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Dental treatment intensity in frail older adults in the last year of life

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Abstract

Background—Palliative care focusing on pain and infection is recommended for patients who are terminally ill. It is difficult to implement this strategy in practice because of the lack of clear guidelines. The authors conducted a study to examine dental treatment provided to a group of long-term care (LTC) residents in the last year of life.

Methods—The authors retrospectively followed 197 LTC residents (60 years or older) in the last year of life to death. On the basis of the dental services patients received between the new patient examination and death, the authors categorized the patients into three groups: no care (NC), limited care (LC) and usual care (UC). The authors developed a multivariable continuation ratio logit model with shared regression coefficients across two logits to identify the factors associated with the end-of-life dental care pattern.

Results—The authors found that 50.8 percent of the patients received NC before death. Among those who received treatment, 62.9 percent received UC, and 60.7 percent of the patients in the UC group had completed their treatment in the last three months of life. A three-month increment in survival and having dental insurance resulted in 1.74 (95 percent confidence interval [CI], 1.32–2.30) and 2.59 (95 percent CI, 1.03–6.52) times greater odds, respectively, of receiving some dental treatment before death. Neither survival nor dental insurance, however, was associated with dental care intensity in the last year of life (that is, UC versus LC).

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None of the authors reported any disclosures.

Conclusions—While most of the patients who were in the last year of life received insufficient dental care, comprehensive treatment was provided commonly to frail patients at the end of life, raising questions about quality of care.

Keywords

Palliative dentistry; oral health; geriatrics; long-term care; terminal illness

Patterns of death (also called “dying trajectories”) are distinctly different among older adults with different diseases and conditions,¹ suggesting that the impact of terminal functional decline on oral health may differ in patients with different dying trajectories. Older adults who die unexpectedly usually do not experience a substantial loss of oral care function before death.¹ Deterioration of oral health may not be clinically significant in these people if oral hygiene and regular dental care have been maintained before death.² Patients with a diagnosis of cancer who are terminally ill often undergo remarkable functional decline in the last weeks or months of life.¹ Cancer therapy and management of the related symptoms may cause severe xerostomia, alter speech, taste and appetite; and substantially affect quality of life. Oral candidiasis, mucositis, atrophic glossitis and oral pain also are common in these patients.³ Unlike patients with cancer, older adults with advanced organ failure or frailty usually experience a progressive functional decline before death.¹ This decline may compromise the patient’s ability to perform oral self-care and may increase the difficulty of accessing regular dental care. Consequently, oral hygiene often is poor in frail older adults,^{4,5} and the risk of developing dental caries and oral infections and of experiencing pain also increases.^{4–7} Oral diseases and conditions may affect quality of life substantially.^{3,8,9} Poor oral hygiene is associated with recurrent aspiration pneumonia, a leading cause of death in elderly people who are medically compromised.¹⁰ Oral pain and infection also can disturb a patient’s homeostatic equilibrium and cause life-threatening complications, accelerating functional decline.^{11,12} For these reasons, oral health must be considered when planning end-of-life care so as to help improve the quality of life in frail older adults at the end of life.

Palliative care focusing on pain and infection is recommended for patients who are terminally ill.^{13,14} However, sometimes it is hard to implement this strategy because it is difficult to reliably estimate survival for frail older adults who usually experience a prolonged functional decline at the end of life. For this reason, when to start and how to provide palliative care rarely are evidence-based in daily dental practice. Dental care, therefore, may be insufficient for addressing the oral health care needs of some patients, resulting in prolonged episodes of treatable pain and infection and a compromised quality of life.^{8,9} On the other hand, aggressive, futile treatment also may be provided unintentionally to this vulnerable population, raising concerns about quality of care.

How dental care is provided to frail older adults in the last year of life is virtually unknown. A review of this issue would provide medical and dental professionals with an opportunity for identifying potential concerns in oral health care management strategies and improving the quality of end-of-life oral health care. For these reasons, we conducted a study to

examine dental treatment intensity provided to a cohort of elderly patients who lived in long-term care (LTC) facilities in the last year of life.

