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# End of life dental service utilization by geriatric patients in a long-term care setting

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*Boston University*

BOSTON UNIVERSITY  
HENRY M. GOLDMAN SCHOOL OF DENTAL MEDICINE

THESIS/DISSERTATION

**END OF LIFE DENTAL SERVICE UTILIZATION BY GERIATRIC PATIENTS  
IN A LONG-TERM CARE SETTING**

by

**KADAMBARI DHANANJAY RAWAL**

BDS, Dr. D.Y.Patil School of Dentistry, 2009  
CAGS, Boston University, 2010.

Submitted in partial fulfillment of the requirements for the degree of  
Master of Science in Dentistry  
In the Department of Health Policy and Health Services Research

2018

First Reader      Woosung Sohn, DDS, PhD, DrPH  
Director, Division of Dental Public Health  
Associate Professor,  
Dept. of Health Policy and Health Services Research.

Second Reader    Joseph Calabrese DMD, CAGS  
Clinical Associate Professor, Department of General Dentistry  
Associate Dean of Students,  
Director of Geriatric Dental Medicine.

Third Reader      Michelle Henshaw DDS, MPH  
Professor, Department of Health Policy & Health Services Research  
Associate Dean for Global & Population Health.

## **DEDICATION**

*I would like to dedicate this work to my grandfather, Late Sri Babubhai Parushottamdas Bhuta (1926-2018) who supported my education and believed in my vision to provide care to older adults.*

## **ACKNOWLEDGMENTS**

I would like to acknowledge Mr. Ron Rieder of the Department of Information Technology at Hebrew Senior Life for his assistance in the extraction of data from the hospital's Electronic Medical Record and the creation of the database that made this study possible.

I also wish to acknowledge Xi Chen, et al for their previous study titled "Dental treatment intensity in frail older adults in the last year of life" published as a cover story in the November 2013 issue of the Journal of American Dental Association. The article served as an invaluable guideline for the current study.

END OF LIFE DENTAL SERVICE UTILIZATION BY GERIATRIC PATIENTS IN A  
LONG-TERM CARE FACILITY.

KADAMBARI DHANANJAY RAWAL

Boston University, Henry M. Goldman School of Dental Medicine, 2018

Woosung Sohn, DDS, PhD, DrPH, Director, Division of Dental Public Health, Associate  
Professor, Dept. of Health Policy and Health Services Research

ABSTRACT

**Objective:** To understand dental service utilization by frail older adults residing in a long-term care (LTC) setting in the last two years of their life. To understand the types of dental services utilized by this demographic, the frequency of utilization and determine the characteristics that may be predictors of ‘higher dental service utilization’.

**Methods:** A retrospective cohort study was conducted by an electronic chart review of all LTC patients at two sites who died between 11/1/2014 - 12/30/2016 and had a dental visit in the two-year period prior to death, resulting in a sample of 369 patients. Based on the number of dental appointments attended prior to death, the patients were categorized into five groups: 0,1-2,3-5,6-9 and 10 or more appointments. A multivariate logistic regression model was created to identify the factors associated with higher dental service utilization.

**Result:** The study found that 84% of patients who died in the study period, utilized on-site dental services in the last two years of their life. Approximately 66% had 3 or more

dental appointments. Diagnostic and preventive procedures were most commonly utilized (utilized by 81% and 73% of patients respectively). Multivariate analysis suggested that dentate patients and patients wearing removable dental prosthesis were about 7 and 12 times more likely respectively to have a higher utilization of dental services (OR=6.5 and OR=11.7). Medicaid beneficiaries were more likely (OR=1.9) to have a higher utilization of dental services than the others.

**Conclusions:** This study showed that a large percentage of frail older adults utilized dental services even in the last years of their lives when given access to these services. As people are living longer and retaining their teeth longer, there is a rising need and subsequent demand for end-of-life dental services. Certain administrative and policy implementation strategies need to be developed to provide dental services to LTC patients in the last years of their lives.

**Keywords:** Long-term care setting, oral health, dental services, geriatric dentistry, end of life.

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**LIST OF ABBREVIATIONS**

- AARP..... American Association of Retired Persons
- EMR..... Electronic Medical Record
- LTC..... Long- Term- Care
- OBRA ..... Omnibus Budget Reconciliation Act

## INTRODUCTION

Older Americans over the age of 65 are projected to more than double from 40.2 million in 2010 to 88.5 million in 2050 and those aged 85 and over are projected to almost triple, from 6.3 million in 2015 to 17.9 million in 2050 (1). For the first time in the history of the United States, older adults are projected to outnumber children. In less than twenty years from now, the ‘graying of America’ will not just be a mere theory it will happen right before our very eyes. Demographers and health policy experts have predicted that with the rising number of older adults, the United States should expect a much greater demand in health care. In a 2015 American Association of Retired Persons (AARP) report, the CEO was quoted saying that the health care system was going to have a hard time keeping up with the graying of America, it would struggle to survive, and that the American population was going to have a very difficult time as the country ages (2). These statistics should motivate health care providers and researchers to focus their attention on the health of the aging American population and its impact on society.

Disability rates among those over 80 years of age are shown to be the highest, indicating a higher need for residing in Long-term care (LTC) settings (1). Currently, about 1.4 million older Americans reside in LTC (3). It has been assessed that patients living in LTC currently are older than ever before (4) and one in three patients who die at age 75 or older, pass away in an LTC setting (5), suggesting that a large number of older adults are projected to live and die in LTC settings in the years to come (6). Evidence also shows a steady decline in edentulism among older adults living in LTCs (7). To

summarize, as Americans continue to live longer, preserve their teeth longer, they may end up spending the last few years of their lives in LTC settings. The oral health of these patients is a significant concern because of its association to quality of life, systemic health and overall well-being (8). This compels the medical community to take a closer look at the dental services provided to patients in the last few years of their lives in LTC settings to ensure quality of life right till the end.

A high level of unmet dental needs with significant oral disease and poor oral hygiene are, unfortunately, common among LTC residents (8). Pre-existing complex medical concerns and comorbidities along with the cumulative effect of a lifetime of untreated oral conditions account for the vulnerability of this population (9). Studies have implied that nursing staff in LTC settings are overworked, inadequately trained in providing effective oral hygiene care and may not even consider providing daily oral hygiene as one of their top priorities (10), furthermore, LTC settings are infamous for not enforcing strict oral care policies (11). All of these environmental factors along with the changes in diet, medications and inadequate mouth cleaning further changes the intraoral flora among medically compromised older adults leading to a high burden of oral disease in this population (12). An increased risk for caries can be associated with not only inadequate daily oral hygiene, but also a high intake of refined carbohydrates and a predisposition for xerostomia. The prevalence of xerostomia among LTC older adults can be as high as 42% and is significantly influenced by polypharmacy (9).

