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COHORT MEMBERSHIP, DENTAL INSURANCE AND UTILIZATION OF DENTAL SERVICES IN ADULTS AGE 47 AND OVER RECEIVING DENTAL CARE AT VIRGINIA COMMONWEALTH UNIVERSITY'S SCHOOL OF DENTISTRY

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

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## **Abstract**

**COHORT MEMBERSHIP, DENTAL INSURANCE AND UTILIZATION OF DENTAL SERVICES IN ADULTS AGE 47 AND OVER RECEIVING DENTAL CARE AT VIRGINIA COMMONWEALTH UNIVERSITY'S SCHOOL OF DENTISTRY.**

By Patricia Brown Bonwell, RDH, BSDH, MSG, PhD

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

Virginia Commonwealth University, 2012.

Major Director: James J. Cotter, PhD, Professor, Department of Gerontology

Co-Director: Constance L. Coogle, PhD, Associate Professor, Department of Gerontology

This cross-sectional, non-experimental study evaluates associations between cohort membership, type of dental coverage, and utilization of dental services in all patients age 47 and over who received dental care at Virginia Commonwealth University's (VCU) School of Dentistry in 2011.

Structural Lag Theory poses that society's institutions lag behind the actuality of a healthy and capable older adult population. The two dynamisms of the Structural Lag Theory were used for this study. The Dynamism of Changing Lives is represented by Cohort differences. Cohort differences include cohort size, people living longer and retaining more of their natural teeth along with different attitudes toward dental care. This dynamism impacts the

Dynamism of Structural Change, represented by the institutions of dental coverage and utilization of dental services.

Cohort membership is an independent variable. The dependent variable, utilization, is defined as Financial-Total amount spent and Procedural-Routine adult dental prophylaxis.

Dental coverage, a dichotomous variable, is used as an independent and dependent variable.

Descriptive statistics revealed employer provided dental coverage is the most prevalent type of dental coverage. However, when considered a payment source, out of pocket funding is the primary source of payment for dental services. Using Chi-square and logistic regression, examination of Cohorts (1-Greatest Generation, 2-Silent Generation, 3-Baby Boomer Generation) revealed that Cohort 2 had more dental coverage than Cohort 1, and Cohort 3 had more dental coverage than Cohort 2.

Using logistic regression, Cohort 2 showed the highest level of Procedural utilization. Evaluating Financial utilization, multiple regression models showed Cohort 1 utilized more than Cohort 2 and Cohort 2 utilized more than Cohort 3. Those with dental coverage spend more on dental services, fees for routine adult dental prophylaxis make up the majority of the total amount spent, and those with dental coverage utilize more dental services when defined as total amount spent.

Because they have experienced different social, political, economic, and technological changes at different times in their life course, the receipt of dental services by new cohorts of older people differs from previous ones. Findings from this study confirm that there is a structural lag in Medicare policy and its coverage of dental services.

## Chapter 1: Introduction

The goal of this project is to evaluate the associations between cohort membership, type of dental coverage and utilization of dental services in adults age 47 and over who receive dental care at the Virginia Commonwealth University (VCU) School of Dentistry. For this exploratory study, dental coverage is defined as Medicare Advantage plans with dental coverage included, employment dental insurance, private dental insurance, and out of pocket pay. For this exploratory study, utilization is defined as total amount spent for dental services by a patient and whether a patient had a routine adult dental prophylaxis procedure in 2011. Differences in dental coverage and utilization of dental services between the Baby Boom, Silent Generation and Greatest Generation cohorts were evaluated. This evaluation supports understanding the impact transitioning to Medicare, which does not include dental coverage, has on dental care coverage and utilization in Medicare eligible cohorts. How Medicare enrollment impacts dental care coverage and utilization is a relatively new research topic with limited history of replications available. “Very little substantive data exists today on the status of Virginia’s senior population. Relevant and meaningful information on older Virginians is neither comprehensive nor readily accessible” (Older Dominion Partnership, 2011, p.1). In Virginia, 2011 survey results presented by the Older Dominion Partnership, showed that 14% of the Baby Boom cohort and 24 % of the Silent Generation and Greatest Generation cohorts combined had not had a dental exam in the past two years (Older Dominion Partnership, 2011).



A life course approach regarding the prevention and treatment of oral disease may be insightful, as it has been for understanding the etiology of other chronic diseases (Northridge & Lamster, 2004). The life course approach can coincide with the continuity theory as different age cohorts have approached oral health differently. Stemming from social, political, economic and technological experiences, members of different cohorts have different long held beliefs pertaining to dental care. Prior to WWII, there was not a lot of focus on maintaining oral health as part of overall health, life spans were shorter and there were fewer dentate older adults. Those who lived through or were raised during the Depression came to believe that routine dental care is not necessary, dentures were thought to last a life time and a dentist only needed to be seen if you had mouth pain (Strayer, 1995; Locker & Jokovic, 1996). In contrast, the majority of the members of the Baby Boom generation were brought up receiving some form of oral/dental care. Many of these individuals continued this care throughout their life course as many had dental insurance through their place of employment. Upon retirement, many from this generation will still have their full dentition but will not retain employer provided dental benefits. In most instances, they will have to pay for such care from out-of-pockets resources (Agency for Healthcare Research and Quality, 2005) because Medicare does not cover dental care. After retiring, many of these individuals will lose their dental insurance coverage and may not have the personal funds to continue such care on their own. This situation leads to the application of the Structural Lag Theory as the main theory to help frame the need for evaluating this issue. Structural Lag Theory poses that societal institutions have failed to keep up with the realities of a healthy and capable older adult population (Atchley, 2008, p.13).

Structural lag is defined as the tendency for the social structure of roles, norms and social institutions to change more slowly, lagging behind changes in peoples' lives (Riley, Kahn &

Foner, 1994). This exploratory study evaluates the differences in dental coverage and utilization as displayed by the Baby Boom, Silent Generation and Greatest Generation cohorts. Norms include laws, language and public policies that are built-in components of structure. Lags in these norms may create pressure for change. “Policies once put in place may lag not unlike the broader social phenomena to which the structural lag construct has traditionally been tied.” (Hudson, 2010, p. 5). Labeling older adults, placing them in created categories and using old cliché phrases sustains structural lag in policies, practices, and programs that do not match the values and expectations of older people (Thornton, 2002). With the anticipated influx of a large Baby Boom cohort into the Medicare program, more studies are needed to address health care disparity stemming from the lack of dental coverage in Medicare. As stated, new cohorts of older people differ from previous ones because age cohorts experience different social, political and technological changes at different time in their life course. Use of Structural Lag Theory, a macro-social gerontological theory, suggests that people respond to available dental insurance coverage when pursuing dental care. Therefore, differences displayed in utilization by age cohorts are evaluated by this study.

The need for such evaluation has become more apparent due to the increase in the number of individuals enrolling in Medicare, which is anticipated to increase dramatically with the influx of the Baby Boom Cohort. This exploratory study is supported by the fact that people are living longer and that more older adults are retaining some or all of their natural teeth, changing the paradigm of dental care services needed by members of the Baby Boom, Silent Generation and Greatest Generation cohorts. Objectives of this project include: 1) Evaluate differences in dental coverage and utilization displayed by cohorts receiving dental services at the VCU School of Dentistry; 2) Evaluate how relationships displayed by cohort succession and

the lack of dental coverage in Medicare reduces the likelihood of dental care needs and expectations of adults age 47 and over from being met. These evaluations were made by examining utilization defined as: Financial- total amount spent for dental care received by patients, Procedural - whether a patient had a routine adult dental prophylaxis procedure and by examining the payment source used to cover dental care costs.

This first chapter will provide a brief overview of background information, which supports the stated purpose of this exploratory study. Also included in the first chapter is a brief discussion of the problem, purpose and study significance. The theoretical framework including research questions and a brief description of the scope of the study are also briefly discussed.

## **Background**

United States citizens become eligible to receive Medicare benefits upon reaching the age of 65. Currently, there are three birth cohorts with Medicare eligible members. For this study, the break down of these three birth cohorts is as follows:

1. Greatest Generation Cohort (Brokaw, 1998), also termed the GI Generation (Straus & Howe, 1992) includes individuals born between 1901 and 1924 (US Census Bureau, 2011).
2. Silent Generation Cohort includes individuals born between 1925 and 1945.

There is some discrepancy in the birth years for this generation cohort. For this generation cohort, Straus and Howe selected the years between 1925 and 1942 in their acclaimed book published in 1992 titled “Generations: A History of America’s future”. However, the U.S. Census Bureau supports the idea that the Baby Boom generation began in 1946, after World War II. Using this approach

for this study, the birth years for the Silent generation Cohort will extend from 1925 to 1945.

3. Baby Boomer Generation Cohort includes individuals born between 1946 and 1964 (U. S. Census Bureau, 2011).
  - a. Those born in 1946 became eligible by age for Medicare enrollment in 2011.

There are approximately 900,000 people over the age of 65 currently living in Virginia and this number is expected to double to approximately 1.8 million by 2030 (Older Dominion Partnership, 2011). The VCU School of Dentistry provides dental care for all citizens of all ages in the Commonwealth of Virginia. The population of patients seen at the VCU Dental School is diverse, displaying variance in age, race, residential location and payment sources. For this exploratory study, secondary data was used on patients age 47 and over seen in the year 2011 at the VCU School of Dentistry. In the year 2011, members of the Baby Boom cohort born in 1946 became eligible, by age, for Medicare enrollment. Findings displayed by Baby Boom cohort members will provide insight on dental coverage and utilization patterns displayed by members of this cohort. Evaluating any differences in dental coverage and utilization of dental services displayed by these age cohorts, as listed, can aid in determining if cohort succession supports lag in the Medicare policy.

Cohort membership shapes socioeconomic and psychosocial aspects of life. A cohort effect may result from historical factors as cohorts who lived through different historical events had different life experiences than cohorts who did not live through those events. Also, the effects of these events vary depending on the age of those who experienced them (George, 2000). Another type of cohort effect reflects compositional characteristics. An example of this

is that the Baby Boom cohort is a large cohort that may face greater competition for social resources than smaller cohorts (George, 2000). It is helpful, when searching for causal explanations, to know whether an underlying mechanism affected only specific cohorts - a cohort effect. Cohort effects enable the observation of the social implications of shared history and cohort composition.

Individuals age 65 years and older generally have the lowest level of dental insurance coverage, in part due to loss of employer-provided insurance at retirement (CDC, 2002). CDC reports indicate that in 1965, when the Medicare policy was implemented, life expectancy was 70 years of age. Life expectancy for the year 2011 is estimated to be 78.5 years and for the year 2025 it is estimated to be 80.5 years (National Center for Health Statistics, 2010). The increase in life expectancy aids in supporting the need to address policy lag in Medicare. In the U.S., there has been a significant reduction in edentulousness (no teeth) in adults over the age of 60, from 31% in 1988-1994 to 25% in 1999-2002 (Beltran-Aguilar et al, 2005). The increase in the number of individuals entering retirement, and the fact that more older adults are retaining some or all of their natural dentition/teeth has helped to make the need to address policy lag more apparent. With limited information addressing this issue, attention is drawn to the need to evaluate policy change (Borrell, 2008).

### **Problem and Study Significance**

The utilization of routine dental care services is an important component of maintaining oral health (ADA, 2009). An important fact is that dental health impacts overall health. Research supports links between dental health and cardiovascular disease (Genco, Offenbacher & Beck, 2002; Grau, Becher, Ziegler, Linchy, Bugge, Kaiser, Lutz, Baltmann, Preusch, & Dorfer, 2004), diabetes (Steward, Wagner, Friedlander & Zadeh, 2001), mental health (Watts,

Crimmins & Gatz, 2008), rheumatoid arthritis (Fletcher, 2008), and pneumonia (Tarpenning, 2005). All of these chronic conditions are prevalent in the older adult population (Bhardwaj, Dubin, Cheng, Maurer & Granieri, 2008). The paradigm of dental care for the older adult population has shifted from predominantly denture care to complex restorative procedures, esthetic dentistry, orthodontics and the placement of implants (Ettinger & Mulligan, 1999; Eklund, 1999). This shift is because of the increase in the number older adults retaining some or all of their natural dentition. This shift increases the need for routine preventative dental care. The preventative routine adult dental prophylaxis procedure is an important component of maintaining oral health (ADA, 2009).