METHODS

We conducted a retrospective cohort study by linking existing dental records with records from the Centers for Disease Control and Prevention's National Death Index (NDI). The University of North Carolina at Chapel Hill's Office of Human Research Ethics approved the research protocol.

Study clinic and study participants

The study clinic was a dental clinic for geriatric patients in Minnesota. During the study period (Oct. 23, 1999–Dec. 31, 2006), 1,626 older adults received dental care as new patients in the study clinic. Among them, 197 met the following inclusion criteria: 60 years or older, resided in an assisted living facility or nursing home and came to the study clinic as a new patient during the last year of life (as determined retrospectively by using the NDI). If all of the inclusion criteria were met, we followed the patient retrospectively. The follow-up period began on the date of the new patient examination (baseline) and ended on the date of the patient's death.

Baseline assessment

The 197 patients received a comprehensive new patient examination during their first appointment at the study clinic. Dentists at the study clinic (including X.C. and S.K.S.) completed the assessments, which included the following five components: review of medical history and medications provided by LTC facilities; oral assessment, including dentition, oral hygiene, periodontal health, caries assessment and denture assessment (if appropriate); if necessary, full-mouth radiographs were obtained for diagnosis and treatment planning; subjective cognitive assessment¹⁵ completed by using a four-level scale (normal, mild, moderate, severe); subjective functional assessment, including oral care capacity and physical mobility; oral care function assessed by means of a three-level scale (self-sufficient, needs assistance, uncooperative); physical mobility was evaluated by means of a four-level scale (walks independently, needs a walker or wheelchair but transfers independently, needs transfer assistance, bedridden); level of cooperation and presence of a language impairment (for example, whether the patient was able to communicate his or her oral health care needs during the examination).

Data collection

We abstracted the data used for this study from dental records, the clinical information system used in the study clinic and the NDI. The dental treatment intensity between the new patient examination and the patient's death was the outcome of interest. Because all patients received a comprehensive examination, prophylaxis, denture cleaning or both and had radiographs obtained (when appropriate) during the new patient appointment, we considered only the treatments provided after the new patient examination and prophylaxis (if appropriate). Following a predetermined protocol, two dentists (X.C., H.C.) independently categorized the patients into three groups on the basis of the services the patients received

before death. The no-care (NC) group included patients who received no treatment after the new patient examination and prophylaxis. The limited-care (LC) group included patients who received care that promoted comfort and eliminated pain or infection. This group also included patients who received only periodic examinations, prophylaxes and fluoride treatments before death or those who received only problem-focused oral evaluations followed by one to two treatments (for example, tooth extraction, emergency treatment of dental-related pain or temporary restoration) within one month after an emergency visit. We also included in this group patients who received only denture repair or a chairside temporary denture relining before death. The usual care (UC) group included patients who received comprehensive dental treatment before death. Patients in this group typically underwent multiple restorations or extractions after the new patient examination and prophylaxis. We also included those who had new dentures fabricated after the new patient examination. Before categorizing the data, we developed the criteria to determine treatment intensity. Following these criteria, two dentists' (X.C., H.C.) data classification skills were calibrated by using 10 percent of the data (interrater agreement = 90 percent) before they independently assigned patients to one of three groups. The two dentists compared their work. Discordances were resolved by means of group discussion.

We abstracted the patients' sociodemographic information from dental records and linked it with records from the NDI to determine the patients' length of survival (that is, the period between the new patient examination and the date of death). We carefully reviewed the patients' dental charts and radiographs and abstracted the following oral health measures for analysis: number of teeth; number of carious teeth, including retained roots; number of restored teeth; oral hygiene status; presence of gingival inflammation; and use of a removable dental prosthesis.

We also reviewed the patients' comorbidity, medications, and cognitive and functional impairment. On the basis of their medical histories, we calculated their Charlson Comorbidity Index scores¹⁶ to measure the burden of comorbidity. To minimize the potential variations resulting from subjective assessments, we reconstructed the cognitive assessment scale by combining the mild, moderate and severe impairment categories to create a new two-level scale (normal, impaired).