The lack of trained dental professionals further complicates pre-existing access to care issues for LTC older adults in the last years of their lives (9). Investigations have

reliably indicated that the oral health status of residents of LTC facilities is poor; the majority require some form of oral health care intervention (8). Multiple comorbidities increase towards the end of life; the loss of visual acuity and decreased manual dexterity, can affect the patient's ability to perform oral self-care, which affects oral hygiene. These conditions are known to worsen if left attended, as the patient's overall health deteriorates the state of oral health remains bleak with an increased likelihood of oral infections, dental caries and fractured teeth resulting in pain originating from the mouth (12-15). Poor oral hygiene has been linked to various debilitating conditions like recurrent aspiration pneumonia, a leading cause of death in frail older adults (16). Oral pain and infection can thus lead to lethal complications and can often worsen a pre-existing functional decline (17, 18). It is, therefore, of utmost importance that oral health considerations are taken into account when planning end-of-life care. This can improve the quality of life in the last few years of life for the geriatric patient. Palliative dental care focusing simply on pain control and treatment of infections is usually the treatment of choice by most dentists aware of the terminally-ill condition of patients (18,19). These treatment choices are made due to a lack of clinical guidelines for best practices in treating older adults in the last years of their lives. There is also inadequate scientific evidence regarding the overall dental care provision and utilization of dental services among LTC patients in the last years of their lives. Multiple studies in this area are needed to develop clear clinical guidelines for the dental management of these patients. A better understanding of the types of dental services provided to these patients and factors affecting the utilization of these services can perhaps aid in establishing best practices.

This could in turn help the medical community identify issues in dental service provision and utilization, aiding in improving the quality of end-of-life dental services (20). To address these concerns, the following study was conducted to examine the dental service utilization by older adults living in a LTC setting in the last two years of their lives.

## METHODS

A retrospective cohort study was conducted by reviewing the electronic medical records of all LTC patients at two long term care (LTC) sites with a total of 725 beds. The study was conducted for the period of 2012-2016.

During this time period, these two facilities (located in the Roslindale and Dedham neighborhoods of Boston) had on-site dental clinics staffed with two dentists, one visiting oral surgeon, two hygienists and a dental assistant providing dental services four days a week. Each dental clinic was located ‘on-site’ within the building of the respective LTC sites, easily accessible by the building elevators. The dental clinics followed universal design concepts to ensure wheel chair accessibility and were fully equipped to provide comprehensive dental services. All LTC patients were evaluated at the dental office within three weeks of admission to the site, in compliance with the federal mandates. All patients were seen at least three times a year for dental hygiene appointments followed by evaluation by the dentist to assess need for further treatment. Treatment plans were then created, and patients were scheduled for appointments. The nursing staff at the sites ensured patient attendance to the on-site dental clinics by reviewing patient schedules a day prior to the dental appointment. At the end of each dental appointment, all patient and nursing communication including detailed visit notes were placed in the site’s Electronic Medical Records system (EMR). The dentists also had access to the patients’ entire medical history through the EMR and used this information to create treatment plans for the patients. The dental office staff used an



interprofessional approach along with other geriatric medical specialists (who were consulted from time-to-time) to deliver patient centric care to all LTC residents. Regardless of patients' medical insurance status, the dental service costs were built into the patients' daily fee for living at the LTC facility, implying that all LTC patients had access to the dental clinic and did not need to pay for dental services. Dental services provided included all procedures to ensure comprehensive dental care except for endodontics and implant surgeries, if these procedures were recommended for the patients they would be referred to neighborhood dental specialists and the required transportation services would be provided. This study does not take into account the latter procedures nor the referrals as initial data suggested this number to be very low.

### **Data collection**

Inclusion criteria for the study were set as follows: patients who were discharged on account of death between 11/1/2014 and 12/30/2016 (this date was chosen as this is when the ICD 10 code usage began at these facilities allowing simpler data collection for medical variables) and having at least one dental visit in the two-year period prior to death. The data was extracted from the Electronic Medical Record (EMR) by a designated IT specialist. Since the study used data from deceased patients, it was not considered human subject research and an IRB approval was not needed. A HIPAA safe harboring method was used create the database by de-identifying all data pertaining to exact dates and ages of the patients. The final sample size based on the inclusion criteria was 369 patients.

For sociodemographic characteristics: age, gender, race/ethnicity, insurance and location of site were chosen. As a consequence of the HIPAA safe harbor method, only two categories for age were permissible i.e. under 90 years of age and 90 and over. The study population mainly had Medicaid and Medicare insurances; some had private medical insurances, and some were private pay (paying for LTC services using private funds). The latter two categories represented a very small demographic and were merged to create the category “Private”.

The Health Care Proxy (HCP) variable was added to this list of sociodemographic characteristics. This was important to consider because in the United States, if the patient does not have the competence to consent to medical treatment, proxies’ function as decision-makers. They are legally appointed individuals (family or other) (21) who make health care decisions for the patient and provide consent prior to medical treatment. This is common practice during the process of formulating advanced directives for end of life care planning, the effect of which is underexplored in dental medicine. A large percentage of LTC patients were cognitively impaired and most patients had their HCP status activated (Table 2, 3a).

Dental billing data was used to identify dental procedures and oral health measures. Dental procedures were then categorized as preventive (prophylaxis/hygiene, fluoride application, maintenance periodontal procedures), diagnostic (charting, treatment plan, evaluations, radiographs), restorative (restorations including caries control), prosthodontic (fabrication of removable complete or partial dentures, repair/ reline/ adjustment of existing dentures) and surgical (extractions, alveoplasty, minor pre-

prosthetic surgery). All other procedures were categorized as adjunct (Figure 1). Patients were categorized into groups based on the frequency of dental appointments. These groups were 0, 1-2 appointments, 3-5 appointments, 6-9 and 10 or more appointments (Table 1, Figure 2). On analyzing these groups, it was decided that the '10 or more appointments' group would be named 'Higher utilization of dental services'. This was done for ease of identification of predictors of higher utilization during model building. All medical variables were recorded based on the data captured at the time of the last dental appointment. With the help of ICD 10 codes, seven most common geriatric co-morbid medical conditions were identified based on a previously published study (22), these included Failure to thrive, Chronic obstructive pulmonary disease (COPD), Cancer, Kidney Failure, Dementia, Congestive Heart Failure (CHF) and Cognitive impairment. The number of active medical diagnoses and number of medications were categorized based on existing literature on geriatric co-morbidity and polypharmacy (23). Diagnoses were classified into four groups, 0-5, 6-10, 11-15 and 16 or more diagnoses and the number of medications were categorized into two groups: 1-8 and 9 and more medications.