According to the Centers for Disease Control (CDC), whether older adults get needed dental care is closely related to whether they have dental insurance (CDC, 2001). Issues affecting dental health in older adults support the need to explore the gap in dental coverage in the health care system. With only 30% of the adults 65 years and older covered by private dental insurance (Manski & Brown, 2007), most dental care expenses for the elderly are paid out of pocket (CDC, 2001). Dental care coverage in older adults is a topic that is not well studied resulting in minimal data published. However, available data indicates that 34% (Manski, Moeller & Mass, 1999), 22% (CDC, 2001) and 10% (Manski et al, 1999) of dental expenditures were paid by private insurance in 1996, 1995 and 1987 respectively in adults age 65 and over. Seventy five percent of dental expenditures are paid out of pocket by adults aged 65 and over (Agency for Healthcare Research and Quality, 2005).

This study is significant in that it will add to existing knowledge pertaining to a health care issue with broad ramifications that is not well understood because of minimal investigation. New research findings aid in evaluating how the transition to Medicare, which does not include

dental coverage, impacts dental care coverage and utilization of dental services in adults age 47 and over utilizing dental care at the VCU Dental School. Exploratory studies are needed to aid in laying a foundation for better understanding lag displayed by the Medicare policy and if it creates a gap between current need and the policies currently in place. Knowledge from new research will assist in determining a need to conduct investigations that address the cost to society resulting from the impact of dental health on overall health in birth cohorts.

### **Purpose**

As dental care has evolved, cohorts have adopted different attitudes toward dental care. Funding for dental care has not kept up. Medicare does not provide dental coverage. This study evaluates the differences displayed in dental coverage and utilization of dental services by the members of the Baby Boom, Silent Generation, and Greatest Generation Cohorts who received dental care at the VCU School of Dentistry in 2011. Differences are evaluated to determine if cohort succession supports lag in the Medicare policy in adults age 47 and over receiving dental care at the VCU School of Dentistry. Findings from evaluating this association may aid in laying a foundation for addressing the health care disparity caused by the lack of dental coverage in Medicare.

### **Theoretical Framework**

Utilizing the life course approach, different cohorts have been exposed to different interpretations of the need for dental care. Before WWII, there was minimal focus on oral health as part of overall health, life spans were shorter and there were fewer dentate older adults. In contrast, the majority of the members of the Baby Boomer generation were raised receiving some form of oral/dental care. Many from this cohort continued dental care throughout their life course as many had dental insurance through their place of employment. Medicare does not

cover dental care, and after retiring most of these individuals will lose their dental insurance coverage and may not have the personal funds to continue such care on their own, impacting needed utilization of dental care. With the Baby Boom cohort being so much larger than the other two cohorts in this study it is important to address the differences by cohort in dental care background and expectations.

The Structural Lag Theory was used as a conceptual framework for this study. The central theme of this theory focuses on the dynamic interplay between the processes of aging and cohort succession, on the one hand, and changing social structures, on the other hand. The construct - dynamism of changing lives was measured by the variable cohort membership, which addressed cohort succession. The construct - dynamism of structural change was measured by two different variables: 1) dental care coverage type, which will be defined as Medicare advantage plans with dental coverage, employer provided, personal private dental coverage and out of pocket; 2) dental care utilization, measured by total amount spent on dental services by patient and by whether a patient had a routine adult dental prophylaxis procedure performed in 2011. These variables address the institution of dental care coverage and dental care utilization.

### **Research Questions**

This exploratory study sought to evaluate the associations between cohort membership, type of dental coverage, and utilization of dental care services in adults age 47 and over who received dental care at Virginia Commonwealth University's (VCU) School of Dentistry. The following questions were addressed:

1. What percentage of older patients have dental coverage, what type is it, and how does this vary by cohort?



2. Does cohort membership predict the existence of dental coverage among older patients?
3. Does the existence of dental coverage predict dental utilization by cohort?
4. Will older adults with dental coverage pay higher amounts for dental services and display more utilization of routine adult dental prophylaxis procedures than those without?
5. Does cohort membership predict the utilization of routine adult dental prophylaxis?

### **Analytical Strategies**

Secondary data, extracted from Axium, the VCU Dentistry Clinical Database system, was entered and analyzed in the PASW/SPSS 19 program. Frequency tables identified misclassified or improperly coded data. Histograms were used for screening of outliers and to check normality. Diagnostics included Pearson Correlations, the Variance Inflation Factor (VIF), and tolerance values to assess intercorrelations and multicollinearity. Multicollinearity exists when independent variables are highly correlated. Correlations in the Pearson coefficient matrix were examined to determine if the correlation coefficient between two explanatory variables is .75 or higher (Tabachnick & Fidell, 2007). The VIF rule of thumb stating 10 or higher or equivalently, tolerances of .10 or less, was used (Hair, Anderson, Tatham & Black, 1995; Multicollinearity, 2012).

Variables and models are examined to ensure they met the assumptions of the statistical models. In the event that they do not, steps are taken to address any deviations from these assumptions (e.g. natural log and a separate block method).

Descriptive statistics were used, pertaining to cohort membership, gender, race, place of residence, Medicare enrollment status, and type of dental coverage. Chi<sup>2</sup> tests, multiple regression analyses and standard logistic regression analyses addressed the research hypotheses.

### **Scope of the Study**

For this exploratory study, a cross-sectional non-experimental study design was performed using secondary data on patients age 47 and over who utilize dental services in 2011 at the VCU School of Dentistry. Variables extracted from the secondary data and evaluated include: age, type of dental coverage/payment source, race, gender, Medicare enrollment status, zip codes to determine place of residence, defined as rural or urban. The total amount spent on dental services rendered and if patient has had a routine adult dental prophylaxis procedure at VCU Dental School 2011 are also variables that were extracted. All data comes from records retained by the VCU School of Dentistry for the year 2011.

### **Summary**

Chapter 1 provides a statement pertaining to the background and problem addressed by this exploratory study. Also included in this chapter is the purpose, study significance and the research questions. This type of study design and methodology enabled an evaluation of the association between cohort membership, type of dental coverage and utilization of dental services in patients age 47 and over who receive dental services in 2011 at the VCU School of Dentistry.

Chapter 2 provides a literature review that supports the need for dental care, and synthesizes and critiques previous work. The rationale for formulating the analytical framework is provided. An explanation pertaining to how the Structural Lag Theory creates a framework for this study and assists in the development of the hypotheses, is also provided.

The following chapters also provide, in Chapter 3, the methods used to conduct this study. The results stemming from the hypotheses tested in Chapter 3 are revealed in Chapter 4. Chapter 5 provides a discussion pertaining to the results.

## **Chapter 2: Literature Review**

### **Overview**

Chapter Two provides an overview of the literature pertaining to the relationship between Medicare enrollment, dental care coverage and utilization of dental care services in the older adult population. Provided is a review of material addressing the importance of the oral-systemic relationship in older adults and the barriers to access dental care faced by this population. There is a brief discussion on the status of this issue from a national and state level. Cohort membership and comparison will be discussed. Also provided is a description of how Structural Lag Theory serves as the theoretical framework for this exploratory study.

### **Importance of Maintaining Oral Health in Older Adults**

Though not required to fully retire, eligible individuals receive Medicare benefits at the age of 65. The Medicare policy does not cover preventative and routine dental services (Centers for Medicare & Medicaid Services, 2010). However, research supports a link between dental health and cardiovascular disease, diabetes, mental health, rheumatoid arthritis, and pneumonia. (Genco, Offenbacher & Beck, 2002; Grau et al., 2004; Steward, Wagner, Friedlander & Zadeh, 2001; Watts, Crimmins & Gatz, 2008; Fletcher, 2008; Scannapieco, 1999).

Impaired oral health may adversely affect diet, nutrition, sleep patterns, psychological status, social interactions and other activities of life in some older adults (Gluck & Morganstein, 2003). Research findings suggest that the improvement of oral health may have a positive

impact on general health and may delay mortality (Padilha, Hilgert, Hugo, Bos & Ferrucci, 2008). Maintaining good oral health is a critical factor in maintaining overall health and well being in older adults. The oral cavity provides the entrance to the body for every nutrient necessary for life (Rosenthal, Williams & Naughton, 2006).

Prevention was the main theme presented in the Institute of Medicine's 2011 report for improving access to oral health care for vulnerable and underserved populations. "Oral health promotion and disease prevention are essential to any strategies aimed at improving access to care." (Institute of Medicine, 2011, p.34). Routine dental visits, which include an exam and periodontal care, which ranges from a basic routine adult dental prophylaxis (cleaning) to more in depth periodontal therapies, are an important component of maintaining oral health at any age. Dental treatment for the older adult population has shifted from primarily providing denture care to providing more restorative and periodontal care (Donaldson, 2011). This change is primarily due to an increase in the number of older adults retaining more of their natural dentition. The number of older adults who have retained some or all of their natural dentition is increasing as the percent of the older population that is edentulous is in decline (U.S. Department of Health and Human Services, 2000). The rate of edentulism in the U.S. has declined significantly from 20.3% in 1972 to 13.9% in 2001 (Cunha-Cruz, Hujoe, Nadanovsky, 2007).

Routine dental visits enable the detection of early signs of decay/cavities and disease along with the treatment of problems at a manageable stage. According to the American Dental Association routine dental exams uncover problems in early stages making them more easily treated and preventing increased damage (American Dental Association, 2011). On average, seeing a dentist twice a year works well for most people. A few people can get away with fewer visits; others may need more frequent visits (American Dental Association, 2009). During an

oral exam that is performed at every routine dental visit, the teeth and gums are examined and any abnormalities such as lumps, swellings, discolorations and ulcerations are looked for. When deemed necessary, biopsies, diagnostic tests for chronic or infectious diseases and salivary gland dysfunction, and screening tests for oral cancer are conducted. This screening aids in detecting early warning signs in the mouth that indicate disease elsewhere in the body and proper referrals can be made (ADA, 2009). The American Cancer Society (ACS) recommends annual oral examinations for adults age 40 and over (American Cancer Society, 1998), and U. S. Preventative Services Task Force (USPSTF) recommends regular dental visits for adults age 65 and over (U.S. Preventative Services Task Force, 1996).

### **Needs Assessment**

**Oral-systemic relationship in older adults.** The increase in dentition retention has improved masticatory function; however, the risk for acute and chronic oral disease persists later in life. Oral infections have a more profound effect on older adults compared to other segments of the population (Meurman & Hamalainen, 2005). Without early prevention and control interventions, older adults bear a greater oral disease burden than other age groups (Lamster & Crawford, 2008). Compromised oral health and oral bacteria have been linked to cardiovascular and cerebrovascular disease, pneumonia, stroke, diabetes, arthritis and Alzheimer's Disease. Researchers have found that periodontitis, which is the advanced form of gum disease, is linked with health conditions such as cardiovascular disease (Genco, Offenbacher & Beck, 2002), stroke and bacterial pneumonia ("Healthy Mouth Healthy Body", 2005). There is a high prevalence of periodontitis in older adults (Boehm & Scannapieco, 2007) making the oral-systemic interaction an important issue to address (Barnett, 2006).

**Cardiovascular disease.** Epidemiological studies have found a strong association between periodontal disease and cardiovascular disease as periodontal inflammation has a significant effect on atherosclerosis and its process (Beck & Offenbacher, 2001). Periodontal disease is also associated with the increased risk of stroke as a result of its inflammatory affect associated with atherosclerosis (Grau et al., 2004).

**Diabetes.** The affects of periodontal disease are magnified in those who also have diabetes. Some studies have shown that having periodontitis causes an increase in the blood sugar level affecting a diabetic's ability to control their blood sugar level. Treatment and control of periodontal disease has been shown to improve glycemic control in diabetic patients (Steward, Wagner, Friedlander & Zadeh, 2001). The relationship between oral health and diabetes has been explained as bidirectional. Diabetes increases the probability of developing periodontal disease while periodontitis also increases the risk of poor glycemic control in diabetics (Gurenlian, 2006). Poorly controlled diabetics are at a higher risk for alveolar bone loss and their severity of periodontal disease is greater than in those with good control of their diabetes (Choi, McKeown, Mayer-Davis, Liese & Merchant, 2011; Soskolne, 1998; Taylor, Burt, Becker, Genco & Shlossman, 1998). Conversely, the presence of periodontal disease may impact metabolic control of diabetes (Soskolne, 1998).