Data analysis

We first conducted a descriptive analysis to describe the dental care patterns of the patients. We also conducted bivariable analyses to examine the associations between the baseline characteristics of the study patients and their dental care patterns in the last year of life. We then developed a continuation ratio logit (CRL) model¹⁷ to identify the contributing factors of dental treatment before death, with one logit describing the log odds of receiving any dental care in the last year of life and the other logit describing the log odds of receiving usual care given that dental care was received. Before we developed the CRL model, we conducted a causal analysis to identify potential confounding factors and mediators. On the basis of the results of this analysis, we selected the following independent variables for modeling each logit: the proportion of the year survived after the new patient examination was conducted (that is, the number of days survived divided by 365), and dental insurance

coverage and oral health measures (that is, number of teeth, number of carious teeth, number of restored teeth and use of a removable dental prosthesis). Rather than using the common predictors of death such as age, sex, burden of comorbidity and functional impairment, we included length of survival in the models because it could provide direct and helpful information for clinicians to guide their decisions about palliative dental care.

We fitted and compared two CRL models. Initially, we considered a model with separate sets of regression coefficients for the two logits. We then fitted the CRL models, assuming common values of the coefficients across logits for the oral health measures. We performed a goodness-of-fit test, the results of which indicated that the model with separate coefficients for oral health measures did not provide a significantly better fit ($\chi^2_4 = 4.335$; $P = .36$). We performed all analyses by using statistical software (SAS 9.3.2, SAS Institute, Cary, N.C.). We defined statistical significance at the 0.05 significance level.

RESULTS

Dental care patterns in the last year of life

The mean survival of the patients was 189.4 days (range, four-362 days). We found that dental treatment intensity was associated with length of survival. Patients in the LC and UC groups survived significantly longer than did those in the NC group (Table 1) ($P < .05$).

Before death, 100 (50.8 percent) patients received NC, 36 (18.3 percent) patients received LC, and 61 (30.9 percent) received UC (Table 1). Among those who received any subsequent dental care, 62.9 percent received UC. Among the patients in the UC group, the mean duration of treatment was 83.8 days. Although most of the patients started their comprehensive treatment seven to 12 months before death, 22.9 percent started their treatment within the last four to six months of life (Figure 1), 9.8 percent started their treatment within the last three months of life. In contrast, only 6.8 percent of the patients in the UC group completed their treatment 10 to 12 months before death. A total of 60.7 percent of them completed their treatment within the last three months of life.

Table 2 shows a distinct dental care use pattern between the LC and UC groups. Among the LC group, 21 (58.3 percent) patients received diagnostic services, including problem-focused limited oral evaluations, periodical oral evaluations and radiographs, 14 (38.9 percent) patients received preventive services, and 14 (38.9 percent) patients received removable prosthodontic services (for example, denture repair, denture adjustment and chairside temporary denture relines). Only a small proportion of the patients in the LC group received restorative services (16.7 percent) and surgical services (8.3 percent). On average, patients in the LC group had 2.2 dental visits (0.18 per person-month) and received 3.2 billable procedures (0.26 per person-month, excluding adjunct services). The mean cost for dental treatment was \$172 (range, \$36-\$396 per person). In contrast, among patients in the UC group, 34 (55.7 percent) received surgical services, 30 (49.2 percent) received restorative services, and 22 (36.1 percent) received removable prosthodontic services (for example, new partial or complete dentures). Only 12 (19.7 percent) patients received subsequent preventive treatment before death. Few patients received endodontic or periodontal treatments. On average, patients in the UC group had 5.9 visits (0.49 per person-

month) and received 8.9 billable procedures (0.74 per person-month). The mean cost for dental treatment was \$857 (range, \$52-\$2,855 per person).