Only two oral health criteria could be extracted from the existing Electronic Medical record (EMR) database; these included absence of teeth (edentulous yes/no) and presence or absence of removable prosthesis (partial or complete dentures) (dental prosthesis yes/no). The EMR being a mainly medically driven system did not support a dental software, as a result individual patient dental charts were difficult to extract through the general EMR software codes.

The designated IT specialist created a database specifically for this study with the aforementioned variables and all data was de-identified prior to analysis.

### **Data analysis**

Initially, a descriptive analysis was conducted to understand the dental utilization patterns. Total number of procedures were calculated by service type to recognize the most commonly utilized dental services (Table 1, Figure 1). Next, bivariate analyses were conducted using Chi square test to evaluate the associations between baseline characteristics (sociodemographic, medical and oral health) of the patients with the frequency of dental visits, comparing the various groups of patients, namely: 0 appointments, 1-2 appointment, 3-5 appointments, 6-9 appointments and 10+ (or more) appointments (Table 2, 3a). Due to insufficient data for patients belonging to the ‘0 appointment’ group, this group was dropped in the bivariate analysis showing the relationship between oral health measures and dental service utilization (Table 3b) as well as the logistic regression model (Table 4).

Thereafter, a causal analysis was conducted to identify potential confounding factors and mediators to help recognize variables for the logistic regression model. Finally, a multivariate logistic regression model was developed to identify predictors of ‘higher dental service utilization’ (frequency of 10 or more visits) (Table 4). SAS version 9.3 was used for data analysis, graphs and charts were created in Microsoft Excel (v16.0).

## **RESULTS**

### **Descriptive Analysis**

During the study period (November 2014 to December 2016) a total of 437 deaths occurred at the two LTC sites according to the EMR data. Among the deceased, 369 patients (84%) utilized the on-site dental services in the last two years of life and they made up this study population, 68 patients (16%) did not utilize the dental services on site. According to Table 1 (and Figure 2), approximately 5.7% of patients demonstrated a higher utilization of dental services (10 or more appointments). The most common dental visits were for diagnostic services (utilized by 81.3% of the study population), followed by preventive services (73.2%). Approximately 18% patients utilized prosthodontic services in the last two years of their life. The ‘higher dental service utilization group’ used prosthodontic, restorative, surgical and adjunct dental services much more than their counterparts who utilized mainly diagnostic and preventive services (Table 1). When analyzing the total number of dental procedures it was noted that a total of 1,754 preventive procedures and 677 diagnostic procedures were performed on the 369 patients in the last two years of their lives (Figure 1).

## **Bivariate analysis**

*Sociodemographic characteristics of study population associated with different dental service utilization (Table 2):* There were no statistically significant differences with regards to age, gender, race/ethnicity or location between the groups. Even though dental services were provided at no cost to all LTC patients regardless of medical/ dental insurance status, when comparing Medicaid, Medicare and 'Private' patients, differences in dental service utilization appear to be statistically significant in the bivariate analysis, compared to other groups, the '0 appointments' group had a lower percentage of Medicaid patients and a higher percentage of Medicare and Private pay patients ( $P < 0.0001$ ) (Table 2). Most patients in the study population had a health care proxy activated. The activation of a health care proxy also showed a statistically significant difference within the groups, in the '0 appointment' group, all patients had health care proxies activated and so did all the patients in the '10 or more appointments' group.

*Medical and oral health characteristics of study populations associated with different dental service utilization (Table 3a, 3b):* With the exception of 'Cognitive impairment' ( $P = 0.01$ ), there were no statistically significant differences in medical conditions, number of medications or number of active diagnosis between the groups. The latter was important to consider because the data showed that most patients in the study population were on more than 9 medications and had more than 16 active medical diagnoses.

Both oral measures: dentate status and dental prosthesis showed marked statistically significant difference between the groups, across the groups, more dentate patients were utilizing dental services than their edentulous counterparts ( $P < 0.0001$ ).

### **Multivariate logistic regression model**

The model (Table 4) shows that dentate status (Edentulous Y/N) and dental prosthesis (Y/N) were statistically significant predictors of higher dental service utilization. Patients with teeth were about 7 times more likely and those wearing dentures were about 12 times more likely to utilize dental services compared to edentulous patients and patients without dentures (OR=6.5 and OR=11.7 respectively).

Even the statistically non-significant findings are noteworthy in this model. Patients on 8 or fewer medications were 1.5 as times as likely to utilize dental services (OR=1.5) than their counterparts and patients on Medicaid were almost twice as likely to have higher utilization compared to the patients in the Medicare and Private categories (OR=1.9). Dental service utilization was similar between age groups, gender and location.

To summarize, the study indicated that older adults with teeth, wearing dental prosthesis, receiving Medicaid benefits and on fewer medications than their counterparts had a higher utilization of on-site dental services at the LTC sites in the last two years of their lives.