**Respiratory Disease.** Respiratory disease, especially pneumonia, is a common cause of mortality in older adults. The oral cavity is an entry point for respiratory pathogens and teeth serve as reservoirs for these pathogens as do dentures and/or partials. These pathogens can be aspirated into the lower airway increasing the risk of infection (Scannapieco, 1999). Poor oral health has been linked to linked to nursing home acquired pneumonia (NHAP) (Adachi, Ishihara,

Abe, Okuda, & Ishikawa, 2002; Mojon, 2002; Mojon & Bourbeau, 2003; Mylotte, 2002; Shay, 2002; Terpenning, 2005; Terpenning et al., 2001).

***Alzheimer's Disease.*** Periodontal disease is also associated with the increased risk of Alzheimer's Disease (Watts, Crimmins & Gatz, 2008). Inflammation caused by periodontal disease can damage brain tissue and increase the risk of dementia. Researchers reported at the first Alzheimer's Association International Conference on Prevention of Dementia that exposure to inflammation early in life from ailments such as chronic periodontal disease quadruples an individual's risk of developing Alzheimer's disease (American Dental Association, 2005).

***Rheumatoid arthritis.*** Rheumatoid arthritis and periodontal disease are both inflammatory disorders and this similarity helps support the link between the two conditions (Fletcher, 2008). Both diseases share risk factors and have pathological pathways in common, resulting in loss of function and disability as a final clinical outcome. There is evidence to suggest that individuals with moderate to severe periodontal disease are at higher risk of suffering from rheumatoid arthritis and vice versa (Pischon et al., 2008).

***Oral cancer.*** Oral cancer is quite prevalent in older adults. Approximately 15,000 older adults are affected by oral cancer each year. The average age of diagnosis is 60-65 years (U.S. Department of Health and Human Services, 2000; Ries, Kosary, Hankey, Miller, Clegg & Edwards, 1999). Based upon information found at <http://seer.cancer.gov/statfacts/html/oralcav.html>, as posted on the National Cancer Institute site, the median age at death for cancer of the oral cavity and pharynx was 67 from 2003 to 2007. The CDC reported that oral cancer is responsible for nearly 8,000 deaths each year and more than half of these occur among those aged 65 and older (CDC, 2001). Routine dental examines are needed for early detection of oral cancer.



**Xerostomia.** Routine preventative dental visits are especially important for older people since many suffer from xerostomia (dry mouth), which slows down the flow of saliva. Saliva plays a major role in preventing tooth decay by rinsing away food particles and neutralizing harmful acids maintaining a neutral-pH. Xerostomia is not caused by aging, but is more prevalent in older adults as it is a side effect caused by medications used to treat chronic conditions. These medications include antihistamines, decongestants, antidepressants, diuretics, antiparkinsonian, antihypertensives and antiseizure (Mayo Clinic Staff, 2011). Reduced saliva production leads to burning mouth, which impacts the ability to swallow, taste food, speak and maintain tissue integrity. Routine dental visits aid in the detection and care of symptoms presented by xerostomia. Preventative visits aid in detecting and diagnosing xerostomia and implementing interventions to help reduce the side effects of the condition (Asa, 2009).

**Importance of maintaining oral health - impact on nutrition.** Impaired oral health may adversely affect diet and nutrition. Gum disease, tooth decay, oral infections, oral cancer, malocclusion, missing teeth, and weakness of the orofacial musculature can all inhibit the intake of nutrients and impact overall health of an older adult. Diabetes is prevalent in the older adult population. Periodontal disease is a common complication of diabetes, thereby poor nutritional habits can have a more significant impact on the health of oral soft tissues in older adults who have diabetes (Loe, 1993).

The process of nutrition, providing the body with the vitamins, minerals and nutrients that it needs, begins in the oral cavity. In the oral cavity both physical and chemical digestion begins. Although oral digestion only lasts about 30 seconds, it has a very important impact on overall digestion and may influence the entire digestive process, including the metabolic response to starches (Hoebler, Karinthi, & Devaux, 1998). Biting and chewing breaks the food

into pieces small enough to be safely swallowed. This is the mechanical part of the oral digestive process. This process of mastication may be more challenging to some older adults as they may suffer from broken un-repaired teeth, arthritis in their temporal mandibular joint, wear ill-fitting dentures or partials, have untreated periodontal disease or suffer from dysphagia.

Micronutrients such as Iron, Vitamin B12 and Folate are critical for maintenance of oral mucosal health. Deficiencies in these can lead to a smooth red tongue and cause burning mouth syndrome. Also associated with deficiencies of micronutrients in older adults is the occurrence of angular cheilitis (sores in the corners of the lips) and denture stomatitis syndrome in older adults who wear dentures and/or partials. Both of these conditions are associated with candida, which is a yeast infection (Sweeney, Bagg, Fell & Yip, 1994).

As mentioned, dry mouth is not a normal consequence of aging and in healthy adults changes in salivary composition and flow are minimal to nonexistent (Nagler, 2004). Dry mouth is usually disease or medication-induced. Many medications that older adults take for their chronic conditions such as high blood pressure and diabetes affect their saliva flow which often impacts their taste and ability to eat.

The Geisinger Health System conducted a study of residents residing in rural Pennsylvania. Findings from the Geisinger Rural Aging Study (GRAS), a nutritional risk screening study of participants age 65 years and older in a managed-risk Medicare insurance program, revealed that oral health problems are associated with impaired nutrient intake as well as poorer general health. These results were strong, even after adjusting for confounders such as use of tobacco and alcohol, total kilocalorie intake, sex, and age in this sample (Bailey, Ledikwe, Smiciklas-Wright, Mitchell & Jensen, 2004).

**Importance of maintaining oral health - impact on over-all wellbeing.** Also directly related to oral health are feelings of social well-being and self-image, which affect psychological well-being. Older adults who experience discomfort while wearing their partials or dentures or are just unable to wear these prosthetics for some reason, or who have broken or chipped teeth are more likely to withdraw from their normal social activities. Many may feel the appearance of their teeth or mouth is unattractive or not socially acceptable. This can lead to isolation and possible depression, negatively impacting their psychological well being and affecting their over-all wellbeing. There are various negative character traits assigned to people with a bad dental appearance and the converse of that is that positive character traits are assigned to those who have good teeth (Price, 2000). Research results suggest that poor self perceived oral health and relatively poor quality of life co-exist in subgroups of older adults (Locker, Clarke & Payne, 2000).

**Barriers affecting oral health in older adults.** The baby boom generation, as defined by the U.S. Census Bureau, is comprised of Americans born during the 17 years following World War II between 1947 and 1964. More dental services will be required by this cohort than previous senior cohorts, however, their ability to afford these needed services may be limited (Ferguson, Steinberg & Schwien, 2010). The lack of dental coverage and rising healthcare costs could put less affluent seniors at risk for inadequate access to dental care (Ferguson, Steinberg & Schwien, 2010). Recognizing the growing numbers of seniors and the impact that dental services can have toward improving their oral and overall health, barriers affecting oral health need to be re-considered to help promote continued access to dental services for this population now and in the future. Healthy People 2000 reported that having adequate access to medical and dental care can reduce morbidity and mortality, preserve function and enhance over quality of

life (National Center for Health Statistics, 2001; Healthy People, 2010). Older adults have an increased need for care; however, barriers to care cause many elders not to receive care on a routine basis (Stanton & Rutherford, 2003). The following is a breakdown of barriers to dental care faced by members of Medicare eligible cohorts.

***Lack of education/awareness.*** Many older adults seek dental care only when they are in pain or discomfort despite the fact that the U.S. Public Health Service recommends annual oral examinations for all adults (United States Public Health Service for Adults, 1994). Postponing care until pain develops eliminates the opportunity to diagnose and treat disease in its early stages, thereby increasing one's risk of developing a serious, disabling and potentially disfiguring disease. As previously stated, routine dental examines are needed for early detection of oral cancer. As stated previously, the median age at death for oral cancer is 67.

***Physical and cognitive limitations.*** Neurologic diseases and musculoskeletal conditions impair the ability to practice proper oral hygiene techniques (Kaplan, 2000). Also, behavioral disturbances associated with dementia can adversely impact oral care (Arai, Sumi, Uematsu & Miura, 2003).

***Frailty.*** Older adults have multiple chronic diseases and medical problems that complicate their dental diagnosis, treatment and daily care (Beck & Offenbacher, 1998). To be considered frail an individual must have three of more of the following characteristics: Low physical activity, Muscle weakness, Slowed performance, Fatigue or poor endurance and/or Unintentional weight loss (Torpy, 2006).

***Lack of adequate transportation.*** Adequate transportation is also a burden affecting access especially in more rural areas where transit systems are not available and/or accessible

(Yellowitz, 2008). A survey found that transportation issues accounted for nearly 85% of dental-care barriers listed by seniors age 85 and over. (“Many American elderly”, 2005).

***Attitudes and practices of oral health professionals.*** Another barrier faced by older adults when it comes to obtaining proper oral health care is the attitude of some oral health care professionals (Yellowitz, 2008). Some of these professionals may be uncomfortable working with older adults, especially older adults with severe chronic conditions, disabilities or cognitive impairment (Bhardwaj, Dubin, Cheng, Maurer & Granieri, 2008). Often this uncomfortable attitude is due to inadequate training during the professional educational process. This type of attitude can impact the quantity and type of dental services offered by oral health professionals.

***Shortage of dentists.*** There is a reported decline in the dentist-to-population ratio, which will adversely affect the older adult population as it is the fastest growing (USDHHS, 2000). The shortage of skilled geriatric dental care professionals is part of a larger national shortage of geriatricians. As the older adult population increases in number, the number of geriatricians decreases. According to the American Geriatrics Society, there is one geriatrician for every 2,620 Americans 75 or older. Due to the projected increase in the number of older Americans, this ratio is expected to drop to one geriatrician for every 3,798 older Americans in 2030 (American Geriatrics Society, 2011). Few dental care professionals are trained to provide care to the older adult population as dental hygiene and pre-doctoral dental education programs provide limited didactic training and rarely allow students opportunities to work with medically compromised and cognitively impaired dependent older adults (Yellowitz, 2008).

***Lack of funding for dental care.*** Obtaining oral health care is influenced greatly by financial resources. Medicare does not cover the cost of dental care, except in certain very specific situations such as reconstruction of jaw after an accident injury, or extractions deemed

necessary for radiation treatment for neoplastic disease of the jaw, or a dental exam, but not treatment, for renal procedures or heart valve replacement (“Medicare Dental”, 2011). The burden of dental expenses being paid for out of pocket has a significant impact on older adults receiving proper oral care as the older individuals themselves may opt not to receive routine dental services, especially if they are not in pain, so they can cover the cost of other services/needs they deem as being more important. Survey findings indicated that the lack of dental coverage presented a barrier to dental care access for study participants age 60 and over (“Many American elderly”, 2005).

Dental care coverage provided through Medicaid varies from state to state and region to region within a state (Virginia Department of Medical Assistance Services, 2010). After viewing the website [http://www.quickbrochures.net/medicare/virginia\\_medicaid\\_medicare.htm](http://www.quickbrochures.net/medicare/virginia_medicaid_medicare.htm), this can be a difficult system to navigate in order to go about obtaining dental coverage which is usually in the form of a reimbursement. Table 1 shows the variance in state Medicaid programs with regard to adult dental coverage provided by.