Characteristics of the study participants with different dental care patterns

The mean age of the patients was 84.4 years. There were no statistically significant differences in age, sex or marital status among the three groups (Table 3, page 1239). Most of the patients had dental insurance, primarily through Minnesota's Medicaid program. However, patients in the NC group were less likely to have dental insurance than were patients in the LC and UC groups ($P = .02$).

There were no statistically significant differences in medical history, burden of chronic diseases, and cognitive and functional impairment among the three groups. On average, patients had 11 chronic conditions and took nine medications when they first came to the study clinic. Regardless of dental care intensity, the overall burden of comorbidity was high among the patients (mean Charlson Comorbidity Index scores range, 2.1–2.8), suggesting that there would be an increased likelihood of death within one year. Dementia was the most common medical condition among the patients, followed by congestive heart failure and cancer. Consequently, cognitive impairment was prevalent in the patients, especially in the UC group ($P = .07$). However, most of the patients were cooperative during the new patient examinations. A total of 33.3 to 47.5 percent of the patients who were at the end of life had difficulty communicating their oral health care needs with the dentists during the new patient examinations. A total of 94 percent of the patients had some type of functional impairment. Compared with patients in the NC and LC groups, patients in the UC group tended to have slightly more impaired physical mobility and needed help performing oral hygiene tasks, but the difference was not significant ($P = .53$).

Oral health was poor in patients who were at the end of life. A total of 34 percent of the patients had lost all of their natural teeth by the time they had their first appointment at the study clinic. However, the prevalence of edentulism was much higher among patients in the LC group than among patients in the UC or NC groups ($P = .03$). There was no significant difference in oral health measures among the dentate patients. The dentate patients had an average of 6.3 carious teeth at the time of the new patient examination. Use of removable dental prostheses was common in the study patients.

Factors associated with end-of-life dental treatment intensity

We developed a multivariable CRL model with shared regression coefficients across two logits to identify the factors associated with end-of-life dental care patterns. The results for the first logit revealed that the baseline oral health measures were not associated with whether a patient received dental treatment before death (for example, NC versus LC or UC). These measures also were not associated with the treatment intensity among those who received dental treatment before death (for example, UC versus LC) (Table 4, page 1240). Rather, a three-month increment in survival and having dental insurance resulted in 1.74 (95 percent confidence interval [CI], 1.32–2.30) and 2.59 (95 percent CI, 1.03–6.52) times greater odds, respectively, of receiving some dental treatment before death (Table 4). Results for the second logit revealed that having dental insurance coverage was not

associated significantly with dental treatment intensity among patients who received dental treatment before death. In addition, people who lived longer tended to be more likely to receive UC, but the difference was not significant (odds ratio [OR], 1.33; 95 percent CI, 0.86–2.04).

DISCUSSION

We examined the dental treatment provided to a group of LTC residents in the last year of life. Our study results revealed a polarized pattern of dental care in patients who were terminally ill. While most of the patients with poor oral health received NC before death, comprehensive treatment, including multiple restorations and tooth extractions also was provided commonly to frail older adults who were at the terminal stage of life, raising concerns about overtreatment. These findings suggest that the palliative oral health care management approaches for frail older adults who are at the end of life may need to be revisited to improve the quality of care.

Although oral diseases and conditions are prevalent, oral health often is neglected among people with terminal illnesses.^{8,9} In our study, although on average nearly 40 percent of a patient's remaining teeth were carious or retained roots, 50.8 percent of the patients who were at the end of life did not receive any dental treatment before death (Table 1). Prevalent dental caries, together with neglect of oral hygiene^{18,19} and lack of regular dental care might increase patients' risk of experiencing dental pain and developing infection substantially, which could have compromised quality of life, contributed to agitated behaviors in patients with cognitive impairments²⁰ and potentially caused life-threatening complications in patients who were immunocompromised.^{11,12,21} Poor dentition and dental pain also could limit food choices and nutritional intake, aggravate malnutrition and, consequently, accelerate functional decline. Therefore, oral health care should be considered as a part of the overall palliative care plan to prevent oral pain and infection, maintain function, prevent systemic complications of oral diseases and conditions, and improve the quality of life of older adults who are at the end of life.²² This is particularly important for frail elderly people whose end-of-life functional decline usually is lingering.¹