## Tables

**Table 1:** A descriptive analysis of dental services provided by frequency of appointments in the two-year period prior to death.

| <b>Service Type</b> | <b># Patients<br/>(N=369)</b> | <b>1 - 2<br/>Appts.<br/>N=125,<br/>33.8%</b> | <b>3 - 5<br/>Appts.<br/>N=136,<br/>36.8%</b> | <b>6 - 9 Appts.<br/>N=87,<br/>23.5%</b> | <b>10+ Appts.<br/>N=21,<br/>5.7%</b> |
|---------------------|-------------------------------|--|--|---|--------------------------------------|
| Diagnostic          | 300<br>(81.3%)                | 110 (88%)                                    | 101<br>(74.3%)                               | 68 (78.2%)                              | 21 (100%)                            |
| Preventive          | 270<br>(73.2%)                | 55 (44%)                                     | 107<br>(78.7%)                               | 87 (100%)                               | 21 (100%)                            |
| Prosthodontic       | 67<br>(18.2%)                 | 11 (8.8%)                                    | 23 (16.9%)                                   | 20 (23%)                                | 13 (61.9%)                           |
| Restorative         | 32 (8.7%)                     | 1 (0.8%)                                     | 10 (7.4%)                                    | 16 (18.4%)                              | 5 (23.8%)                            |
| Surgical            | 44<br>(11.9%)                 | 0 (0%)                                       | 12 (8.8%)                                    | 18 (20.7%)                              | 14 (66.7%)                           |
| Adjunct             | 29 (7.9%)                     | 2 (1.6%)                                     | 5 (3.7%)                                     | 16 (18.4%)                              | 6 (28.6%)                            |



**Table 2:** Bivariate analysis showing sociodemographic characteristics and dental service utilization.

| <b>Characteristics</b>          | <b>0 Appts.<br/>(N=68)</b> | <b>1 - 2 Appts.<br/>(N=125)</b> | <b>3-5 Appts.<br/>(N=136)</b> | <b>6 - 9 Appts.<br/>(N=87)</b> | <b>10 + Appts.<br/>(N=21)</b> | <b>P-value</b> |
|---------------------------------|----------------------------|---------------------------------|-------------------------------|--------------------------------|-------------------------------|----------------|
| <b>Age</b>                      |                            |                                 |                               |                                |                               |                |
| under 90                        | 37 (54.4%)                 | 59 (47.2%)                      | 60 (44.1%)                    | 30 (34.5%)                     | 9 (42.9%)                     | 0.157          |
| 90 and over                     | 31 (45.6%)                 | 66 (52.8%)                      | 76 (55.9%)                    | 57 (65.5%)                     | 12 (57.1%)                    |                |
| <b>Gender:</b>                  |                            |                                 |                               |                                |                               |                |
| M                               | 18 (26.5%)                 | 36 (28.8%)                      | 29 (21.3%)                    | 24 (27.6%)                     | 7 (33.3%)                     | 0.599          |
| F                               | 50 (73.5%)                 | 89 (71.2%)                      | 107 (78.7%)                   | 63 (72.4%)                     | 14 (66.7%)                    |                |
| <b>Race/ ethnicity</b>          |                            |                                 |                               |                                |                               |                |
| African American                | 1 (1.5%)                   | 4 (3.2%)                        | 8 (5.9%)                      | 3 (3.4%)                       | 0 (0%)                        | 0.578          |
| Asian                           | 0 (0%)                     | 0 (0%)                          | 1 (0.7%)                      | 0 (0%)                         | 0 (0%)                        |                |
| Caucasian                       | 65 (95.6%)                 | 119 (95.2%)                     | 121 (89%)                     | 77 (88.5%)                     | 20 (95.2%)                    |                |
| Hispanic                        | 0 (0%)                     | 0 (0%)                          | 1 (0.7%)                      | 0 (0%)                         | 0 (0%)                        |                |
| Other/ Unknown                  | 2 (2.9%)                   | 2 (1.6%)                        | 5 (3.7%)                      | 7 (8%)                         | 1 (4.8%)                      |                |
| <b>Insurance</b>                |                            |                                 |                               |                                |                               |                |
| Medicaid                        | 35 (51.5%)                 | 90 (72.0%)                      | 105 (77.2%)                   | 75 (86.2%)                     | 18 (85.7%)                    | <0.0001*       |
| Medicare                        | 25 (36.8%)                 | 34 (27.2%)                      | 29 (21.3%)                    | 11 (12.6%)                     | 2 (9.5%)                      |                |
| Private                         | 8 (11.8%)                  | 1 (0.8%)                        | 2 (1.5%)                      | 1 (1.1%)                       | 1 (4.7%)                      |                |
| <b>HCP - Health Care Proxy</b>  |                            |                                 |                               |                                |                               |                |
| Activated                       | 68 (100%)                  | 116 (92.8%)                     | 118 (86.8%)                   | 80 (92%)                       | 21 (100%)                     | 0.0103*        |
| Not activated                   | 0 (0%)                     | 9 (7.2%)                        | 18 (13.2%)                    | 7 (8%)                         | 0 (0%)                        |                |
| <b>Facility Name (Location)</b> |                            |                                 |                               |                                |                               |                |
| Rosindale                       | 30 (44.1%)                 | 77 (61.6%)                      | 85 (62.5%)                    | 50 (57.5%)                     | 15 (71.4%)                    | 0.07           |
| Dedham                          | 38 (55.9%)                 | 48 (38.4%)                      | 51 (37.5%)                    | 37 (42.5%)                     | 6 (28.6%)                     |                |