Table 1. Variance in State Medicaid Adult Dental Coverage in 2007 (McGinn-Shapiro, 2008)

No dental coverage	6 States
Only emergency dental service (i.e. extractions)	16 States
Exclude coverage in at least one category of service (generally periodontal and advanced restorative services such as root canals and crowns)	13States
Coverage in all dental service categories	16 States

**Oral health care in nursing home facilities.** Claims are made that oral health in these facilities is not maintained due to lack of adequate staff numbers, lack of proper staff education and lack of adequate funding to assist in making a change. Oral care in institutional settings is often neglected, although the minimum data set (MDS) includes a section on resident oral health. The prevalence of dental pain in nursing home residents, especially those with dementia, is high (Cohen-Mansfield & Lipson, 2002). In 1987, the Omnibus Budget Reconciliation Act (OBRA '87) was introduced and became effective on April 1 of 1990 (Yellowitz, 2008). This legislation states that all nursing home facilities receiving Medicaid and Medicare reimbursements must provide routine and emergency oral health care to their residents ("U.S. Code Collection", 2010). Medicaid pays for the majority of nursing home care in the U.S., but in many states it does not cover dental service costs for Medicaid-eligible nursing home residents. This lack of coverage, despite the mandate to provide routine and emergency oral health care, makes the provision of dental service/care unrealistic in many of these facilities. Virginia is one of the states that does not cover adult dental care in its Medicaid program. Research shows that in states where adult dental care is covered by Medicaid the probability of a dental visit increased by 5.9% (Choi, 2011)

### **Status of Issue**

At the national level, the U.S. Department of Health and Human Services has prompted a national call to action to promote oral health ("National Call", 2010). Origins of this call to action stem from the document titled Oral Health in America: A report of the Surgeon General, in which a major theme is oral diseases and disorders in and of themselves that affect health and well-being throughout life. Regarding the older adult population, this report recognizes the impact oral health has on overall health and well being and the challenges faced by this

population to maintain oral health. The Vision of the “Call To Action” is to advance the general health and well-being of all Americans by creating critical partnerships at all levels of society to engage in programs to promote oral health and prevent disease. The Goals of the “Call To Action” which are to promote oral health, to improve quality of life and to eliminate oral health disparities, reflect those of “Healthy People 2010” (U.S. Department of Health and Human Services, 2003). “Healthy People 2010 is designed to achieve two overarching goals: The first goal of Healthy People 2010 is to help individuals of all ages increase life expectancy and improve their quality of life. The second goal of Healthy People 2010 is to eliminate health disparities among different segments of the population” (“Healthy People”, 2010). The Actions of the “Call To Action” include: Change perceptions of oral health; overcome barriers by replicating effective programs and proven efforts; build the science base and accelerate science transfer; increase oral health workforce diversity, capacity, and flexibility and increase collaborations (U.S. Department of Health and Human Services, 2003).

Professional organizations such as the American Dental Association (ADA) and the American Dental Hygiene Association (ADHA) have initiated programs and are cultivating ideas to help combat this oral health issue. The ADA has launched an Oral Longevity Initiative which is designed to increase awareness about the oral health needs of older Americans. Specifically, the Oral Longevity program encourages patients to visit the dentist where they can receive information and guidance from trusted professionals. Oral Longevity educational materials explore the link between oral health and general health and discuss ways to keep your teeth for life (“Oral Longevity”, 2010).



According to Ron Tankersley, the 2009-2010 ADA President, the ADA advocated for rebuilding the dental infrastructure in public health but no funds in the trillion-dollar healthcare reform bill were specifically targeted for the underserved dental care population (Snead, 2010).

The (ADHA), in an effort to provide a solution to the issue of access of dental care, is working to establish the Advanced Dental Hygiene Practitioner (ADHP) as a mid-level oral health care provider that will leverage the existing dental hygiene work force to have an even greater impact on the delivery of care to those in need (“The Advanced”, 2010). An ADHP will be educated and licensed to provide both preventative and limited restorative services to meet identified patient needs. Dentists are in short supply in rural areas and this mid-level provider may increase access to the older adults living in those areas and in nursing home facilities which seem to be unpopular sites for dentists to practice.

The 2009 President of the Virginia Dental Hygiene Association, Kelly Williams, RDH, MSDH , spoke with the Virginia Dental Association’s Executive Board at their January, 2009 meeting. Ms. Williams spoke regarding the role of an Advanced Dental Hygiene Practitioner (ADHP) and how this role of an expanded function dental hygienist as a mid-level provider could make a positive impact on the communities they would serve (Williams, 2009). She also discussed with the board the benefits to the public if the dental hygienist were to have more direct access to the population versus general supervision.

At the state level, the Virginia Department of Health’s Division of Dental Health has launched Beyond the Smile: The Campaign for Adult Oral Health. Through this campaign, the Division of Dental Health is developing and offering new programs and education materials for adults. Current educational programs include Virginia’s oral cancer project, diabetes and oral

health, oral health for the elderly and disabled, oral health and overall health-a healthy body begins here, and senior smiles (“Adult and Elderly”, 2010).

The Division of Dental Health has completed collecting data from a survey they conducted for the under-served older adult population to assess dental oral health of this population in Virginia. Through personal communication, June 7, 2011, with Tonya McRae Adiches, Adult Oral Health Coordinator with the Virginia Department of Health Division of Dental Health, I learned that their in-house epidemiologist has the report and wants to streamline it before she gets it. (Tonya McRae Adiches, personal communication, June 7, 2011). This data will be very beneficial in determining the need for, creating and implementing programs that may help better serve the older adult population's dental health needs in the state of Virginia.

**How the issue is being addressed in other states.** Increasing awareness of oral health needs and barriers faced will not only aid in preparing oral health care professionals to address these issues, but will also support a positive impact on the overall health and well-being of members of the growing older adult population. Virginia is not the only state in which barriers to oral health care for older adults are being addressed. Various efforts and approaches have been implemented throughout the U.S. to address the barriers affecting oral health in the older adult population. The following section will briefly discuss some approaches implemented in different states.

**New York.** In 2005, the state of New York developed Oral health Plan. One of the State Objectives was to ensure that all health care workers employed to assist the elderly and people with disabilities are trained in daily oral health care for the individuals they serve (New York State Department of Health, 2005).

**Massachusetts.** Through grant funding received by the Oral Health Care Initiative of North Central Massachusetts the provision of dental services has been expanded to older adult who do not receive routine dental care (The Health Foundation, 2011).

**Florida.** Project: Dentists Care (PDC) is a state-wide dental access to care network overseen and supported by the Florida Dental Health Foundation, Inc. Under the PDC banner, clinics and referral programs are organized by local dentists who volunteer their time and services to offer preventive and restorative dental care to Floridians in greatest need, which includes members of the older adult population (Florida Department of Health, 2011).

**California.** The California Statewide Task Force on Oral Health for People with Disabilities and Aging Californians is designed to advocate for and expand access to affordable, quality oral health care for people with disabilities and older Americans (Community Involvement, 2011).

### **Cost and Insurance for Dental Care in Older Adult Population**

The nation's total bill for dental services in 2002 was estimated by the Department of Health and Human Services' Centers for Medicare and Medicaid Services to be \$70.1 billion. However, this figure underestimates the true cost because it does not take into account the indirect expenses of oral health problems, nor the cost of services by other health care providers for treatment of conditions stemming from oral health problems (U.S. DHHS, 2003).

In 2010, an estimated \$108 billion was spent on dental services in the United States (CDC, 2011). According to the Centers for Disease Control (CDC) whether older adults get needed dental care is closely related to whether they have dental insurance (CDC, 2001). Having dental insurance has been shown to be an important factor in the decision to seek dental care (Manski, Macek & Moeller, 2002). With data analysis determining that only between 22-30% of

adults aged 65 years and older are covered by private dental insurance (CDC, 2001; Manski, Goodman, Reid & Macek, 2004; Manski & Brown, 2007), most dental care expenses for the older adult population are paid out of pocket (CDC, 2001). Available data indicates that 34% (Manski, Moeller & Mass, 1999), 22% (CDC, 2001) and 10% (Manski et al, 1999) of dental expenditures were paid by private insurance in 1996, 1995 and 1987 respectively. Seventy five percent of dental expenditures are paid out of pocket by adults aged 65 and over (Agency for Healthcare Research and Quality, 2005).

The Medicare program, as a policy, does not cover routine dental care (Medicare, 2011; Centers for Medicare & Medicaid Services, 2010). Research has shown that the advantages of dental insurance on dental care utilization are more likely to benefit individuals from middle to lower income groups (Eklund, 2001). Issues affecting dental health in retired adults support the need to explore the gap in dental coverage in the health care system.

CDC reports indicate that in 1965, when the Medicare policy was implemented, life expectancy was 70 years of age. Life expectancy for the year 2011 is estimated to be 78.5 years and for the year 2025 it is estimated to be 80.5 years (National Center for Health Statistics, 2010). According to the CDC, research has shown that in the U.S., there has been a significant reduction in edentulism (no teeth) in adults over the age of 60, from 31% in 1988-1994 to 25% in 1999-2002 (Beltran-Aguilar et al, 2005). With an increase in the number of older adults retaining more of their natural dentition, geriatric dental care can no longer be equated with denture care. The paradigm of dental care for the older adult population has shifted from predominantly denture care to complex restorative procedures, esthetic dentistry, orthodontics and the placement of implants (Ettinger & Mulligan, 1999; Eklund, 1999). This shift increases the need for routine preventative and restorative dental care.

With such a small percentage of adults 65 years and older covered by private dental insurance, as stated, most dental care expenses for the elderly are paid out of pocket. In a study analyzing data collected through the National Expenditure Survey administered in 1987, it was determined that only 10% of dental expenditures were paid by private insurance, and 79% were paid out of pocket by adults aged 65 and over (Manski, Moeller & Maas, 1999). Research has revealed that the safety net for comprehensive dental care is small and fragmented (Grant Makers in Health, 2001).

Older adults, not retired, are more likely to have dental coverage than retired older adults (Manski et al., 2010). Although the failure to receive needed care may result in poorer oral health, only 43% of the older adult population had at least one dental visit during 2004 (Manski et al., 2009). The older adult population has the lowest utilization rate of dental services (Jack, 1983). Using data from the 1999 NHIS, findings displayed that cost of dental care combined with lack of dental care coverage was second only to not having a dental problem as the reason respondents did not visit a dentist (Vargas, Dye & Hayes, 2003). Older adults with dental insurance are 2.5 times more likely to make regular dental visits (Manski, Goodman, Reid & Macek, 2004). Again, more members of this population have retained more of their natural dentition and hold more favorable oral health beliefs (Adegbembo, Leake, Main, Lawrence & Chipman, 2001). These findings suggest that providing older adults with dental insurance may serve as an enabler of dental service utilization. This will become even more important as more and more people keep their natural teeth into advanced old age. (Kiyak, & Reichmuth, 2005). Findings from an analysis of the Asset of Health Dynamics Among the Oldest Old dataset from 1993 to 1995 revealed that Medicare played a very important role in providing older minority Americans with access to medical care. However, in this same analysis it was clear that the lack

of Medicare dental coverage was a barrier to accessing dental care for this same population (Dunlop, Manheim, Song & Chang, 2002). Minimal attention has been placed on the limited amount of health programs or public policies directed toward improving the oral health of economically disadvantaged older adults (Marshall et al., 2009).

Using data from the 2002 Medicare Current Beneficiary Survey, the use of preventative dental care services by the US Medicare population was analyzed. Analysis showed that beneficiaries who used preventative dental care had more dental visits, but fewer visits for expensive non-preventative procedures. These same beneficiaries had lower dental expenses than beneficiaries who saw a dentist only for treatment of oral problems. The researchers conducting this study concluded that the addition of dental coverage for preventative care to Medicare could pay off by improving oral health of the older adult population and by limiting the costs of expensive non preventative restorative dental care for the dentate older adult population (Moeller, Chin & Manski, 2010). Table 2 provides a breakdown of the different types of dental coverage available to adults age 65 and over.