The reasons for the lack of dental care in more than one-half of the study patients are complex. How dentists contributed to this phenomenon remains unclear because the decision to not provide dental care might have come from dentists, patients or their families. Although having dental insurance coverage increased the likelihood of a patient's receiving dental treatment before death (OR, 2.59; 95 percent CI, 1.03–6.52), it was not associated with dental treatment intensity (for example, LC versus UC: OR, 1.00; 95 percent CI, 0.21–4.69). These results suggest that the influence of dental insurance on end-of-life dental care might be different from that of medical insurance.²³ Although having dental insurance coverage determines whether patients who are terminally ill received any dental care before death, it does not necessarily lead to overtreatment in these people. Therefore, when interpreting the results of this study, readers should exercise caution to avoid overinterpreting the influence of dental insurance on dental care at the end of life. Given that 77.0 percent of the patients in the NC group had dental insurance but received no care before death, other factors also might have contributed to the lack of dental care for these patients.

Residents in LTC facilities and their families may be less likely to prioritize oral health care needs owing to increased disease burden, transportation difficulties and psychological distress at the end of life. Owing to the lack of awareness of the intercorrelation between oral health and systemic health and inadequate education regarding oral health assessment and management,²⁴ physicians, nurses and other health care providers may lack skills in identifying and managing oral pain, discomfort or infection and therefore may not sufficiently address the oral health care needs of LTC residents at the end of life. The limited involvement of dental professionals in LTC and the lack of interprofessional interaction also increase the barriers for these patients to access necessary dental care.^{24,25} Furthermore, owing to the time needed for treatment plan processing and consent and the possible difficulty associated with coordinating and scheduling appointments or transferring patients who are functionally disabled from LTC facilities to dental offices, patients who have terminal illnesses or advanced frailty may be less likely to receive dental treatment before death.

The fact that length of survival was not associated with dental treatment intensity at the end of life suggests that during the new patient examination, dentists might have failed to identify patients at the end of life. Consequently, a patient's prognosis might not have been considered, and thus comprehensive treatment was provided to patients who were terminally ill. For instance, 62.9 percent of the patients who used dental services before death received UC. Among them, 60.7 percent completed their treatment within the last three months of life. Given that the patients were close to death, some treatments might not have benefited these patients, raising a concern for better use of our society's limited health care resources (91.8 percent of these patients had government-subsided dental insurance). These potentially futile treatments also might have caused the patients unnecessary pain, discomfort and physical distress and increased their risk of developing systemic complications during dental treatment, especially in invasive treatment. Functional reserves might have been compromised substantially in elderly patients at the end of life.²⁶ Transferring patients from LTC facilities to dental offices could be physically challenging for these patients. This stressful process, together with intensive dental treatment, could have disrupted the homeostatic equilibrium of these patients and increased their risk of having systemic health complications or iatrogenic problems, especially in patients who were in their terminal stage of life. Given the potentially negative effects of aggressive treatments, a patient's prognosis and dying trajectory should be considered during clinical treatment planning so that appropriate treatment approach and intensity could be chosen to safely and efficiently manage the care of these vulnerable people while minimizing the provision of potentially futile treatment.

Education may need to be improved to help physicians, nurses and dentists better address the oral health needs of and improve the quality of oral health care for frail older adults who are at the end of life. Oral disease and its effects on systemic health and quality of life in patients who are terminally ill should be introduced to medical and nursing students so that oral health care can be included into daily palliative care. End-of-life dental oral health management also should be enhanced in dental education. The guidelines and tools for estimating prognoses for patients who are terminally ill, as well as the patients' distinct

patterns of death and their effects on oral health care, should be introduced to dental students to prepare them for managing the care of patients who are terminally ill.

