction of the tooth (Table 5).

**Table 5. Treatment needs of the 126 partially dentate residents**

<b>Reason for referral</b>	<b>Number of residents (%)</b>
No treatment	20 (15.9)
Caries (Restoration)	35 (27.8)
Periodontal care	59 (46.8)
Acute Tooth infection requiring extraction	4 (3.2)
Prosthetic replacement of missing teeth	1 (0.8)
Denture adjustment, relines, repair	5 (3.9)
Oral mucosal lesion	2 (1.6)

### 3.5 Oral Hygiene

The oral hygiene of the 126 partially dentate subjects was measured using the Geriatric Debris Index Simplified (GDI-S) and Geriatric Calculus Index Simplified (GCI-S) and showed no statistical differences between baseline and 6 months later (Table 6).

**Table 6. Oral hygiene at baseline and after 6 months using GDI-S and GCI-S**

Outcome	Baseline Mean (SD)	6-month follow up Mean (SD)	Paired t-test (95% CI)	P-value
<b>GDI-S</b>	1.11 (0.55)	1.09 (0.47)	0.02 (- 0.50 to 0.10)	0.60
<b>GCI-S</b>	0.75 (0.49)	0.77 (0.46)	- 0.01 (-0.83-0.52)	0.64

The mean oral hygiene scores were categorized as 0–1, 1-2 and 2–3 to reflect good, moderate and poor hygiene. The mean GDI-S of 43% of participants ranged between zero to one, 55% ranged between 1-2 and 22% between 2-3 (Table 7). The majority of participants in this study had relatively clean mouths.

**Table 7. Distribution of GDI-S and GCI-S**

Mean	0-1 (good) %	1-2 (moderate) %	2-3 (poor) %
<b>GDI-S</b>	43%	55%	22%
<b>GCI-S</b>	84%	15%	1%



## **CHAPTER FOUR: DISCUSSION AND CONCLUSION**

### **4.1 Discussion**

As the population of developed countries continues to age and the number of dependent elders increases, the challenges to LTCF personnel to provide daily mouth care and to the dental profession to maintain the oral health is increasing (Vigilid 1993; Reed et al. 2006)

Elderly residents of LTCFs have limited self-care abilities resulting in increased dental plaque accumulation and poor oral health (Felder et al., 1994). There does not appear to be a single solution to address the challenge of daily mouth care and poor oral health (De Lugt-Lustig et al. 2014).

Many studies have emphasized the need for clinical educational interventions for LTCF care aides regarding daily mouth care (Frenkel et al. 2001; Paulsson et al. 2003; Gammack et al. 2009).

Frenkel et al. (2001) provided education sessions for nursing staff covering the role of plaque in oral disease, demonstrations of cleaning techniques for dentures and natural teeth. Frenkel et al. (2001) documented a reduction of the amount of dental plaque & debris on teeth for over 300 elderly subjects residing in 22 nursing homes. In this study, each facility has 3-4 in-services educational sessions on daily mouth care in conjunction with hands-on training of individual care-aides as requested. The difference in the educational content and the intensity of the mouth care programs makes it difficult to compare the result of one study with another. Unfortunately studies on educational interventions have uncertainty due to lack of standardization, examiner calibration, and appropriate sampling, so it is challenging to compare the result of different studies in this

regard (Berkey et al. 1991; MacEntee, 2005).

Wardh & Wikstrom (2014) demonstrated that trained oral care aides were able to improve the oral hygiene of elderly residents over a two-year period within one LTCF. Staff interviews revealed that it took two years for daily mouth care routines to become established (Wardh & Wikstrom, 2014). Our study was unable to demonstrate an improvement in daily mouth care after six months using an Oral Health Coordinator. A possible explanation for this is that the multiple oral care aids in Wardh & Wikstrom study were directly placed in charge of daily mouth care for a limited number of residents over a longer period of time.

Charteris & Kinsella (2001) recruited nursing staff to provide direct daily mouth care for elderly patients with neurological disabilities. They documented 30% improvement using a modified gingival index (Loe and Silness, 1963).

Pronych et al. (2010) recruited an Oral Health Coordinator to serve 3 New Hampshire LTCFs. There was a very limited sample size in each of the 3 LTCFs and categorized their LTCFs as small (4 participants), medium (9 participants) and large (33 participants). Their result showed a decrease in the mean Debris Index Simplified Scores (DI-S) from baseline to 12-month follow-up. However the greatest effect was within the smallest LTCF with only four participants (the mean value in this group was 2.08 at baseline which decreased to 1.68 at 12-month). In the medium size group with 9 subjects the mean value for DI-S had decreased from 2.46 at baseline to 1.76 at 12-month follow-up. In this study there was only one OHC in charge of educating the nursing staff and care aides of

the four facilities with a resident population of over 450.

Over time, residents of LTCF are becomingly increasingly older, more medically compromised, and are being prescribed a greater number of medications, all of which negatively impacts their oral health. The retention of natural teeth, increased complexity of dental reconstructions, and the inclusion of oral implants have most likely made daily mouth care an increasingly difficult task for care staff.

The importance of assisted daily mouth care should not be underestimated in the maintenance of a healthy mouth. The majority of the residents (73%) at baseline were not receiving any assistance with their daily mouth care. A lack of assistance for daily mouth care has been also reported in other studies and high numbers of LTCF residents reported that they have never received any help with brushing, let alone flossing of teeth (Wyatt, 2002). Common reasons reported for not providing daily mouth care include residents not wanting to be helped and caregivers deciding that residents were able to manage their own mouth care (brushing and flossing) (Wyatt, 2002). Uncooperative patients are frequently mentioned to be challenging for care staff to provide daily mouth care. (Bots-VantSpijker et al., 2014)

#### **4.2 Implication of the Study**

Frail elders residing in LTCFs have limited abilities to provide their own daily mouth care leaving them vulnerable to poor oral health. This study revealed that 73% of residents did not get any help in the provision of their daily oral care, and the addition of an Oral Health Coordinator to train staff

to provide daily mouth care did not improve the situation. Future studies should therefore focus on different means of improving oral health other than training care staff to provide daily mouth care.

### **4.3 Limitations of the Study**

One of the limitations of the study includes generalizability to other LTCF settings and other elderly populations. While it is likely that similar results may be found among elderly population residing in other LTCFs the fact that the participants in this study were a small sample may make it difficult to conclusively apply these results to other populations. Another limitation is that the GDI-S index, which uses fewer tooth surfaces than other gingival indices, may underestimate the true oral hygiene status for individuals. However, the indices used in this study enabled us to obtain sufficient data while requiring minimal cooperation from the subjects.

### **4.4 Conclusion**

Based on the results from this study it has been concluded that despite providing an OHC to work with nursing staff in all four LTCFs, there was no significant improvement in oral hygiene as measured by the GDI-S and GCI-S for the participating residents. This is likely due to the low level of residents receiving any form of assistance with daily mouth care.

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