Table 2: Sources for the Provision of Dental Care to Adults Age 65 and Over

Funding Source	What is Covered
Medicare	<p>No coverage for routine dental care. Coverage is provided in very specific situations such as reconstruction of jaw after an accident injury, or extractions deemed necessary for radiation treatment for neoplastic disease of the jaw, or a dental exam, but not treatment, for renal procedures or heart valve replacement (“Medicare Dental”, 2011)</p> <p>A chart, displayed at <a href="http://www.centerforbenefits.org/downloads/Medicare-Preventive-Benefits-chart.pdf">http://www.centerforbenefits.org/downloads/Medicare-Preventive-Benefits-chart.pdf</a>, developed by <b>The National Center for Benefits Outreach and Enrollment (NCBOE, 2011)</b>, lists the Medicare Preventative Benefits. Dental exams and/or screenings are not included in the “Welcome to Medicare Exam” (<a href="http://www.centerforbenefits.org/downloads/Original-Medicare-Closer-Look-WME.pdf">http://www.centerforbenefits.org/downloads/Original-Medicare-Closer-Look-WME.pdf</a>) or in “Annual Wellness Exams” (<a href="http://www.centerforbenefits.org/downloads/Original-Medicare-Closer-Look-AWV.pdf">http://www.centerforbenefits.org/downloads/Original-Medicare-Closer-Look-AWV.pdf</a>).</p>

Table 2 Continued: Sources for the Provision of Dental Care to Adults Age 65 and Over

Funding Source	What is Covered
<p>Medicare Advantage Plans, (Sometimes called Part C or MA Plans)</p>	<p>Medicare Advantage Plans (like an HMO or PPO) are health plans run by Medicare-approved private insurance companies. Medicare Advantage Plans (also called “Part C”) include Part A, Part B. Medicare Advantage plans that include prescription drug coverage (Part D) are called Medicare Advantage-Prescription Drug plans, or MA-PDs. Medicare Advantage Plans include a variety of plans that may offer additional benefits to traditional Medicare, such as dental, vision and hearing, and/or health and wellness programs. In addition to the Part B premium, there is an additional monthly premium for the services included. Monthly premiums and how much is paid out of pocket for services vary depending on the plan. (CMS, 2011).</p> <p>Different types of Medicare Advantage Plans</p> <ol style="list-style-type: none"> <li>1. Health Maintenance Organization (HMO) Plans</li> <li>2. Preferred Provider Organization (PPO) Plans</li> <li>3. Private Fee-for-Service Plans</li> <li>4. Special Needs Plans (SNP)</li> </ol> <p>(<a href="http://www.medicare.gov/navigation/medicare-basics/medicare-benefits/part-c.aspx?AspxAutoDetectCookieSupport=1">http://www.medicare.gov/navigation/medicare-basics/medicare-benefits/part-c.aspx?AspxAutoDetectCookieSupport=1</a>).</p> <p>According to the October 2010 Kaiser Family Foundation Medicare Advantage 2011 Data Spotlight, the average Medicare Advantage premium in 2011 is \$43 (Gold, Jacobson, Damico &amp; Neuman, 2010).</p> <p>“Medicare pays plans a capitated rate for the 22 percent of beneficiaries enrolled in MA plans in 2008. These payments amounted to \$78 billion in 2007, 18 percent of total Medicare spending.” (<a href="http://www.medpac.gov">http://www.medpac.gov</a>).</p>
<p>Medigap</p>	<p>No Dental Coverage (CMS, 2011)  <a href="http://www.medicare.gov/publications/pubs/pdf/02110.pdf">http://www.medicare.gov/publications/pubs/pdf/02110.pdf</a></p> <p>“In 2011, enrollment in Medigap coverage increased by about 300,000 policies to 9.7 million, up from 9.4 million Medigap policies in force in December 2010.” ( <a href="http://www.ahipcoverage.com/2011/07/27/9-7-million-beneficiaries-rely-on-medigap-for-their-health-security-new-ahip-report-finds/">http://www.ahipcoverage.com/2011/07/27/9-7-million-beneficiaries-rely-on-medigap-for-their-health-security-new-ahip-report-finds/</a>).</p>
<p>Medicaid</p>	<p>States may elect to provide dental services to their adult Medicaid-eligible population or elect not to provide dental services at all as part of its Medicaid program. While most states provide at least emergency dental services for adults, less than half of the states provide comprehensive dental care. There are no minimum requirements for adult dental coverage. (<a href="https://www.cms.gov/medicaiddentalcoverage/">https://www.cms.gov/medicaiddentalcoverage/</a>)</p> <p>In Virginia, no routine dental care is covered under Medicaid for adults. “Adult dental services are limited to medically necessary oral surgery and the services used to determine the medical problem such as X-rays and surgical extractions.” (<a href="http://www.dmas.virginia.gov">www.dmas.virginia.gov</a>).</p>

Table 2 Continued: Sources for the Provision of Dental Care to Adults Age 65 and Over

Funding Source	What is Covered
Dental Clinics	Care provided varies from clinic to clinic. Most individuals must meet eligibility requirements as established by a clinic. Dental care may be free or there may be a minimal fee charged for services depending on the clinic's guidelines for services rendered.
Program for All Inclusive Care for the Elderly (PACE)	Some of these programs provide dental usually not on site, but through referrals to participating dental offices.  "It is an optional benefit under both Medicare and Medicaid that focuses entirely on older people, who are frail enough to meet their State's standards for nursing home care. It features comprehensive medical and social services that can be provided at an adult day health center, home, and/or inpatient facilities. PACE receives a fixed monthly payment per enrollee from Medicare and Medicaid. The amounts are the same during the contract year, regardless of the services an enrollee may need. Persons enrolled in PACE also may have to pay a monthly premium, depending on their eligibility for Medicare and Medicaid." <a href="http://www.medicare.gov/nursing/alternatives/pace.asp">http://www.medicare.gov/nursing/alternatives/pace.asp</a>

### Variance in Findings Supports Need For More Studies Addressing Lag in Medicare

Based on analysis of data collected in the 2006 Health and Retirement Study, 48% of all adults age 51 and over had dental coverage, but the coverage rate dropped steeply for adults 65 years and older, consistent with previous findings (Manski, Clair & Pepper, 2010). Analysis from this same study, also concluded that older adults not retired are more likely to have dental coverage than retired older adults, however, coverage rates only differed significantly by retirement status for the elderly between 51 and 64 years of age. Differences in coverage rates were also noted for race/ethnicity, income, age, marital status, family size, health status, education categories and presence of teeth (Manski, Clair & Pepper, 2010). However, in an analysis of the 2006 HRS data, it was found that retirement has no independent effect on out of



pocket dental expenditures once controlling for coverage (Manski, Clair & Pepper, 2010). The odds of taking up dental coverage were higher for persons aged 51 to 64 years and 65 to 69 years compared with those 75 years and older (Manski et al., 2009).

An evaluation of the HRS 2006 data indicated that fully retired persons are less likely to visit the dentist than non-retired elderly persons still in the labor force (Manski et al., 2009).

When 2004 HRS responses were compared to 2006 HRS responses, findings indicated that 75% of older adults not retired and out of the labor force had a dental visit in the two year span.

Comparatively, 71% of those partially retired, 62% of the fully retired, and 53% of those not retired and out of the labor force had a dental visit in the two year span (Manski et al., 2009).

Other study results indicate that once controlling for other factors, individuals who are fully retired report rates of use that are 20 percent higher than those who are not retired at all (Manski et al, 2009).

With variance in reported results, more studies are needed to aid in gaining a better understanding of the type of insurance plan a Medicare eligible member of a retirement eligible cohort is enrolled in and utilization of dental services and dental care coverage in adults age 65 and over. This better understanding will assist in addressing lag in Medicare. Study findings, previously stated, are results of the analysis of data collected from nationwide multistage sampling techniques, which aid in providing a representation of the older adult population at a national level, but does not provide an adequate representation of specific areas such as states, cities, counties or regions. More studies addressing this topic will also assist in determining a need for and establishing ways of improving access to oral health care to members of the older adult population as it is important component of overall health. More studies focusing on

specific geographic areas will help in determining if there are issues stemming from this topic and how they can be addressed at state and local levels.

### **Influence of Age Cohort on Structures**

Life-course patterns of people differ in successive cohorts. This difference creates collective pressure toward changes in social structures and roles. Common patterns of response as well as common definitions and beliefs transform to common norms and become institutionalized in revised structure and role as members of the same cohort respond to shared historical experiences (Riley & Riley, Jr, 1994). The identification of the cohort succession effects in a study using data from the Health Interview Surveys (HIS) conducted by the National Center for health Statistics (NCHS) suggested that “dental contact is a lifestyle trait that is relatively stable over the life course” (Wolinsky & Arnold, 1989, p.49).

Cohort succession was indicated as the cause for the rates of dental care use to consistently increase over time in Spain. Using data collected in three sequential Spanish National Health Surveys, the trend in the percentage of people visiting the dentist in a three month period was analyzed. Findings showed that the number of people visiting the dentist grew from 13.6% in 1987, to 17.2% in 1997 (Bravo, 2001). The researchers concluded that the dental utilization rate increased overall as older cohorts, characterized by fewer dental visits, die and are replaced by younger ones.

By comparing socioeconomic and dental events over time, one can track the impact of these developments on each generation’s oral health behaviors (Ettinger, 1992). For example, individuals born in the 1950s and later had access to fluoridated water during tooth development and were influenced by toothpaste commercials with the advent of television. In the US, cohorts born in the 1930s, 1950s, and 1980s have widely varying views of the purpose, maintenance, and

appearance of teeth. Preventive and esthetic dentistry are concepts that have had more public exposure in more recent decades. Also, orthodontics, dental implants, commercial tooth bleaching, and new dental materials have become more common (Kiyak, & Reichmuth, 2005). These events support the suggestion that it may not be age, but cohort differences that affect oral health practices and values.

In a study dating back to 1993, cohort differences were noted as patterns of utilization of dental services by older adults changed by cohort. Analysis of data extracted from the 1980 Iowa household survey was used. Findings revealed that different cohorts had different life experiences and that these experiences affected their attitudes and utilization of dental care services (Ettinger, 1993).

### **Public Policy and Structural Lag**

Public policy has been understood to be mostly a political more than social structure in and of itself (Hudson, 2010). Structural lag is exacerbated by public policies that were designed to address the needs of individuals and families during an earlier historical time when demographic and social circumstances were different (Wilmoth, 2010). The following examples will demonstrate how policies enacted by the government (political structure) and implemented within social institutions create structure that shapes social norms and individual behavior (social structure). Thereby supporting the conclusion that public policy is a critical component of structural lag.

“When people grow up and grow old in antiquated social structures that provide inadequate opportunities and incentive lives, the mismatch is known as ‘structural lag.’” In aging research, the concept is useful for understanding the failure of firms, families, and other social structures to provide rewarding

roles for the large numbers of comparatively healthy people who are living longer and growing older in new ways” (Riley, 1996, p. 81).

**Structural lag in family policy.** The structural lag theory was used to help establish that U.S. policy has not realized the diverse family forms. The traditional idea of “the family” has changed from the model family consisting of two opposite sex parents and dependents. This change stems from increased divorce rates, increased single parent families and an increase in both parents working outside of the home. These changes have led to an increased rate of grandparents raising grandchildren. After evaluating changing roles, family dynamics, and structural and ideological barriers, it was determined that with regard to serving grandparents who are raising their grand children, “families” who are most vulnerable often receive the least support in current policy (Baker, Silverstein & Putney, 2008).

**Structural lag in social security policy.** Social norms have been shaped by the creation of Social Security and Medicare program policies, which, without modification, lead to structural lag issues. The Social Security Act was created to address the issue of old-age pensions in the United States (National Archives, 2011). The U.S. social security “insurance” was supported from “contributions” in the form of taxes on individuals’ wages and employers’ payrolls rather than directly from Government funds.

When the policy for this program was initially established, individuals were eligible to receive full social security benefits at the age of 65. With the increase in life expectancy, the understanding of a capable older adult population accompanied by the large influx of “baby boomers” turning this age starting in 2011, structural lag in this policy became apparent. In the 1980 major federal budget, legislation was enacted during the 1980s to contain costs of Medicare.

This legislation included introduction of a prospective payment system (PPS), under which hospitals are paid a prospectively determined amount per discharge based upon diagnosis related groups (DRGs), resulting in a decrease in growth in Medicare’s inpatient hospital costs (AARP, 2005). To control the costs of other types of services, Medicare has introduced prospective payment systems or fee schedules in other settings, as well. The lag and its economic impact was also addressed in 2003 as the age for receipt of full retirement benefits began to gradually rise from 65 to 67. It will be the age of 67 for all of those born after 1959 (Johnson, 2009). If you were born in 1942 or earlier, you are already eligible for your full Social Security benefit at age 65. “If you were born from 1943 to 1960, the age at which full retirement benefits are payable increases gradually to age 67” (Social Security Administration, 2010, p.5). However, no adjustments have been made to the eligibility age to receive Medicare coverage. It remains 65. Table 3 provides a breakdown of full retirement age eligibility by birth year.

