ORAL HEALTH IN NURSING HOME RESIDENTS

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A. ABSTRACT

ORAL HEALTH IN NURSING HOME RESIDENTS

Objective: Using data from a national sample, this project measures differences in oral health status among nursing home residents to determine whether racial/ethnic disparities in oral health status exist, and to identify risk indicators for oral disease in this population.

Methods: A cross-sectional, secondary analysis of a 10% nationally representative random sample of annual assessments of nursing home residents in the U.S. (n = 159,157) was performed, using the Minimum Data Set (MDS).

Results: More than 29% (n = 46,155) had oral health problems (broken/loose or carious teeth, inflamed, bleeding gums or oral abscess, chewing problems or mouth pain). Independent correlates of oral health problems (multivariate analysis) included resident characteristics -Activities of Daily Living or ADL, having oral debris before going to bed, which is defined as soft, easily movable substances present in mouth prior to going to bed at night. Other correlates of these oral health problems include use of a feeding tube, age > 85 years and racial/ethnic characteristics (Asian/Pacific Islander and Hispanic).

Conclusion: This study found that significant differences exist in oral health status among nursing home residents based upon race and ethnicity in this nationally representative sample. Furthermore, some specific resident characteristics were associated with increased oral health problems. Strategies need to be developed and documented that ensure oral health services are provided to residents, especially those residents with a variety of health problems.

B. NAME OF PROJECT

ORAL HEALTH IN NURSING HOME RESIDENTS

C. STATEMENT OF PURPOSE

The purpose of this research study was to measure the differences in oral health status among U.S. nursing home residents. This study will explore whether racial/ethnic disparities in oral health status exist, and to identify risk indicators for oral disease. Using a nationally representative dataset, Minimum Data Set (MDS) (CMS, 2003), the author analyzed indicators of oral health in a sample of nursing home residents. The aim was to identify risk indicators that affect and influence the oral health of elderly, to foster the improvement and creation of oral health programs to treat and reduce the prevalence of disease.

D. APPLICANTS ROLE IN PROJECT

The applicant was the principal researcher in planning, implementing, analyzing, interpreting and reporting this study.

E. BACKGROUND AND REVIEW OF THE LITERATURE

Oral health is more than simply good teeth; it is integral to general health and essential for well-being. Oral health implies being free of chronic oral-facial pain, oral and pharyngeal (throat) cancer, oral tissue lesions, birth defects such as cleft lip and palate, and other diseases and disorders that affect the oral, dental and craniofacial tissues, collectively known as the craniofacial complex (WHO, 2003).

Recent studies reveal that relatively little attention has been paid to the oral health of elderly population in America, particularly by public health and public policy interventions (Lamster, 2004). The population predictions for the next decade suggest

that the elderly will comprise a significant and increasingly large portion of the population (Lamster, 2004). Oral health disparities evident within the older adult population include inadequate oral hygiene status. The elderly are at increased risk for experiencing difficulty while performing oral hygiene, and at greater risk for oral infection resulting in systemic diseases, including respiratory illness, cardiovascular disease, diabetes and multiple other disorders (Lamster, 2004).

Population Statistics of Elderly

Helgeson, et al. (2002) noted that the number of people age 65 and older in the United States is growing. In 1999, more than 34.5 million Americans were age 65 and older. Lamster (2004) notes in 2001 roughly 12.6% of the U.S. population was age 65 years or older, and expects by 2015 that number will increase to roughly 14.7% of the population. The number of elderly persons "has increased 10-fold" since 1990, a sign that the "baby boom" generation is aging (Helgeson, et al., 2002).

Lamster (2004) notes that the elderly population is more diverse, both racially and ethnically, and facing increasing financial burdens and living conditions challenges. All of these factors may impact access to care and the quality of care that elderly patients receive, particularly in institutionalized settings.