\*Denotes statistically significant values,  $P < 0.05$

**Table 3a:** Bivariate analysis showing medical variables and dental service utilization.

| No. of active diagnosis (DX)                                     | 0 Appts. (N=68) | 1 - 2 Appts. (N=125) | 3-5 Appts. (N=136) | 6 - 9 Appts. (N=87) | 10+ Appts. (N=21) | P-value |
|--|-----------------|----------------------|--------------------|---------------------|-------------------|---------|
| 0-5 Dx   | 0 (0%)          | 0 (0%)               | 1 (0.7%)           | 3 (3.4%)            | 0 (0%)            | 0.126   |
| 6-10 Dx  | 4 (5.9%)        | 17 (13.6%)           | 13 (9.6%)          | 8 (9.2%)            | 5 (23.8%)         |         |
| 11-15 Dx   | 23 (33.8%)      | 38 (30.4%)           | 51 (37.5%)         | 34 (39.1%)          | 5 (23.8%)         |         |
| 16+ Dx   | 41 (60.3%)      | 70 (56%)             | 71 (52.2%)         | 42 (48.3%)          | 11 (52.4%)        |         |
| No. of medications at time of last dental appointment (Rx count) |                 |                      |                    |                     |                   |         |
| 0-8 Rx   | 21 (30.9%)      | 20 (16%)             | 35 (25.7%)         | 25 (28.7%)          | 4 (19%)           | 0.102   |
| 9+ Rx  | 47 (69.1%)      | 105 (84%)            | 101 (74.3%)        | 62 (71.3%)          | 17 (81%)          |         |
| Cognitive impairment   |                 |                      |                    |                     |                   |         |
| Not impaired   | 0 (0%)          | 9 (7.2%)             | 18 (13.2%)         | 7 (8%)              | 0 (0%)            | 0.01*   |
| Impaired   | 68 (100%)       | 116 (92.8%)          | 118 (86.8%)        | 80 (92%)            | 21 (100%)         |         |
| Medical Conditions**   | 0 Appts. (N=68) | 1 - 2 Appts. (N=125) | 3-5 Appts. (N=136) | 6 - 9 Appts. (N=87) | 10+ Appts. (N=21) | P-value |
| Failure to thrive  | 13 (27.7%)      | 11 (23.4%)           | 12 (25.5%)         | 9 (19.1%)           | 2 (4.3%)          | 0.197   |
| COPD   | 7 (25%)         | 11 (39.3%)           | 7 (25%)            | 3 (10.7%)           | 0 (0%)            | 0.201   |
| Cancer   | 11 (28.2%)      | 10 (25.6%)           | 11 (28.2%)         | 6 (15.4%)           | 1 (2.6%)          | 0.236   |
| Cognitive Impairment   | 9 (16.7%)       | 18 (33.3%)           | 14 (25.9%)         | 11 (20.4%)          | 2 (3.7%)          | 0.874   |
| Kidney Failure   | 1 (14.3%)       | 3 (42.9%)            | 0 (0%)             | 3 (42.9%)           | 0 (0%)            | 0.292   |
| Dementia   | 36 (13.5%)      | 71 (26.6%)           | 92 (34.5%)         | 55 (20.6%)          | 13 (4.9%)         | 0.239   |
| CHF  | 13 (13.7%)      | 36 (37.9%)           | 31 (32.6%)         | 11 (11.6%)          | 4 (4.2%)          | 0.079   |

\*\* Multiple patients had multiple medical conditions. For ease of comparison, row percentages are used here instead of the usual column percentages. For all other tables, column percentages have been used. \*Denotes statistically significant values, P < 0.05

**Table 3b:** Bivariate analysis showing oral health measures and dental service utilization.

| <b>Edentulous</b>        | <b>1 - 2 Appts.<br/>(N=125)</b> | <b>3-5 Appts.<br/>(N=136)</b> | <b>6 - 9 Appts.<br/>(N=87)</b> | <b>10+ Appts.<br/>(N=21)</b> | <b>P-value</b> |
|--------------------------|---------------------------------|-------------------------------|--------------------------------|------------------------------|----------------|
| Yes                      | 45 (36%)                        | 29 (21.3%)                    | 3 (3.4%)                       | 2 (9.5%)                     | <0.0001*       |
| No                       | 80 (64%)                        | 107 (78.7%)                   | 84 (96.6%)                     | 19 (90.5%)                   |                |
| <b>Dental Prosthesis</b> |                                 |                               |                                |                              |                |
| Yes                      | 11 (8.8%)                       | 23 (16.9%)                    | 20 (23%)                       | 13 (61.9%)                   | <0.0001*       |
| No                       | 114 (91.2%)                     | 113 (83.1%)                   | 67 (77%)                       | 8 (38.1%)                    |                |

\*denotes statistically significant values,  $P < 0.05$

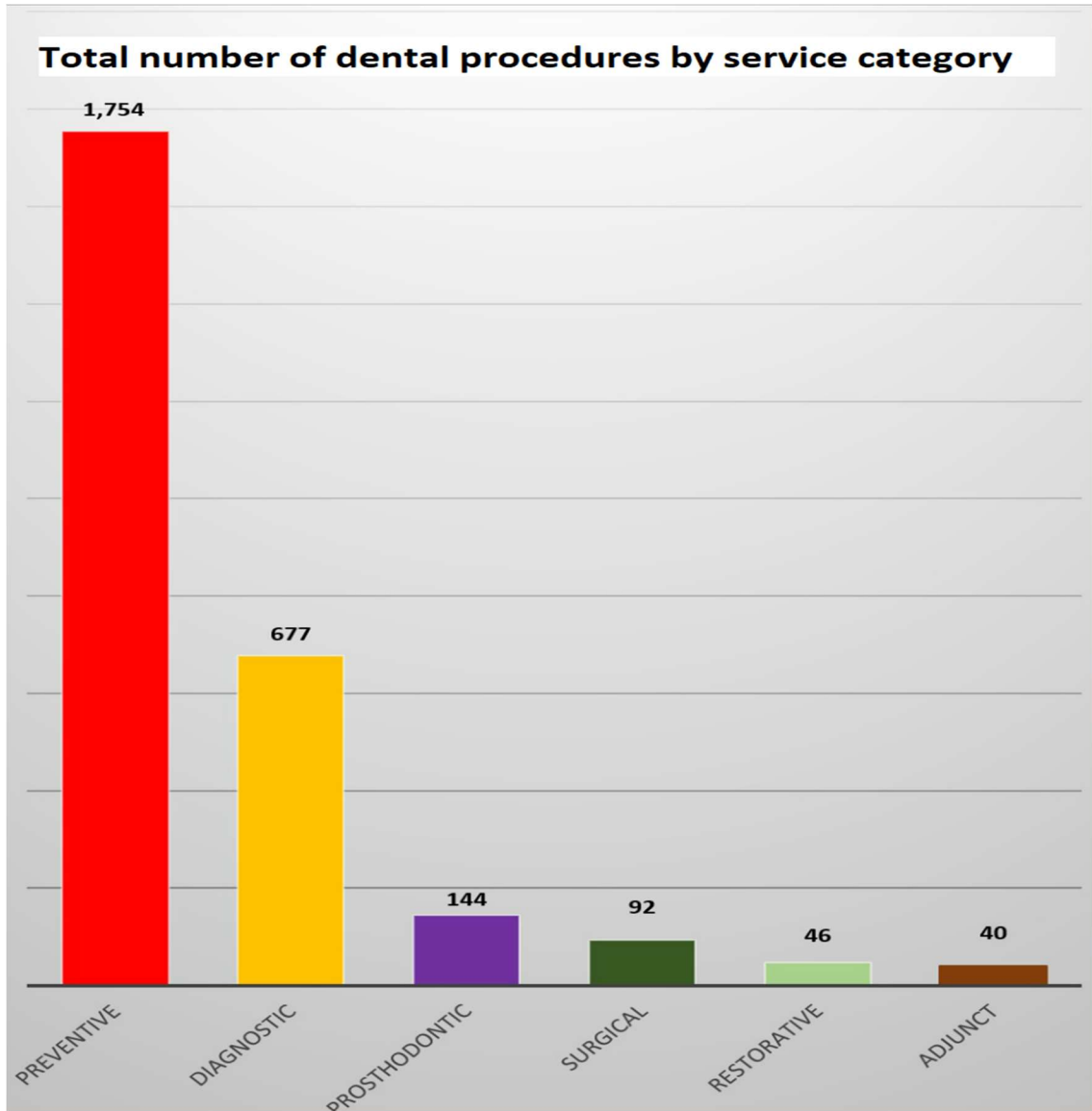
Table 3b onward- dental status data for "0" appointments was not available so this category has been dropped.