Table 3: Age to Receive Full Social Security Benefits

<b>Year of Birth</b>	<b>Full Retirement Age</b>
1943-1954	66
1955	66 and 2 months
1956	66 and 4 months
1957	66 and 6 months
1958	66 and 8 months
1969	66 and 10 months

Note. (<http://www.ssa.gov/pubs/10035.pdf>)

Policy changes aimed at a particular age group can have different implications for individuals within that group, depending on their social location. An example of this is longer life expectancy has placed added pressure on the Social Security program. Increasing the

minimum age for receiving early program benefits in conjunction with raising the age of full benefits could help reduce this pressure (Wilmoth, 2010). As previously stated, when the Medicare policy was implemented in 1965, life expectancy was 70 years of age. Life expectancy for the year 2011 is estimated to be 78.5 years and for the year 2025 it is estimated to be 80.5 years. With the anticipated growth of the 65 and over adult population, there will be a significant rise in the number of older adults enrolled in and receiving benefits from the Medicare plan. “Between 2010 and 2030, the number of people on Medicare is projected to rise from 46 million to 78 million.” (Kaiser Foundation, 2008)

**Lag displayed in Medicare policy.** The Social Security Administration was charged with providing health care to beneficiaries aged 65 or older, under the new Medicare Act signed into law by President Lyndon B. Johnson on July 30, 1965 (Medicare and Medicaid Center, 2010).

Medicare has covered almost all people 65 or over since July 1, 1966 (Atchley & Barusch, 2004). The general eligibility requirements are that recipients be U.S. citizens or permanent citizens who are eligible to receive Medicare if they have worked for a minimum of 10 years at a job that has paid into the Medicare system. This same eligibility rule applies to a spouse, which means that if either worked for ten or more years in a job that paid into the Medicare system, both are covered. You must also be at least 65 years old unless you are permanently disabled or have permanent kidney failure necessitating dialysis or transplant.

There are four basic components of Medicare coverage. Part A, usually free to an enrollee, covers hospital stays and nursing home care related to hospital stays. Part B, which enrollees pay a monthly premium to obtain, is an optional medical insurance plan that covers some medical services not covered by Part A, such as doctors visits. Part C gives enrollees the

option to receive their care through private insurance plans. Part D provides prescription drug coverage to Medicare enrollees. The implementation of Part D was a response to structural lag pertaining to the high level of prescription medications utilized by older adults covered by the plan.

“Structural lag has become massively evident in the years since Medicare and its basic structure were put in place” (Hudson, 2010, p. 6). Based upon the previously stated overview of Medicare coverage, initially Medicare or the “old” Medicare was shaped by paradigmatic conditions such as heart disease, cancer and stroke. The next generation of Medicare will be shaped by paradigmatic conditions stemming from chronic conditions such as diabetes, mental health conditions such as depression, dementia, and interactions of such conditions as osteoporosis and with fall or other life shocks (Lawlor, 2008).

Medicare is predicated on a medically based acute health care model. Coverage for long-term care services in a facility or at home must be conditioned by a post-acute care episode and reimbursement is limited to physician services or services which are authorized by a physician (Hudson, 2010). Coverage afforded in the Medicare policy fails to address the change in the paradigm of conditions presented by older adults from acute conditions to chronic conditions, making more apparent the lag presented in this policy as a structure.

The Medicare program does not cover several health services, including general physical, vision, or hearing exams; long-term custodial care; dental care; and the cost of eyeglasses or hearing aids, and it requires a deductible and copayment for most services (CMS, 2011) . As stated, Medicare does not cover the cost of dental care, except in certain very specific situations such as reconstruction of jaw after an accident injury, or extractions deemed necessary for radiation treatment for neoplastic disease of the jaw, or a dental exam, but not treatment, for

renal procedures or heart valve replacement (“Medicare Dental”, 2011). The number of older adults who have retained some or all of their natural dentition has increased as the percent of the older population that is edentulous is in decline (U.S. DHHS, 2000). This combined with the increase of life expectancy and improved health conditions of older adults helps support the need to include dental care coverage in the Medicare plan as oral health impacts overall health. Previous discussion in this proposal supports the need to evaluate the relationship between retirement, dental care coverage and utilization and how it is impacted by the lack of dental coverage in the Medicare program.

**Structural lag impacts fulfilling oral health obligations set forth in OBRA’87.** As previously stated, OBRA’87 legislation states that all nursing homes receiving Medicaid and Medicare reimbursements must provide routine and emergency oral health care to their residents. The appropriate treatment needs of residents must be met either by staff dentists or by dentists under contract with the facility to provide those services (Guay, 2005). There are indications that in some areas these requirements are not being met or are only partially being met (Sinykin, 2000). Research shows that adequate dental/oral health care, on average, is not provided within these facilities. With Medicare not covering routine dental/oral health care costs and with the variance in Medicaid coverage, access to this care in these facilities is limited despite the legislation calling for the provision of the same. The structural lag of the Medicare program policy instigates lag in the provision of dental/oral health care deemed mandatory within nursing home facilities.



## **Other Examples of Structural Lag**

Other examples of structural lag are briefly covered in the following section. This brief overview provides extended support that life changes are impacted by and also impact structural changes in society.

**Structural lag in field of dentistry.** The following is an elaboration on some of the material that has been briefly mentioned. Institutions of dental education over all are failing to adequately train future dental professionals on how to properly treatment plan and render treatment to medically compromised and cognitively impaired dependent older adults (Tepper, 2008). Geriatrics is included within the dental curriculum in all U.S. dental schools; however, the format in which it appears varies greatly (Mohammed, Preshaw, & Ettinger, 2003). Woldrop, et al performed a study to assess dental students' knowledge about aging, their comfort with varying types of patients and their strategies for managing difficult situations. An 8-week course on special needs patients that was only provided to 4<sup>th</sup> year students served as the intervention for this study and was evaluated by a pre- and post-test measure. Study results indicated that dental students' knowledge of aging was low, comfort with geriatric issues improved after the first year of intervention, and strategies for patient care changed with experience (Waldrop, Fabiano, Nochajski, Zittel-Palamara, Davis, and Goldberg, 2006).

In a study conducted by Murphree, et al in 2002, a survey was designed and mailed to 780 Texas licensed dental hygienists, representing 10 percent of the Texas dental hygiene population. These dental hygienist were surveyed regarding elder abuse education received in dental hygiene school and post-graduation. Respondents were also asked to self-assess their knowledge level in recognizing the six types of elder abuse and to answer questions regarding Texas law and mandatory reporting of abuse. Over one-half of the respondents (56 percent)

stated that abuse education was not part of their dental hygiene school curriculum. Only 46 percent of the respondents who replied that abuse education had been included in the curriculum were educated on elder abuse. A majority of respondents stated they lacked knowledge in recognizing the six types of elder abuse, and 81 percent of respondents reported being unknowledgeable about reporting elder abuse (Murphree et al., 2002). These findings help support the conclusion that the current status of elder abuse education in dental hygiene programs and post-graduation is insufficient.

Many private practice dental offices are not properly equipped to handle treatment of older adults who express frailty or cognitive impairments (Tepper, 2008). Despite passage of the Americans with Disabilities Act in 1990, widespread access barriers, including physical layout or environment for patients with disabilities, still exist within US health care settings (Kirschner, Breslin & Iezzoni, 2007). Wheelchair inaccessibility into and within the dental office building is prevalent and hinders the provision of dental care services in dental office facilities (Yuen, Wolf, Bandyopadhyay, Magruder, Selassie & Salinas, 2010).

Also, long term care facilities do not uphold guidelines addressed by legislation, mostly due to lack of funds (Yellowitz, 2008). Linda and John Whitman in 2005 conducted a study designed to understand how long-term care residents in nursing homes currently receive dental and oral care services and to identify improved methods of assuring better dental and oral care services in the future. The study utilized focus groups conducted in the State of Florida. Three groups with residents of nursing homes and three groups with families of current residents. Focus group sizes ranged from six to ten participants and were conducted by a professional focus group leader. Also, interviews with other industry experts, nursing facility staff, administrative staff, geriatric dentists, general practice dentists specializing in nursing home care, geriatricians,

attorneys specializing in eldercare and healthcare issues, insurance experts, brokers and social workers were conducted by telephone and in person. Findings from this referenced study indicate that the dental and oral health care needs of the elderly residing in nursing homes are not being adequately met due to several key factors:

#1. A pervasive lack of knowledge of the importance of dental and oral health care on the part of residents, their families and the nursing facilities staff.

#2. Difficulties faced by some residents in providing self care due to physical limitations despite the desire to maintain good oral health and the desire to remain independent.

#3. Providing good daily oral care to residents with dementia and/or behavioral problems can be extremely difficult for staff despite good intentions and efforts.

#4. Ageism prejudices are overtly evident among staff, families and even the residents themselves.

#5. A lack of or severely limited reimbursement for professional dental services resulting in significant access problems.

#6. Extremely poor dental and oral health care is currently being seen among the cohort of elderly between the time they retire and their admission to a nursing facility, resulting in new nursing home residents with tremendous dental and oral care needs upon admission (Whitman & Whitman, 2005).

Medicare does not cover dental services and Medicaid coverage for dental services is very limited for older adults and varies from state to state. There has been little assistance in obtaining dental insurance to older adults in terms of the high premium costs for such policies. Dental coverage offered through private insurance policies is considered costly by those on a limited income. Findings from the previously referenced study presented by Kimberly Zittel-

Palamara revealed that the most serious barrier to dental care reported by the older adults surveyed was cost (“Many American elderly”, 2005).

**Structural lag through age segregation of roles.** Matilda White Riley’s Age Stratification Theory, from which the Structural Lag Theory is derived, is based on age segregation. Age segregation is based on the division of roles across the life course. There are three divisions including education roles allocated to the young, work and family roles allocated to the middle aged and leisure to the old (Riley & Riley, 1994). Organized around the principle of work, this age segregation of roles limits opportunity structures and creates various pressures for different age groups. Available social roles at a given age may not be consistent with the roles an individual might want to assume. For example, older adults are limited to primarily leisure activities and nonpaid volunteer opportunities, even though most are sufficiently healthy to participate in work and educational roles (Wilmoth, 2010).

**Structural lag associated with gender issue.** The mismatch between women’s increasing rates of labor participation and the dearth of low-cost, high-quality child care is an example of structural lag (Wimoth, 2010). According to the U.S. Department of Labor Bureau of Labor Statistics:

1. Currently, 71.3 percent of women with children are in the labor force.
2. In 1975, only two out of every five mothers with a child under age 6 held a paid job.
3. As of 2007, 63.5 percent of women with children under age 6 were in the labor force, and 60 percent of mothers with children under age 3 were in the labor force.

Access to and implementation of affordable quality child care has not kept up with an increase in the number of working mothers in the labor force. The impact of child care shortages is most acutely felt at the local level (American Planning Association, 1997). The United States

is the only industrialized nation that provides no job protection or child care support for working parents. American women have no statutory entitlement to quality child care.

Gender wage gaps remain a persistent feature of the U.S. workforce (U.S. Bureau of Labor Statistics, 2001). Gender gaps in salary have existed throughout history in all occupations (Gibelman, 2003). Findings from a recent study conducted by the American Bar Association showed that despite surging numbers of female lawyers, bias against women remains entrenched in the legal profession and results in steep inequities of pay, promotion and opportunity (Bernstein, 1996). Median salaries for men are higher than that of women among college and university admissions officers in doctoral and comprehensive institutions (National Association for College Admission Counseling, 1997).

According to Colburn's Washington Post article, a large number of physicians trained at the University of Michigan Medical School had been tracked for a 10 year period after graduation. Findings from this study revealed that women physicians occupied lower status positions and received unequal pay (Colburn, 1993).

In an analysis of year end 1998 data from the Bureau of Labor Statistics, it was revealed that as the percentage of women in an identified occupational groups increases, the weekly salaries decrease. Conversely, as the number of men increases in an industry, so does salary (Gibelman, 2003).