Growing Numbers of Elderly in Nursing Homes

The living arrangement selected for elderly persons depends on multiple variables including general health, income and the number of available health workers to care for elderly persons (Helgeson, et. al., 2002). Studies suggest in 1997 more than 1.6 million elderly lived in nursing homes, comprising roughly 5% of the population of older persons (Helgeson, et. al, 2002). This number has been dramatically increasing in recent years,

with roughly 19% of the elderly population aged 85 and above staying in a nursing home (Helgeson, et al., 2002).

Pyle & Stoller (2003) confirm that roughly 5% of the population over age 65 years currently reside in long-term care settings, and found that oral health of elderly in these settings is "consistently poor".

Significance of Oral Health Issues of Elderly in Nursing Homes

Taylor (1990) noted that 65% of nursing home residents have been identified with oral health problems. Oral health problems are common among nursing home residents. However, it is not well understood whether there are differences in the oral health status of residents based on race and ethnicity.

Helgeson, et al. (2002) found that current surveys fail to distinguish between differences in institutional settings and differences in characteristics among the elderly housed in them. He suggests that because a greater number of elderly are living in nursing homes, it is vital that health care services for these persons are analyzed critically.

Jablonski et al. (2005) estimated that 1.65 million elderly Americans living in nursing homes experience oral health problems. The author cites a study of 1,063 nursing home residents in 31 geographically and demographically different areas, finding that "poor oral hygiene was observed in 72% of persons wearing dentures" (Jablonski et al., 2005).

MacEntee, Nolan & Thomason (2004) observe that maintaining optimal oral health in frail elders is particularly vital for improving the health outcomes and quality of life for patients in institutionalized facilities. These health issues, according to the

authors, prove a significant concern for the elderly living in institutionalized settings. The authors show a correlation between a lack of attention to oral health and frailty as a condition of the elder's health and well-being (MacEntee, Nolan & Thomason, 2004).

Importance of Oral Health in the Elderly

Helgeson et al. (2002) cite Ettinger & Beck's functional definition of the elderly that is based on the person's ability to seek dental services. This categorization groups elderly into the following categories: (1) functionally independent older adults, (2) frail older adults and (3) functionally dependent older adults. Roughly 70% of elderly persons fall into the functionally independent category, described as those capable of going to the dentist regularly, roughly 14% of the population are defined as "frail" meaning they suffer chronic conditions creating mobility limitation that may lead to poor access to dental care and approximately 5% are functionally dependent, typically including those institutionalized in nursing homes (Helgeson et al., 2002).

Pyle & Stoller (2003) state that approximately 72 percent of aging adults were dentate, described as people with more than eighteen natural teeth. These adults are at increased risk for periodontal and dental disease as well as diseases of the soft tissues and palate. Further the growing population of older patients "presents a combination that impacts dental needs" because chronic dental disease experience combined with systemic diseases may lead to more complex treatment protocols for these patients (Pyle & Stoller, 2003).

Effects of Poor Oral Health

Poor oral health can lead to negative effects on a person's quality of life; oral facial pain. For example, loss of teeth can reduce a person's functional ability and can

affect his or her ability to communicate or eat properly (Helgeson, et al., 2002). Social disfigurements resulting from oral diseases can result in self esteem problems, increased risk for depression and "social stigma" (Helgeson, et al., 2002: 42S). Further, the person's ability to socially interact with others or maintain a healthy psychological status is impaired by the presence of oral diseases (Helgeson, et al., 2002).

Peterson and Yamamoto (2005) suggest that poor oral health is linked with chronic disease. Researchers suggest that high levels of tooth loss, dental caries experience, increased incidence of periodontal disease and oral cancer or pre-cancer decrease the quality of life in elders, making oral health care "an important public health issue that must be addressed by policy makers". Weight loss, chewing problems, communication handicaps and increased risk for systemic illness including diabetes, ischemic heart disease and chronic respiratory disease, are all evident in elderly populations with dental problems (Peterson & Yamamoto, 2005; Scannapieco, 1999; Joshipura, et al., 2003).