In addition, it may be necessary to develop a better palliative care model that enables dental professionals, as active members of multidisciplinary palliative care teams, to interact more frequently with physicians, nurses and other palliative care staff members; provide oral health consultations; and receive timely feedback from other health care professionals. This active interprofessional interaction also can help dentists address one of the most critical questions in palliative dental care: when to start treatment for patients with terminal illnesses or advanced frailty and adjust treatment plans according to the patient's prognosis and function, minimizing futile and potentially harmful treatments and improving quality of care. A patient-centered care approach also should be adapted in palliative dental care. Besides addressing clinical dental findings, dental professionals also should consider the patient's or their family's preferences during clinical treatment planning, because oral health care needs may vary in older adults with different educational levels, socioeconomic backgrounds and health care values.^{27–29} From a policymaker's perspective, it is necessary to develop a mechanism to minimize potentially unnecessary treatment and optimally use or allocate public resources to improve the quality of life for patients with terminal illnesses or advanced frailty.

In terms of limitations, our study was based on the data of an LTC cohort from a single dental clinic. These findings may not be generalizable to, or representative of, end-of-life dental care in other populations of patients who are terminally ill, geographic areas or dental practices. Furthermore, the classification of dental care patterns was made solely on the basis of the treatment provided to the patients. How dentists originally planned treatment for these patients remains unknown. Because dental treatment is mostly elective, the autonomous decisions regarding dental care made by patients or their families may have influenced the dental treatment intensity of the study patients substantially. While comprehensive treatment might have been proposed for patients in the NC group, comprehensive treatment, such as multiple extractions or complete dentures, also could have been requested by patients or their families for esthetic or other reasons. As a result, it might be difficult to judge whether the decision to provide UC to a person in the last year of life was appropriate. It also was unclear whether dentists knew the end-of-life status of patients when the treatment decisions were made. Evidence shows that when a patient's prognosis is known, dentists are fairly conservative in caring for patients who are terminally ill.³⁰ Therefore, more studies are needed to understand the potential issues in end-of-life dental care.

CONCLUSIONS

The results of our study reveal a polarized dental care pattern in frail older adults at the end of life. While most of the patients with poor oral health received little dental care and might have been at an increased risk of experiencing dental pain and developing infection, comprehensive treatment was provided to older adults who were at the terminal stage of life. These findings suggest that oral health care needs to be included as part of the overall

palliative care plan and considered within a larger context of the patient's pattern of death, health care needs and quality of life.

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Practical Implications

Palliative oral health management needs to be revisited to improve quality of care for frail older adults at the end of life.

Figure 1.
Treatment start and end times in the end of life participants who received usual care

Table 1

Length of survival, according to dental care intensity

	No subsequent care (N=100)	Limited care (N=36)	Usual care (N=61)	Significance	
				Overall ^a	Pairwise ^b
Length of survival in days (Mean, SD, Min, Max)	155.4 (109.9) (4, 362)	208.9 (95.9) (18, 355)	233.8 (85.3) (67, 361)	<0.001	a, b

^a Analysis of variance (ANOVA).

^b Student T-test. Significant pairwise comparisons (P<0.05): a = No subsequent care vs. Limited care; b = No subsequent care vs. Usual care; c = Limited care vs. Usual care

Table 2

The detailed dental care utilization in the limited care and usual care groups

Treatment Group	Service, N (%)							
	Diagnostic	Endodontic	Periodontal	Preventive	Removable Prosthodontic [*]	Restorative	Surgical	Adjunct [‡]
Limited care	21 (58.3)	0 (0)	0 (0)	14 (38.9)	14 (38.9)	6 (16.7)	3 (8.3)	16 (44.4)
Usual care	19 (31.2)	2 (3.3)	1 (1.6)	12 (19.7)	22 (36.1)	30 (49.2)	34 (55.7)	36 (59.0)

^{*} The removable prosthodontic services received by the limited care group included denture repair, denture adjustment and chairside temporary denture relining, whereas the removable prosthodontic services received by the usual care group referred to removable complete denture or partial denture treatment.