Federal, state, and private sector efforts to address equal pay among genders have not been successful. There is still a discrepancy between policy goals and policy outcomes. The Glass Ceiling Commission released in March of 1995 findings from its study. The commission identified pay inequity as a continuing discriminatory practice (Glass Ceiling Commission, 1995).

**Later-life financial security for working women impacted by structural lag.** Another example of structural lag includes public policy related to the U.S. pension system not recognizing or addressing the variation across women regarding the time allocated to educational, work and family roles. In light of change in demographic trends such as married couples sharing the role of being “bread winners”, the Social Security program is still based on the one-breadwinner model that privileges married couples in which one spouse, usually the male, is employed (Wilmoth, 2010). Women who qualify for Social Security on their own earnings records are likely to receive fewer benefits than men with comparable work histories, due to wage discrimination (Wilmoth, 2010).

Findings from research studies addressing the impact of the lack of dental care coverage in the Medicare policy may urge policy makers to look more closely at adding dental benefits to Medicare. With the current economic climate, gaining a better understanding of the relationship between retirement and dental care coverage and utilization of dental service will help in establishing the best ways of improving oral health and access to dental care for older adults.

### **Structural Lag Theory**

The Structural Lag Theory stems from Matilda White Riley’s Age Stratification Theory, which pulls together some important concepts such as cohort flow, age norms (aged graded opportunity structures), and structural lag (the aging of society in the sociology of aging) (Riley, Kahn & Foner, 1994; Morgan & Kunkel, 2007). The Age Stratification Theory has evolved into the Aging and Society (A&S) Paradigm (McMullin, 2000).

The Structural Lag Theory poses that societal institutions have failed to keep up with the realities of a healthy and capable older adult population (Atchley & Barusch, 2004). Riley, Kahn and Foner (1994) define structural lag as the tendency for the social structure of roles, norms and

social institutions to change more slowly, lagging behind changes in peoples' lives (Morgan & Kunkel, 2007). The Structural Lag Theory is used to describe the mismatch between the characteristics of people and the social structures, institutions and norms that surround them (Riley, Kahn, Foner & Mack, 1994). Norms include laws, language and public policies that are built in components of structure. Lag in these norms create pressure for change. "Policies once put in place may lag not unlike the broader social phenomena to which the structural lag construct has traditionally been tied." (Hudson, 2010, p. 5). "Policies create structure that shapes social norms and individual behavior." (Wilmoth, 2010, p. 44). Table 4 provides a descriptive breakdown of the Structural Lag Theory.

Table 4: Structural Lag Theory

<b>Structural Lag Theory</b> (Riley, Kahn & Foner, 1994)
<p>Focuses on the dynamic interplay between the processes of aging and cohort succession, on the one hand, and changing social structures, on the other hand. Aging and Social Structures</p> <p>The tendency for the social structure of roles, norms, and social institutions to change more slowly, lagging behind changes in peoples' lives as they age.</p> <p>Interdependence of Two Dynamisms</p> <ol style="list-style-type: none"> <li>1. Dynamism of Structural change – age, or some surrogate for age, is built directly or indirectly into social and cultural institutions as a criterion for entering and performing in certain roles and for relinquishing others.</li> <li>2. Dynamism of Changing Lives – as society changes, the aging process also changes. The shape of people's lives is continually being altered from one cohort to the next.</li> </ol> <p>Interdependence of the two dynamisms means people are influenced by and are influencing these structures.</p> <p>Addresses roles open or closed to people of different ages</p> <p>Emphasizes the process of growing up, growing older, and includes the number and kinds of older people in society and their needs, goals and expectations at a stage in life along with aging patterns.</p>

### Development of Hypotheses

Constructs for this study are pulled from the Structural Lag Theory. Constructs from Structural Lag Theory as expressed as dynamisms: The dynamism of changing lives which

impacts the dynamism of structural change. Due to different social, political, economic, and technological changes experienced at different times in their life course, new cohorts of older people differ from previous ones. The variable cohort membership will be used to measure the dynamism changing lives. Stemming from different social, political, economic and technological experiences, members of different cohorts have different long held beliefs pertaining to dental care (Strayer, 1995; Locker & Jokovic, 1996). Different cohorts have different life experiences and these experiences affect utilization of dental care services.

Dental insurance coverage is highly correlated with the utilization of dental care services (CDC, 2001; Manski, Macek & Moeller, 2002). Dental care coverage and utilization of dental services represent social and cultural institutions. The age of 65 is a criterion for enrolling in and receiving Medicare benefits. However, Medicare does not include dental coverage, thereby possibly impacting these cultural institutions. The variables utilization of dental care services and dental coverage will be used to measure the dynamism of structural change from Structural Lag Theory. Figure 1 provides a diagram of the constructs and variables being used from the Structural Lag Theory. Concepts from the Structural Lag Theory aided in composing questions to be addressed by this project as well as the development of the hypotheses for quantitative analysis.

### **Hypotheses.**

H1a: Cohort 3-Baby Boom will display a higher percentage of dental coverage.

H1b: Employer provided dental insurance will be the most prevalent type of dental insurance coverage.

H2a: Members of Cohort 1-Greatest Generation are less likely to have dental coverage than members of Cohort 2-Silent Generation.



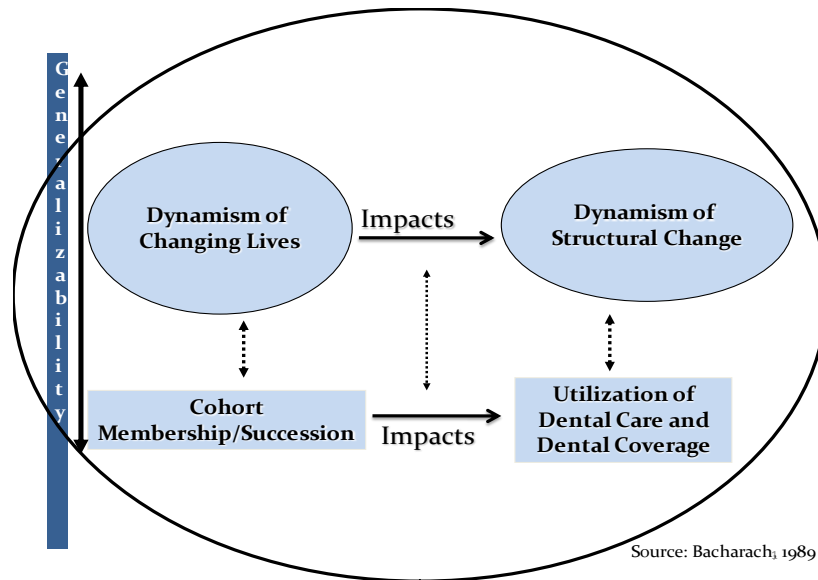


Figure 1. Constructs from Structural Lag Theory

H2b: Members of Cohort 2-Silent Generation are less likely to have dental coverage than members of cohort 3-Baby Boom Generation.

H3a: Members of Cohort 1-Greatest Generation will display less dental utilization than members of Cohort 2-Silent Generation.

H3b: Members of Cohort 2-Silent Generation will display less dental utilization than members of Cohort 3-Baby Boom Generation.

H4a: Older adults with dental coverage will pay a higher amount for dental services than those without.

H4b: Older adults with dental coverage will display more utilization of adult dental prophylaxis procedures than those without.

H5a: Members of Cohort 1-Greatest will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 2-Silent Generation.

H5b: Members of Cohort 2-Silent Generation will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 3-Baby Boom Generation.

### **Conclusion**

Reflecting on the aforementioned examples, there seems to be a disconnect regarding how public policy affects and is affected by structural lag. It is as though society has failed to realize the increase in life expectancy (Centers for Disease Control and Prevention, 2007) and how it impacts older adults along with how this population will grow immensely as the baby boom cohort enters the retirement phase. This increase will impact the institution of health care as we know it. Many from this cohort will have maintained their dentition and are wanting to continue dental services and oral health care. Oral health is an important part of over all health that needs to be addressed throughout the life course.

The previous discussion demonstrates how certain aspects of policy are not consistent with the lived experiences of many older American cohorts, creating structural lag. The lack of dental care coverage in the Medicare program is an example of this, thereby there is a need to evaluate the impact this lag has on access to dental/oral health care. This type of structural lag created by policy increases social, economic and health inequalities among older adults

### **Chapter 3: Methodology**

Chapter 3 describes the methodology, including a description of the research design, and population used for this exploratory study. Also included is a brief discussion of the sample population, outcomes measurement variables, data collection procedures, and data analysis.

The purpose of this exploratory study is to evaluate differences displayed in dental coverage and utilization of dental services by the members of the Baby Boom, Silent Generation, and Greatest Generation Cohorts who received dental care at the VCU School of Dentistry in 2011. Associations will be evaluated to determine if cohort succession supports lag in the Medicare policy among the study population. Findings from evaluating associations may aid in laying a foundation for addressing health care disparity caused by the lack of dental coverage in Medicare.

A cross sectional, non-experimental study design is used. The sample is a convenience sample of all patients age 47 and over, over 11,000, who received dental care at the VCU School of Dentistry in the year 2011. This study explored the association between cohort membership, type of dental coverage, and utilization of dental care services in adults age 47 and over utilizing dental care at the VCU School of Dentistry.

For analysis, the cohorts are aggregated by patient's age on December 31, 2011. Cohorts are aggregated as follows:

1. Greatest Generation Cohort includes individuals born between 1901 and 1924 (US Census Bureau, 2011; Brokaw, 1998; Straus & Howe, 1992).
2. Silent Generation Cohort includes individuals born between 1925 and 1945 (US Census Bureau, 2011; Straus & Howe, 1992)
3. Baby Boomer Generation Cohort includes individuals born between 1946 and 1964 (US Census Bureau, 2011).
  - a. Those born in 1946 became eligible by age for Medicare enrollment in 2011.

Analyses is performed on secondary data pertaining to patients age 47 and over who utilize dental services at the VCU School of Dentistry determined the percentage of adults age 47 and over with dental coverage. Also identified is the predictive association between cohort membership and type of dental coverage. Predictors of dental utilization, defined as total amount spent for services rendered are determined and compared by cohort. The use of dummy-coded variables allowed for the determination of differences between cohort membership and routine utilization of adult prophylaxis procedure in patients age 47 and over who utilized dental services at the VCU School of Dentistry.

### **Operation of Variables**

The following are operational definitions describing what the variables are and how they are measured within the context of this study. With operationally defining each variable, there is a better understanding of what is being measured, enabling control of a variable by holding it constant or using it as an independent variable.

**Dependent variables (DVs).** The population consists only of individuals age 47 and over who received dental care service in 2011 at the VCU School of Dentistry. For this exploratory study there are three dependent variables:

1. Utilization of dental services: Financial defined as total amount spent for services rendered aggregated by patient (continuous).
2. Utilization of dental services: Procedural defined as Routine Adult Dental Prophylaxis procedure performed (dichotomous Yes/No).
3. Dental Care Coverage
  - a. A dichotomous variable: Yes-have/No-do not have
  - b. Type of dental coverage, defined as:
    1. Medicare Advantage plan with dental coverage included
    2. Dental coverage through place of employment
    3. Private Dental Insurance
    4. Out of Pocket

In 2010 an estimated \$108 billion was spent on dental services in the United States (CDC, 2011). The definition of utilization: Financial is deemed as expenditures, meaning the total amount spent on dental care aggregated by patient. Expenditures can be analyzed in terms of sum of payments (Brown, Wall, & Manski, 2002, p.627). Utilization has been successfully measured by the total amount spent or total expenditures per person to focus on changes in the funding of dental services in the U.S. (Brown, Wall, & Manski, 2002).

Utilization: Procedural is defined as having a routine adult dental prophylaxis procedure performed. Because of the increase in the number older adults retaining some or all of their natural dentition, a routine adult dental prophylaxis is used as a dependent variable. This routine preventative procedure is an important component for maintaining oral health (ADA, 2009). The paradigm of dental care for the older adult population has shifted from predominantly denture care to complex restorative procedures, esthetic dentistry, orthodontics and the placement of

implants (Ettinger & Mulligan, 1999; Eklund, 1999). This shift increases the need for routine preventative dental care. This variable also served as a control variable because adults without full dentition may show a decreased rate of utilizing routine adult dental prophylaxis, but may have utilized other dental services displayed in total amount paid.