Oral Health Disparities & General Health among Nursing Home Residents

Jablonski et al. (2005) attempted to identify how bio-behavioral aging, nursing home environments and ageism may contribute to oral health disparities among the aging population. The authors found that elders in nursing homes generally exhibit more limited choices with regard to access and payment for dental care services. Many dentists are reluctant to care for Medicaid patients, even in those states providing this adult dental insurance, further complicating the issues and increasing the level of disparity present in nursing homes (Jablonski et al., 2005).

Pyle & Stoller (2003) found that elderly persons in poverty, those experiencing social isolation, those residing in long-term care institutions and those with medical illnesses experience varying levels of oral health care and some receive no care. Multiple factors are to blame for disparities in oral health care among the elderly. These include: limitations resulting from health or education policy implications, insufficient "evidence based research", and health professions failure to examine "nontraditional education models" (Pyle & Stoller, 2003). The same authors also cite the "lack of inclusion of oral care services in Medicare" and the continual preservation of "the dental profession's independence" as contributing to the access to care problems and oral health disparities evident in nursing homes. Currently less than 15 percent of nursing home patients have adequate dental insurance, with most paying for services out of pocket (Pyle & Stoller, 2003).

Lamster (2004) noted that regional and state differences exist with regard to tooth loss among older Americans with higher percentages of edentulous persons in Kentucky (42.3%) and West Virginia (41.9%), while the lowest percentages were observed in Hawaii (13.1%) and California (13.3%).

Significance of Disparities

Pyle & Stoller (2003) point out that the projected rapidly aging population of America emphasizes the urgency of addressing the dental needs of this population because they are increasingly at risk for oral health decline and associated systemic illnesses. Peterson & Yamamoto (2005) note that the need for improved oral health care is particularly evident among the elderly, where health programs are typically inadequate. Karter et al. (2003) find that higher rates of complications are typically associated with

disparate access to quality health care. In particular these researchers' points out that ethnic disparity in access to quality health care leads to increased disease and disability rates including those associated with systemic diseases. Systemic diseases themselves can be associated with poor oral hygiene.

Edelstein (2001) notes that the increasing prevalence of disparities related to health care and oral health care result in a disconnect between disease processes and access to care. For those most affected by oral disease and other health issues, "physical, functional and behavioral consequence" may result, inhibiting normal functioning and increasing pain and inflammation experienced by patients (Edelstein, 2001). Further persistent disparities in care result in higher than average levels of social problems and increasing rates of serious and complicated systemic illnesses that might otherwise have been prevented.

Benefits of Identification of Disparities in Oral Health among Nursing Home Residents

A "substantial number of older adults" will be able to function more independently with a higher quality of life when provided access to quality health care (Lamster, 2004). Edelstein (2001) notes that identifying disparities in oral health can lead to policy changes and educational programs directed at increasing awareness of the needs of certain populations and improving access to health care for at-risk populations including the elderly. It is important that researchers identify the disparities that exist in oral health among nursing home residents so that appropriate interventions and policy recommendations may be designed to improve the physical and emotional well being of this rapidly growing population.

F. DESCRIPTION OF THE PROJECT

The applicant analyzed a national dataset of nursing home residents collected by Centers for Medicare and Medicaid Services (CMS) (CMS, 2003). Data from 2001 was analyzed for this project. The purpose of this project is to identify factors that impact the oral health status of nursing home residents and to explore racial/ethnic oral health disparities in this population.

Hypothesis

The hypothesis of this research study is that some residents of nursing homes have a poorer oral health status than others. Oral health status can be described by using risk indicators for oral disease as surrogate measures. The author analyzed indicators of oral health in a representative sample of nursing home residents. The aim was to identify factors that impact the oral health of nursing home elderly. By understanding the influence of these variables on the oral health status of this population, we can better develop oral health programs for the elderly.

To examine this hypothesis, and to define those groups with poorer oral health, this study used bivariate and multivariate logistic regression analyses of risk indicators in this population.

G. PROCEDURES AND METHODS

MDS, a national representative data set that includes demographic and physiological information, was used to measure differences in oral health status among the nursing home residents (N= 159,157).