**Table 4:** Multivariate logistic regression model to predict ‘higher dental service utilization’ (frequency of 10 or more appointments)

| <i>Variable</i>                               | <i>Adjusted OR</i> | <i>95% CI</i> |
|---|--------------------|---------------|
| <b>Edentulous</b>                             |                    |               |
| YES   | Reference          |               |
| NO  | 6.5*               | 1.3 - 11.9    |
| <b>Dental Prosthesis</b>                      |                    |               |
| YES   | 11.7*              | 4.2 – 22.5    |
| NO  | Reference          |               |
| <b>Insurance</b>                              |                    |               |
| Medicaid                                      | 1.9                | 1.0 – 4.2     |
| Medicare                                      | Reference          |               |
| Private                                       | 1                  | 0.3 – 3.1     |
| <b>No. of medications (Rx)</b>                |                    |               |
| 0-8   | 1.5                | 0.2 - 2.8     |
| 9 and more                                    | Reference          |               |
| <b>Age</b>                                    |                    |               |
| Less than 90                                  | Reference          |               |
| 90 and over                                   | 0.9                | 0.3 - 2.4     |
| <b>Gender</b>                                 |                    |               |
| Male  | Reference          |               |
| Female  | 1                  | 0.4 - 2.8     |
| <b>Race/Ethnicity</b>                         |                    |               |
| Caucasian                                     | Reference          |               |
| Other/Unknown/Asian/Hispanic/African American | 0.4                | 0.04 - 3.5    |
| <b>Location</b>                               |                    |               |
| Roslindale                                    | Reference          |               |
| Dedham  | 0.7                | 0.2 - 2.3     |

\*denotes statistically significant values,  $p < 0.05$ . OR=Odds ratio, CI=Confidence Interval

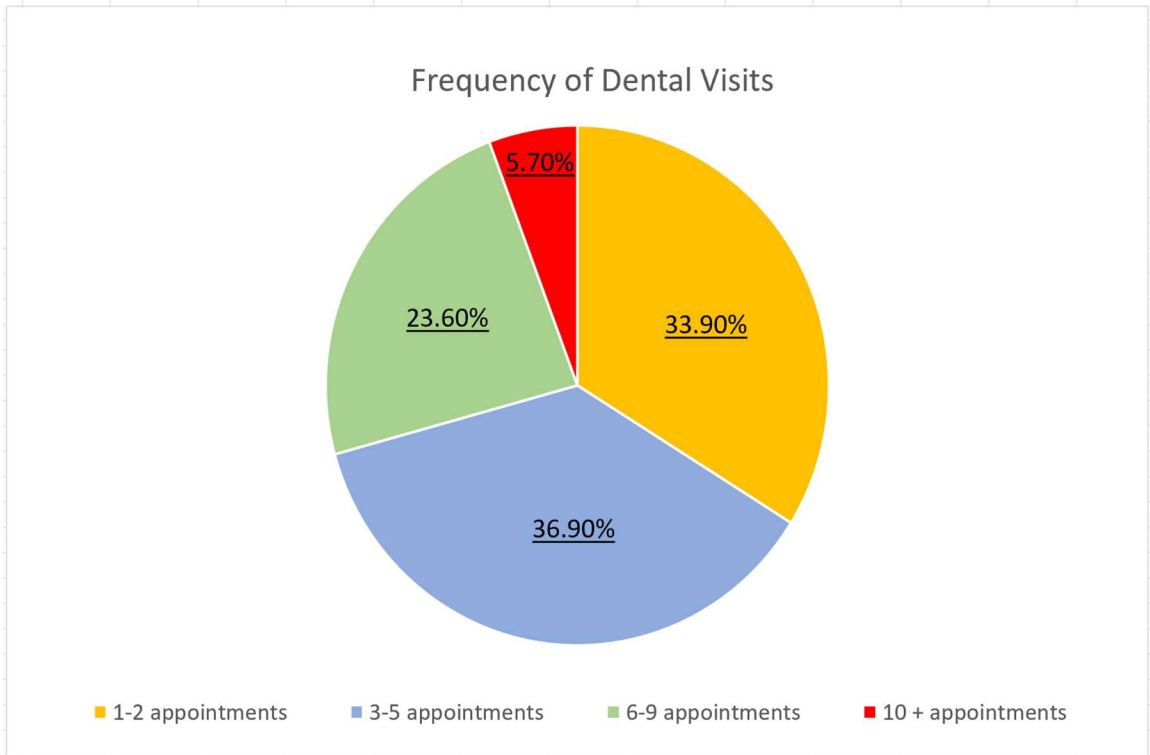
## Figures



**Figure 1:** Total number of dental procedures by service type.

These were the dental procedures that were utilized by LTC patients in the last two years of their life. This graph does not show patient level data, it only shows the number of procedures that were performed.

Total number of dental procedures performed on 369 patients in LTC in the last 2 years of life.



**Figure 2:** Pie graph showing the frequency of dental visits by percentage of LTC patients in the last two years of life.

## DISCUSSION

This study examined the utilization of dental services by older adults housed in two LTC sites in the last two years of their lives. These sites had on-site dental clinics providing comprehensive dental services to its patients.