[‡] Adjunct services included miscellaneous services (for example, office visit no charge and behavior management).

Table 3

Baseline Characteristics and Dental Care Intensity Prior to Death

Baseline Characteristics	Dental Care Pattern			P Value
	No subsequent treatment (N=100)	Limited Care (N=36)	Usual Care (N=61)	
Sociodemographics				
Age (Mean, SD)	85.2 (7.7)	83.5(8.1)	84.4 (8.6)	0.28
60–74 (%)	9.0	16.7	16.4	
75–84 (%)	34.0	41.7	26.2	
85 (%)	57.0	41.7	57.4	
Gender (female, %)	68.0	83.3	60.7	0.08
Marital status (%)				0.13
Divorced/Separated/Widowed	66.0	88.9	65.6	
Unmarried	7.0	5.6	9.8	
Married	27.0	5.6	24.6	
Dental insurance (yes, %)	77.0	91.7	91.8	0.02
Medical and functional measures				
Number of medical conditions (Mean, SD)	11.2 (5.4)	11.3 (6.5)	11.4 (5.6)	0.97
Congestive heart failure (%)	37.0	30.6	26.2	0.36
Chronic obstructive pulmonary disease (%)	17.0	8.3	13.1	0.43
Cancer (%)	22.0	19.4	18.0	0.82
Dementia (%)	61.0	44.4	67.2	0.09
Kidney Failure (%)	20.0	8.3	18.0	0.30
Charlson Comorbidity Index score (Mean, SD)	2.6 (1.7)	2.1 (1.3)	2.8 (2.0)	0.16
Number of Medications (Mean, SD)	8.6 (4.0)	9.8 (3.9)	9.1 (4.2)	0.27
Cognitive impairment (%)				0.07
Not Impaired	19.0	33.3	13.1	
Impaired	75.0	66.7	85.2	
Missing	6.0	0	1.6	
Having communication problem, %	37.0	33.3	47.5	0.41
Missing	12.0	2.8	1.6	
Cooperative to care (%)				0.29
Sometimes Uncooperative	12.0	8.3	21.3	
Usually Uncooperative/Never Cooperative	2.0	2.8	4.9	
Always Cooperative	84.0	88.9	73.8	
Missing	2.0	0.0	0.0	
Functional dependence score (Mean, SD)	2.1 (1.0)	2.4 (0.9)	2.5 (0.9)	0.06
Oral health measures				
Edentulism (%)	35.0	50.0	23.0	0.03
Number of remaining teeth (Mean, SD)	16.4 (7.6)	17.2 (6.9)	18.0 (7.3)	0.51

Baseline Characteristics	Dental Care Pattern			P Value
	No subsequent treatment (N=100)	Limited Care (N=36)	Usual Care (N=61)	
Number of carious teeth (Mean, SD)	6.4 (5.7)	5.3 (4.4)	6.7 (6.0)	0.66
Number of filled teeth (Mean, SD)	8.4 (5.8)	9.5 (5.7)	9.2 (6.6)	0.70
Use of a removable dental prosthesis (%)	56.0	61.1	47.5	0.39

Table 4

Factors associated with dental treatment intensity in the last year of life

Variable	Logit 1 – Limited or Usual Care vs. No Care (N=197)	Logit 2 – Usual Care vs. Limited Care (N=97)
	OR (95% CI) ^a	OR (95% CI) ^a
Length of survival (3 months increment)	1.74 (1.32, 2.30)	1.33 (0.86, 2.04)
Has dental insurance	2.59 (1.03, 6.52)	1.00 (0.21, 4.69)
	Common OR (95% CI)*	
Number of teeth	1.03 (0.97, 1.10)	
Number of carious teeth	1.02 (0.96, 1.08)	
Number of filled teeth	1.01 (0.94, 1.08)	
Has a prosthesis	1.48 (0.71, 3.07)	

^aBased on a shared parameter Continuation Ratio Logits model, adjusting for length of survival, having insurance, number of teeth, number of carious teeth, number of filled teeth and having a prosthesis.