Data

MDS is a federally mandated instrument used to assess all residents in Medicaid supported/certified long-term care facilities (LTCF) (Teno et al., 1997). Nurses, social workers, therapists, or physicians complete the MDS when patients enter a LTCF, when they experience changes in health status, and at a minimum, on an annual basis after admission (Morris et al., 1990; Hawes et al., 1995). A subset of queries on the MDS requires additional quarterly assessment (Hawes et al., 1995). The MDS is designed to cover comprehensive items including, but not limited to, resident health, demographic characteristics, and treatments (Morris et al., 1990; Center for Medicare and Medicaid Services, 2004). Studies of the reliability and validity of these data suggest that they are useful for clinical applications and epidemiological and policy research studies (Gambassi et al 1998, Gambassi et al 2000, Mor 2004). The MDS data for the present sample were taken from 2001 and included information for nursing home facilities in all 50 states and Washington, DC. Given the very large sample size of the MDS data set, a 10% random sample of the MDS data was used in this analyses (N= 159,157). Resident characteristics included in this study are: (1) age (65 years and above), (2) drug use (take hypnotic, antidepressant, anti-psychotic, or anti-anxiety medication), (3) activities of daily living (ADL) status (resident was considered ADL dependent if he was dependent for bed mobility or eating), (4) eating between meals most days, (5) use of tobacco daily, (6) feeding tube. (7) diabetes (8) debris before going to bed (soft, easily movable substances present in mouth prior to going to bed at night), (9) chemotherapy.

Oral health problems among the elderly were classified based on the following criteria: (1) reported presence of chewing problems, (2) reported presence of mouth pain

(3) identified broken/loose/carious teeth and (4) report of presence of inflamed/bleeding gums/oral abscess.

Statistical Analyses

Statistical analyses were performed using SPSS software (SPSS, 2001). In the bivariate analyses, the investigation examined proportional differences between nursing home residents with and without oral health problems using chi-square analysis for categorical variables and with Students'*t*-test for continuous variables. In the multivariate model, the analysis used a logistic regression analysis to assess associations between oral health problems and race/ethnicity. Given the very large sample size for the reported analyses of the MDS data, all results were considered significant if at the p < .01 level.

H. FINDINGS

Of the 159,157 nursing home residents sampled in this study, 84.3% were Non-Hispanic White, 2.8% were Hispanic, 11.5% Non-Hispanic Black, 0.4% American Indian/Alaskan Native, and 1.0% were Asian/Pacific Islanders. 29% of those 159,157 subjects were classified as having oral health problems. Table 1 describes the variables included in this study and Table 2 presents the baseline data for the available resident's characteristics that are believed to affect or be related to the oral health status of nursing home residents. Patients were on average 81.6 years old (SD \pm 12.5). 72.4% of the residents were women, comprising the majority of the nursing home population. 8.5% were fed using a feeding tube and 9% of the resident population used tobacco daily. 29% of the residents had oral health problems defined as broken/loose or carious teeth, inflamed, bleeding gums or oral abscess, chewing problems or mouth pain. 0.5% of the resident population were observed to have some debris in their mouth before going to bed. 17.3% of the residents required support for either bed mobility or eating or personal

hygiene. 24.5% of the residents had diabetes, and 0.7% of them underwent chemotherapy.

Table 3 presents the proportional difference in the prevalence of residents who had oral health problems and those who did not, by resident characteristics (risk indicators). Proportionally more residents with debris in the mouth before going to bed had oral health problems (45.7%) than did residents who did not have such oral debris recorded (28.9%). Residents in age group 85 years and above had higher prevalence of oral health problems (30.8%) in comparison with residents 85 years and below (27.5%). It was of interest to note that only 26% of the residents who used tobacco daily had oral health problems in contrast to 30.1% of those who didn't use tobacco daily. In addition, 25.9% of the residents with diabetes had oral health problems. By comparison, 30% of the nursing home residents without diabetes had oral health problems. More residents who were ADL dependent had oral health problems (36%) than did residents who weren't ADL dependent (27.5%). Additionally, 37.1% of the residents who were tube fed had oral health problems. In contrast to 28.2% of residents who were not tube fed. In addition, 35.6% and 34.1% of the residents who were American Indians and Asian/Pacific Islanders respectively had oral health problems, in comparison to 29% of those who weren't in those respective racial/ethnic groups. Also, 34.7% of the Hispanic residents had oral health problems in contrast to 28.8% of the residents who weren't Hispanic. Additionally, 28.6% of the residents who were Non-Hispanic Whites had oral health problems, in comparison to 31.1% who were not.