Results demonstrated that a high percentage of patients (84%) in the last two years of their life utilized these dental services. One may speculate that this finding may be a result of the convenience of having fully staffed, equipped and accessible on-site dental offices. This demonstrates that the most common access to care barriers, like patient transportation, dental treatment cost and availability of trained geriatric dental professionals were addressed (24). It is important to note that frail older adults utilized the dental services in large numbers when given access to these services, even in the last years of their lives. This finding should motivate others to adopt a similar model of care and offer dental services as part of end-of-life services. At the same time, it compels us to examine why the 68 patients who also died during the study period did not utilize any dental services in the last two years of their lives (Tables 2 and 3a)? The bivariate and descriptive analyses suggested that there was no significant difference in dental service utilization in the last two years of life between the various groups (0 appointments versus 1-2 appointments, 3-5 appointments, 6-9 appointments and 10+ appointments) when comparing sociodemographic data like age, gender, race/ethnicity and location (Table 2). It was interesting to note that this study detected that Medicaid beneficiaries were more likely to see the dentists., this may imply that not having Medicaid benefits could

possibly be an access to care to barrier even though dental services were provided to patients at no additional cost. As mentioned before, all of the patients in the ‘0 appointments’ group had cognitive impairment (Table 3a) and had their Health Care Proxy status activated (Table 2) , but so did all of the patients in the ‘10+ appointments’ group, it could be inferred that the health care proxies may have opted out of dental treatment for the ‘0 appointment group’ due to the advanced cognitive decline of these patients (21). The finding that those with cognitive impairment and with a health care proxy were more likely to be high dental services utilizers raises questions , however the fact that the ‘0 appointment group’ had comparatively more patients diagnosed with ‘failure to thrive’ compared to the ‘10+ appointment group’ (Table 3a) may suggest a reason for this finding. The ‘0 appointments’ group also had a higher number of patients who had ‘16 or more active medical diagnoses’ compared to other groups (Table 3a), suggesting a high burden of medical comorbidities. This agrees with a past study which have shown that the comorbid status of the patient correlates with lower dental care utilization (25). Even though the study population included few individuals in the ‘0 appointment’ group, and the oral health measures could not be studied for these patients, the study throws light on some possible barriers for dental service utilization for this group (Table 2, 3a).

As previously mentioned, an interesting finding was that, even though dental services were provided to all LTC patients at no cost (regardless of having dental insurance), Medicaid beneficiaries showed higher dental service utilization than their counterparts (Table 2). This finding may be linked to the fact that patients on Medicare



were not eligible for dental services prior to admission to LTC, and may not have been accustomed to utilizing dental services even if they were offered at no cost once admitted to LTC. According to a 2012 Kaiser Family Foundation Medicare policy issue brief, in 2010, one in five Medicare beneficiaries had not visited a dental provider in the prior five years (26). A further study to compare the study population's insurance status with the number of canceled dental appointments is warranted to identify a definitive conclusion about the influence of prior insurance status on care utilization patterns. Literature further suggests that Medicare beneficiaries in LTC settings are at an increased risk of oral diseases and have limited access to routine dental care. They often end up in emergency rooms resulting in costly hospital admissions (27). It is worthwhile to consider that the addition of dental benefits within Medicare may positively impact the overall health of older adults in LTCs.

This study demonstrates a standardized model of dental services set up at two LTC sites, this may have contributed to dental service utilization among patients in the last years of their life. The multivariate regression model showed that dental service utilization by patients was similar at both sites (Table 4), confirming the standardization of care delivery at both locations. This model of care is not common in most parts of the country. Even though the Omnibus Budget Reconciliation Act (OBRA) of 1987 made it mandatory for Long Term Care facilities receiving federal funding to provide oral health care to its residents (28), today, more than three decades later, models of dental service provision in LTCs throughout the U.S. continue to vary incredibly with no standard of care for provision of dental services in these settings (29). State policy and regulations

have since progressed under the federal mandate, but they lack evidence-based guidelines for the adoption of best practices. These policies fail to meet the dental needs of the LTC population, including patients in the final years of their lives. Literature shows that dental service provision models at LTCs vary from state to state because they are highly dependent on the states' policy environment (30). At the time of this study, adult dental benefits were optional under Medicaid and ranged widely across states; even today, Medicaid covers some dental benefits for LTC residents in some states, but not uniformly across the country (30, 31). For example, the most recent Oral Health America's State of Decay report (32) illustrates that among the top 13 dental services utilized by older adults under Medicaid, only 9 states cover all the services for older adults while 6 states cover none. After years of work, 34 states now have State Oral Health Plans of which only 31 include older adults in their plans. It was interesting to note that Massachusetts (where this study population was housed) covered only 7 of the 13 dental services for older adults under Medicaid during the study period, but at the LTC study settings, 11 of the 13 services were offered and utilized by the study population (Table 1, Figure 1). This may have been a result of the fee structure of the on-site model which aided in removing the financial barrier to seeking dental services (24).

Some public health experts have suggested using alternatives to on-site dental offices to provide dental services to LTC settings, such as traditional patient transport to neighborhood private dental offices, mobile dental services, and tele-health enhanced models to name a few (31). Others have recommended that, because dental benefits are not routinely covered under Medicare (except under certain conditions e.g. oral cancer), it

might be advisable to seek dental services provided by mid-level providers. In 2016, 39 states permitted hygienists to provide preventive oral health services in community-based and LTC settings without requiring direct or general supervision by a dentist (32).

Despite these recommendations, the movement towards providing dental services to LTCs has been slow, and geriatric patients across the country continue to lack access to quality dental services. Research suggests that deterioration in oral health reduces healthy life expectancy, reduces quality of life, and continues to remain an important concern for this demographic (33, 34). It is pertinent now more than ever for geriatric oral health research to be better funded and become a high-health priority to help develop administrative and policy guidelines. This will, in turn, address the growing oral health issues faced by the ‘very’ old in the last years of life. It is important to point out that currently no guidelines exist for the dental treatment of geriatric patients towards the end of life. The American Geriatrics Society and the American Association of Family Physicians have various clinical guidelines for the care of geriatric patients, to help clinicians in their day to day decision making for the wellbeing of the dependent older adult patient. Fall prevention guidelines for nursing homes is one such successful recommendation from the Clinical Preventive Services manual (35). Studies have shown that these guidelines have helped reduce morbidity and mortality, enabled clinicians to better care for their patients, and have enabled older adult patients to have a better quality of life (36). Literature shows a need for guidelines for the dental treatment of geriatric patients, and several authors have attempted to create recommendations (37, 38), but due to the lack of studies based on the dental care provision and utilization by older adults in

the last years of their life, creating best practice guidelines has been difficult. More studies are needed on this subject matter to enable researchers to create clinical guidelines to benefit geriatric patients and their clinicians alike (37).

A possible predictor (but not statistically significant according to multivariate modeling, Table 4) for higher utilization of dental services was the ‘number of medications’. Patients on 8 or fewer drugs were more likely to utilize dental services. It is likely that patients who are on fewer medications may be in better overall health to have an increased compliance for dental visits. Some geriatric medical journals define polypharmacy as the use of 9 or more medications (23), polypharmacy is a significant concern for geriatric patients in LTCs. The study population throws light on the important issue that even in the last years of life, frail older adults continue to be on more than 9 medications (Table 3a). A further review of medications prescribed by the on-site dental office to patients in the last years of their lives provide better understanding about whether dentists contributed to the significant polypharmacy issue among frail older adults.

A focused look at this study reveals that ‘dental prosthesis’ was a strong and significant predictor for higher dental service utilization (10 or more appointments; adjusted OR=11.7) (Table 4). While the fabrication of new dentures takes multiple appointments to accomplish (39), it was surprising that even in the last two years of life, patients utilized “prosthodontic” (removable prosthesis) services. A further analysis of the types of prosthodontic procedures would help to better understand if patients were having new prosthesis (dentures) fabricated or were simply having them adjusted or

repaired. All these reasons are significant enough to explore in future studies, especially whether a high number of denture repair or replacement visits could imply poor handling of dentures by patient or nursing staff, and could aid in establishing denture care and handling guidelines for staff and patients (40).

The study showed that a larger percentage of patients in the last two years of their lives were dentate (had their own natural dentition) and had higher dental service utilization than their edentulous counterparts (Table 4). The logistic regression model demonstrated that having natural teeth was a significant predictor of higher dental service utilization (adjusted

OR=6.5), which is logical given that a higher burden of dental disease is borne by the dentate population and hence they would be more likely to utilize dental services. The study was also representative of the downward national trend in edentulism (Table 3b) in recent years among older adults (27) and suggests an increased need for dental services for these patients. As people are living longer and maintaining their teeth longer, they are faced with physical and/or cognitive impairments and other medical comorbidities, increasing the likelihood of having dental disease. Literature suggests that while the need for dental services for these individuals is high, the demand is high as well (40).

Understanding this phenomenon along with the effect of Medicare/ Medicaid policies explains the significant increase in dental expenditure among the elderly (41). The 2013 Health Policy Institute research brief indicated that dental expenditures were higher among the elderly as compared to younger adults. It was also stated that as baby boomers age, the percentage of older adults above the age of 65 will continue to grow, growing the

dental expenditure among this demographic (41). This rising demand for dental services may continue to rise even in the last years of their lives. With higher expenditure and higher demand for dental services, on-site dental clinics within LTC settings may be a possible solution. This type of model offers a collaborative inter-professional approach to patients. The on-site dental team can forge relationships with other medical professionals, functioning as a part of the larger medical team, ensuring patient-centric care. Past studies have suggested that this type of inter-professional approach helps to expand the clinicians' knowledge and skills to meet the needs of geriatric patients (37). Further studies are needed to compare the on-site model with mobile and telehealth models in order to determine the most effective model of care for geriatric patients (29).

In the past, the shortage of trained geriatric oral health providers exacerbated the unmet oral health needs of the older adults (42). This shortage continues to exist. To treat the medically complex older adults in the last years of life, the level of expertise needs to be higher, and requires the advanced training and education of more oral health professionals. Postdoctoral education and advanced training in geriatric dental medicine may address the workforce deficit and help meet the rising demand for dental services among the LTC population (43, 44), along with the training and education of dental public health specialists who can advocate and provide services for this vulnerable older adult population (45).

It was refreshing to see that patients over the age of 90 had similar dental service utilization as their younger counterparts (Table 4, adjusted OR= 0.9). Although the LTC in the study had a predominantly Caucasian population, the regression model showed that

dental service utilization among other racial groups was similar (Table 4), implying yet again that when most access to care issues are addressed (46, 47), dental services are utilized. This study shows that in the last two years of patient's lives, dental service utilization was not influenced by patient age, gender or race/ethnicity. Several studies on social determinants of health indicate that age, gender and race/ ethnicity serve as barriers to care for adults throughout life (48-50) but this particular study showed that for LTC older adults, none of these sociodemographic factors were predictors of dental service utilization, the most significant predictors were oral health measures, i.e. presence of teeth and presence of removable prosthesis (Table 4). This indicates a stark difference between the LTC population and community dwelling older adults (51). While the LTC population may represent only a small percentage of the larger older adult population, this study shows that, in a controlled environment (where it is possible to address most access to care barriers), a high utilization of dental services is possible.

This study has a few limitations. Since the study population was from two LTC sites with on-site dental offices, the results of this study may not be generalizable to other end-of-life population groups or groups in different settings or geographical areas. Due to data limitations, the oral health measures of the remaining 16% of patients (who died in the same time period and did not utilize any dental services) are unknown. This is unfortunate since that data could have helped identify patient, caregiver and institutional barriers, especially given the fact that oral health variables turned out to be the most significant predictors of dental service utilization.

While missed and cancelled appointments were logged into the EMR, the reasons for cancellation remain unknown. Detailed oral health data, including charting, restorations, caries, etc. were not accessible as these were entered as individual patient notes and could not be extracted due to the absence of a dental software in the EMR system. Due to HIPAA regulations, a separate look at centenarians' dental service utilization was not possible; information which could have added to the quality of this study.

Despite these limitations, this study may contribute to the limited body of available literature on dental service utilization at the end-of-life (44) for the LTC population, and may aid in creating clinical and policy implementation guidelines for best practices, for e.g. dentate patients and denture wearers are more likely to use dental services, more frequent dental services may be offered to this population during their stay at the LTC facility. Looking at the number and type of dental services utilized by LTC patients in the last years of their lives (Table 1, Figure 1), LTC facilities could consider providing at least preventive, diagnostic and prosthodontic services in-house and on a frequent basis following the four monthly protocol as followed at the study clinic. Future studies could focus on these factors to help create reliable guidelines.

Given the access to the patients' EMR, the dentists may have known the end-of-life status of the patients. A 2011 study indicates that when dentists treat terminally ill patients, they tend to be more conservative when the patients' prognosis is known (51). However, this study showed that comprehensive dental services were provided to and utilized by the patients even in the last two years of life. More studies are needed to



further understand the predictors of low dental service utilization for this vulnerable patient population.

Finally, this study suggests that through this model of care, even at the end of life, dental concerns were addressed for geriatric patients, and that the larger medical community should include dental services in the overall end-of-life care plan for patients.

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## CURRICULUM VITAE