Table 4 presents the results of multivariate analysis of the association of resident characteristics with oral health problems. All resident characteristics, except

chemotherapy and eating between meals were independently associated with oral health problems. Residents who had debris in their mouth before going to bed were 2.35 times more likely to have oral health problems than the residents who didn't. Also, residents in the age group of 85 years and above were 1.14 times more likely to have oral health problems. The occupants in the nursing homes, who were fed through feeding tubes, were 1.5 times more likely to have oral health problems in comparison to those eating normally. Interestingly, residents who had diabetes or were on specific medications were less likely to have oral health problems. The residents who were ADL dependent were 1.58 times more likely to have oral health problems in comparison to those that were ADL independent. Hispanic and Asian/Pacific Islander residents were significantly more likely than Non-Hispanic White, Non-Hispanic Black and American Indian residents to be having oral health problems. We also found that in our sample, being diabetic and using tobacco was significantly associated with higher edentulous rates. It was noted that 42% of the people who smoked were edentulous compared to 34% of the people who did not smoke and 36% of the residents who had diabetes were edentulous compared to 34% who were not diabetic.

I. DISCUSSION

The present study shows that significant differences exist in oral health status among nursing home residents based upon race and ethnicity. The race distribution according to the 2001 census (65 years and above) shows that Non Hispanic Whites were 83% of the total population, African Americans were 8% of the population, Asian/Pacific Islanders were 3% of the population and Hispanics were 6% of the population and Native American were 0.9% of the total population (Census, 2001). This distribution by race

seen in the census data was consistent with this study's proportion of nursing home residents by race.

The findings of this study show that having debris in the mouth before going to bed, being tube fed, using various medications and being ADL dependent are variables associated with increased probability of having oral health problems. Debris in the mouth, which indicates lack of oral care and poor oral hygiene, harbors microorganisms and causes increased caries activity and periodontal disease. Being tube fed prevents the residents from performing mastication which is a mouth clearing and cleansing activity. leads to decreased salivary flow, and thereby additionally increasing susceptibility to oral diseases. Medication use in the residents could cause xerostomia, which will in turn influence increased caries activity. Residents who are ADL dependent could not adequately perform personal self care. They would have decreased fluoride exposure and increased plaque associated diseases. However, contrary to the current literature, having diabetes and using tobacco daily didn't increase the odds of having oral health problems in our study. This finding could be a reflection of the higher edentulous rates associated with a history of diabetes and previous tobacco use in found our sample. It is well known that diabetes and tobacco use are significantly associated with edentulism (Cleary, 1995; Bergstrom, 2004).

The results of the study suggest that certain populations are more at risk for oral health problems than others. These include minority persons, classified as Hispanic and Asian/Pacific Islander residents living in institutionalized settings. Non-Hispanic Whites and African Americans have highest rates of edentulism (Surgeon General, 2000). This observation may support the association between the oral diseases among Hispanics and

Asian/Pacific Islanders, as they are more likely to be dentate. There are likely to be additional reasons behind the disparities identified, and may include inadequate access to proper oral hygiene, lack of dental insurance coverage, lack of education and understanding regarding the effects of poor oral hygiene and the general barrier of low socio-economic status among these populations (Frankel, Harvey & Newcombe, 2001; Pyle & Stoller, 2003; Helgeson et al., 2002).

The strengths of this study include the reliability of the MDS dataset. Most of the variables used in our research eg: - age, sex, race/ethnicity, debris before going to bed, feeding tube, oral health problems, medication use, being ADL dependent, met a standard for excellent reliability (i.e., intraclass correlation of .7 or higher) (Hawes et al. 1995). Variables with lower but acceptable reliability were diabetes, chemotherapy, eating between meals, tobacco use daily (Hawes et al. 1995). Further, the ability to study a cross-sectional prevalence sample of the U.S. nursing home population, in which every subject was sampled once over a one year period, strengthens expectation that the results will be generalizable for the United States institutionalized population. This study also has number of limitations. The criteria used to define oral health problems were not normatively measured by dental professionals. In addition, because of the 10% random sampling of the U.S. nursing home population it may not be possible to generalize our findings to particular subpopulations seen in nursing homes by city, standard metropolitan statistical area or county.

Policy makers and providers have an ethical obligation to attend to the needs of this growing population. Census information reveals the number of persons aged 65 and older and age 85 and older will continue to grow and expand in the coming years

(Helgeson et al., 2002). Such expansion is likely to result in greater burdens to health care providers and nursing care facilities charged with overseeing the quality of life and well being of this population. Much evidence exists supporting the need for oral care in the elderly population. Attention to oral care may decrease mortality among this population, improve self esteem and quality of life among persons living in nursing homes and decrease the burden of caregivers attending to the aging population. Despite this knowledge, little progress has been made in the way of policy changes directed toward improving the health and well being of elderly persons living in nursing home communities.

Frenkel, Harvey & Newcombe (2001) also emphasize the importance of education particularly with regard to caregivers working in institutionalized environments to help reduce disparity of care and increase the likelihood of positive health outcomes for older patients. Their studies show that while patient's baseline oral health care revealed poor quality of health, oral health score improved dramatically with proper attention and education from caregivers working with functionally dependent clients.

J. CONCLUSION

The implications of this study are wide ranging. While empirical evidence exists regarding the disparities of general care provided aging persons, little information focuses specifically on the disparities racial and ethnic minorities living in nursing homes experience with respect to oral health care. The study indicates the need for more education, preventative and therapeutic treatment and policy changes related to this issue. The results of this study provide caregivers and the health care community an impetus to take action and improve the quality of life of elderly persons living in nursing care

communities. They may be applied to larger studies in the future directed at resolving the disparities of oral health and dental care that currently exist among the aging population in nursing homes.

SUGGESTED CHANGES IF THE PROJECT WAS REPEATED

The project would be strengthened through a longitudinal analysis of data over

several years to define the temporal relationships of these associations. An analysis of

regional and state differences would also be informative.

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Characteristic	How Variables were Measured
Age	In years-Basic Assessment Tracking Form-
	MDS
Sex	Male/Female- Basic Assessment Tracking
	Form-MDS
Debris before going to bed	Presence/Absence-Oral Status Part of MDS-
	Inspection/ Staff Observations/ Resident
	Complaints
Feeding tube	Presence/Absence-Nutritional Status Part of
	MDS-Inspection
Tobacco use daily	Yes/No- Cycle of Daily Events Part of MDS
Oral health Problems ^a	Presence/Absence-Oral Status Part of MDS-
	Inspection/ Staff Observations/ Resident
h h	Complaints
Medication use ⁶	Presence/Absence-Medications Part of
	MDS-Medical Records
ADL dependent	Self-Performance/ Independent/ Supervised/
	Limited Assistance/ Extensive Assistance/
	Total Dependence-Physical Functioning and
	Structural Part of MDS-Direct Care Staff
Distant	Interviews
Diabetes	Presence/Absence-Part of Disease Status of
C1	MDS-Clinician and Medical Records
Chemotherapy	Yes/No- Part of Special treatments,
	Procedures and Therapies of MDS-Medical
Dana/Etheriaiter	Records
Race/Ethnicity	American Indian/Alaskan Native, Asian/
	Hispania Non Hispania White Daria
	Assessment Treaking Form MDS
	Assessment fracking romi-widd

Variables Considered in this Study (N=159,157)

Note. ^a Had one of the following: broken/loose or carious teeth, inflamed,

bleeding gums or oral abscess, chewing problems or mouth pain.

^b Used at least one of the following: diuretic, hypnotic, antidepressant,

anti-psychotic, or anti-anxiety medication.

^c Dependent if the resident required support for either bed mobility or eating or personal hygiene.

Characteristic	Mean	Standard	Percentage
		Deviation	
Resident			
Age	81.6	12.5	
Sex-Female			72.4
Debris before going to bed			0.5
Feeding tube			8.5
Tobacco use daily			9.0
Oral health Problems ^a			29.0
Medication use ^b			75.9
ADL dependent ^c			17.3
Diabetes			24.5
Chemotherapy			0.7
Race/Ethnicity			
American Indian/Alaskan Native			0.4
Asian/ Pacific Islander			1.0
Non-Hispanic Black			11.5
Hispanic			2.8
Non-Hispanic White			84.3

Resident Characteristics (N=159,157)

Note. ^a Had one of the following: broken/loose or carious teeth, inflamed,

bleeding gums or oral abscess, chewing problems or mouth pain.

^bUsed at least one of the following: diuretic, hypnotic, antidepressant,

anti-psychotic, or anti-anxiety medication.

^c Dependent if the resident required support for either bed mobility or eating or personal hygiene.

Risk Indicator	Total	Oral Health Problems		Significance ^b
	Sample	Present	Absent	-
	(N =	(N =	(N=	
	159,157)	46120)	113037)	
	%	%	%	
Age-85 and above	44.4	30.8	27.5	0.000**
Debris before bed	0.5	45.7	28.9	0.000**
Feeding tube	8.5	37.1	28.2	0.000**
Tobacco use daily	9.0	25.9	30.1	0.000**
Eats between meals	33.4	28.6	30.3	0.000**
Medication use	75.9	27.6	33.2	0.000**
ADL dependent	17.3	36.0	27.5	0.000**
Diabetes	24.5	25.9	30.0	0.000**
Chemotherapy	0.7	26.7	29.0	0.089
Race/Ethnicity:				
-American Indian	0.4	35.6	29.0	0.000**
-Asian/Pacific Islander	1.0	34.1	28.9	0.000**
-Non-Hispanic Black	11.5	29.9	28.9	0.003**
-Hispanic	2.8	34.7	28.8	0.000**
-Non-Hispanic White	28.6	28.6	31.1	0.000**

Resident Characteristics by Risk Indicators Versus Oral health Problem Status^a

Note. ^a Had one of the following: broken/loose or carious teeth, inflamed,

bleeding gums or oral abscess, chewing problems or mouth pain.

^b Proportional differences between residents with oral health problems present and residents with oral health problems absent were examined using contingency tables with χ^2 statistic for categorical variables and with Student's *t*-test for continuous variables. ** p < .01

Association of Resident Characteristics with Oral health Problems Status, Using

Characteristic	Odds	Confidence Interval		Significance
	Ratio	Lower	Upper	
Age-85 and above	1.145	1.101	1.190	0.000**
Debris before bed	2.354	1.890	2.933	0.000**
Feeding tube	1.506	1.410	1.609	0.000**
Tobacco use daily	0.889	0.829	0.953	0.001 **
Eats between meals	0.953	0.916	0.993	0.021
Medication use	0.803	0.768	0.838	0.000**
ADL dependent	1.586	1.513	1.663	0.000**
Diabetes	0.810	0.773	0.848	0.000**
Chemotherapy	0.848	0.661	1.087	0.194
Race/Ethnicity:				
-American Indian	0.145	0.923	1.723	0.145
-Asian/Pacific Islander	1.292	1.098	1.519	0.002**
-Non-Hispanic Black	1.038	0.977	1.104	0.226
-Hispanic	1.259	1.126	1.408	0.000**

Multivariate Logistic Regression (N= 159,157)

** p < .01