Dental care coverage, as a dichotomous variable, is another dependent variable. There is a strong correlation between utilization of dental services and dental care coverage (CDC, 2001). Having dental insurance has been shown to be an important factor in the decision to seek dental care (Manski, Macek & Moeller, 2002). Dental coverage also served as an independent variable in the analysis of utilization. The variable dental coverage is serving a dual role depending on the analysis conducted. It serves as a dependent variable for some models and a independent variable in others. Specifically, in one analysis, how cohort membership is related to dental coverage is examined, and then in another, how dental coverage affects utilization is examined.

**Controls.** Controls include: Gender, Race, Place of Residence, Age, Medicare enrollment status, and Adult Dental Prophylaxis Procedure. Each of these variables are associated with utilization of dental services and dental care coverage. Though they are not of primary theoretical interest, they must be controlled for in the analysis. These controls are included in the model so that inferences are not confounded by spurious correlations or relationships that are not being addressed by this study.

**Gender.** Previous study findings indicate that females age 47 and over utilize dental services more than males (Manski, Goodman, Reid, & Macek, 2004; Manski, Moeller & Maas, 2001).

**Race.** Significant differences in dental coverage and utilization exists between races (Manski & Brown, 2007). A higher proportion of white-non Hispanic adults utilize dental services in the U.S. (Kiyak, & Reichmuth, 2005; Brown, Wall & Manski, 2002).

**Place of residence.** Place of residence refers to either rural or urban residence, as defined by the U.S. Census Bureau. The Census Bureau's classification of rural consists of all territory, population, and housing units located outside of urbanized areas and urban clusters. Urbanized areas include populations of at least 50,000, and urban clusters include populations between 2,500 and 50,000 (Coburn et al., 2007, p. 4). This control variable is important to evaluate as research supports lower dental coverage and utilization rates in individuals residing in rural areas when compared with those residing in urban areas of Virginia (Virginia Health Care Foundation, 2011)

**Age.** Previous and more recent research studies indicate that the older adult population has the lowest utilization rate of dental services (Jack, 1983, Manski et al, 2004). Utilization of dental care fluctuates when associated with age (Manski & Brown, 2007).

**Medicare enrollment.** For this study, the variable Medicare enrollment status is defined only by the age of eligibility, which is 65. Patients on Medicare who are under the age 65, meaning those with disabilities, will be omitted. Medicare does not cover dental care. Studies have demonstrated a decrease in dental care coverage and utilization associated with Medicare enrollment in individuals age 65 and over (Manski et al., 2010; Kiyak, & Reichmuth, 2005; Manski, Goodman, Reid & Macek, 2004). This study is focusing on Medicare eligibility solely based on reaching the age of 65. This approach excludes individuals on Medicare for other reasons as this exploratory study is focusing on age of eligibility alone.

***Routine adult dental prophylaxis.*** Like Utilization: procedural, this variable is defined as having a routine adult dental prophylaxis procedures performed. Because of the increase in the number older adults retaining some or all of their natural dentition, routine adult dental prophylaxis is used as both a dependent variable and a control variable. Adults without full dentition may not utilize routine adult dental prophylaxis, but may have utilized other dental services as displayed in total amount paid.

**Independent variables.** The following section provides a description of the independent variables used in this study. Also provided are sources that support the use of listed independent variables.

***Cohort membership.*** Cohort membership is the focus of this exploratory study, making it a key independent variable. For this study Cohort Membership=Age which is defined as: 1- Greatest Generation Cohort (Age 87-110), 2-Silent Generation Cohort (Age 66-86), 3-Baby Boomer Generation Cohort (Age 47-65). Research has indicated that utilization of dental care increases overall as older cohorts, characterized by fewer dental visits, die and are replaced by younger ones (Bravo, 2001). Common patterns of response, definitions and beliefs are a product of cohort members sharing historical experiences, resulting in common norms which become institutionalized in social structure and role (Riley & Riley, Jr, 1994). These events support the suggestion that it may not be age, but cohort differences that affect oral health practices and values (Kiyak, & Reichmuth, 2005).

***Dental coverage.*** Dental care coverage, as a dichotomous variable, is another independent variable for this study. There is a strong correlation between utilization of dental care and dental care coverage (CDC, 2001). Having dental insurance has been shown to be an important factor in the decision to seek dental care (Manski, Macek & Moeller, 2002). As



previously stated, dental coverage will also serves as a dependent variable based upon hypothesis and analysis as described under dependent variables. Table 5 provides a detailed breakdown defining all variable in this study.

Table 5: Variables Defined

Type of Variable	Variable	Definition
Independent Variables (IVs)	Cohort Membership	Based on Age As of 12-31-2011. 1. Greatest Generation (born 1901-1924, Ages 87 to 110) 2. Silent Generation (born 1925-1945, Ages 66 to 86) 3. Baby Boom (born 1946-1964, Ages 47 to 65)
	Dental Care Coverage {Also a DV} (Dichotomous: Yes or No)	Yes = have; No = did not have
Controls	Gender	Male or Female
	Race/Ethnicity	1.White, 2. African American, 3. Asian, 4. American Indian, 5. Hispanic
	Place of residence	Rural or Urban, based on zip codes using census 2004 Virginia Map of rural/urban areas because no later dated maps were available to view <a href="http://www.census.gov/population/metro/data/maps.html">http://www.census.gov/population/metro/data/maps.html</a> <a href="http://www.census.gov/econ/census02/maps/va/04000us51m.pdf">http://www.census.gov/econ/census02/maps/va/04000us51m.pdf</a> and <a href="https://www.usps.com">https://www.usps.com</a>
	Medicare Enrollment (by age of eligibility- 65 and over only)	Yes - Enrolled, No - not enrolled
	Age (Continuous)	As of 12-31-2011
	Routine adult dental prophylaxis {Also a DV}	Yes = had; No = did not have

Table 5 Continued: Variables Defined

Type of Variables	Variable	Definition
Dependent Variables (DVs)	Dental Care Coverage {Also an IV} (Dichotomous: Yes or No)	Yes = have; No = did not have
	Dental Care Coverage Type/Payment Source (Categorical – when included in the models it will be represented by individual dichotomous variables because these cannot be considered ordered categories)	<ol style="list-style-type: none"> <li>1. Medicare Advantage plan with dental coverage included</li> <li>2. Employer provided - Dental coverage through place of employment</li> <li>3. Private Dental Insurance that patient purchased on own.</li> <li>4. Out of Pocket</li> </ol>
	Utilization:Financial - Use of Dental Care Services in 2011. (Continuous)	Total Amount Paid for Dental Services Rendered
	Utilization:Procedural - Routine adult dental prophylaxis in 2011 (Dichotomous: Yes/No)	Yes = had; No = did not have

### Data Source

Secondary data was extracted on individuals age 47 and over who received dental services at the VCU School of Dentistry in 2011, from Axium, the VCU School of Dentistry Clinical Database system, housed at the VCU Computer Center. Data, on each patient, is collected and entered into the Axium data system, by administrative staff, faculty, pre-doc students or residents at the VCU School of Dentistry. Upon extraction, utilization was aggregated, as previously defined, by patient.

Relying upon an existing data source is advantageous for several reasons. The most salient benefit is that this proposed secondary analysis is much more economical than collection of primary data, which would be exorbitantly time consuming and expensive (Polit & Beck, 2008). Moreover, this study is absent of problems stemming from subjects' awareness of, and reaction to, research participation (e.g., Hawthorne effect). Subject cooperation and attrition are immaterial as well. There should be no biases affecting the entry of the data collected as the content is straight forward in terms of answers provided. An exception to this could be determining race or date of birth given, but that would be an error in self reporting by the patient that cannot be controlled.

This design is useful for charting population-wide features at one single point in time in a designated population, such as patients age 47 and over receiving dental care at the VCU School of Dentistry. Subgroups within the sample can be compared, enabling inferential statistics to be used to draw inferences about the relationship between cohort membership, dental care coverage and utilization of dental services. This type of study design and the use of secondary data, as described, enabled sufficient evaluation of the associations between cohort membership, type of dental coverage, and utilization of dental care services in adults age 47 and over utilizing dental care at the VCU School of Dentistry.

### **Target Population**

The target population consists of over 11,000 patients age 47 and over who utilized dental services at the VCU School of Dentistry. This population was selected because it includes members for the aforementioned aggregated cohorts, 1-Greatest Generation, 2-Silent Generation, and 3-Baby Boomer Generation. For the inclusion criteria, all patients age 47 and over utilizing dental services at the VCU School of Dentistry in 2011 were included. Medicare enrollment is

based solely on age eligibility, which is the age of 65. Patients younger than 65 who are on Medicare were omitted.

## **IRB**

This proposal was submitted to and approved by the Virginia Commonwealth University's Internal Review Board (IRB) as a social-behavioral quantitative project. This proposal qualified for expedited review as it presents minimal risk to the human. The VCU School of Dentistry is a hybrid entity of the VCU Affiliated Covered Entity (ACE). Therefore, this study falls under the Limited Data Set Category. A Health Insurance Portability and Accountability Act (HIPAA) Appendix A and a Data Use Agreement was submitted to the VCU IRB in order to extract and analyze data from Axium, the Dentistry Clinical Database system.

## **Setting**

The VCU School of Dentistry has provided quality and affordable general and specialty dental care for citizens of all ages in the Commonwealth of Virginia for over 100 years. The population of patients seen at the VCU Dental School is diverse, displaying variance in age, race, residential location, and payment sources. Dental students, dental residents, and dental hygiene students provide the treatment under the supervision of the dental faculty in clinics that are equipped with state-of-the-art equipment while following the strictest health, safety and sterilization guidelines (<http://www.dentistryatvcu.com>).

## **Analytical Strategies**

Secondary data on all patients age 47 and over, was extracted from Axium, the VCU Dentistry Clinical Database system, and entered into the PASW/SPSS 19 program to be analyzed. Histograms were used to screen for outliers and to check normality. Diagnostics for assessing multicollinearity include Pearson's correlation coefficient matrix, to examine if the

correlation coefficient between two explanatory variables is .75 or higher (Tabachnick & Fidell, 2007), the Variance Inflation Factor (VIF), and tolerance values. The VIF rule of thumb of 10 or higher or equivalently, tolerances of .10 or less and not greater than 1 is used (Hair, Anderson, Tatham & Black, 1995; Multicollinearity, 2012). Tolerance and Variance Inflation Factor for each variable is examined. The correlation between independent variables was also measured by tolerance values, which can vary between 0 and 1. The closer to zero the tolerance value is for a variable, the stronger the relationship between this and the other predictor variables. For each independent variable,  $Tolerance = 1 - R^2$ , where  $R^2$  is the coefficient of determination for the regression of that variable on all remaining independent variables, low values indicate high multivariate correlation. VIF is the reciprocal of tolerance in that a large value indicates a strong relationship between predictor variables (Brace, Kemp & Snelgar, 2009). The VIF is  $1/Tolerance$ , it is always  $\geq 1$  and it is the number of times the variance of the corresponding parameter estimate is increased due to multicollinearity as compared to as it would be if there were no multicollinearity. The VIF shows how much the variance of the coefficient estimate is being inflated by multicollinearity (O'Brien, 2007).

VIF is used to assess multicollinearity in both linear and logistic regression models. However, it must be noted that in SPSS there is no formal way to test for multicollinearity in logistic regression (Pallant, 2007). The focus is on the relationship between the independent variables, therefore, the function form of the model for the dependent variable is irrelevant to the estimation of collinearity (Menard, 2002). The dependent variable from logistic regression analysis is used as a dependent variable in the linear regression. The collinearity diagnostic statistics are based on the independent variables only, so the choice of the dependent variable does not matter (Menard, 2002).

In both logistic regression and multiple regression, a block method is used to help with determining the effect of the IVs and the co-variates on the DV. When running the logistic regression models, two blocks are used to check for model fit using the Omnibus Test of Model Coefficients. Chi-square test results are evaluated to determine significance. When running the models in linear regression, two blocks are used to determine the effect of the IVs and covariates on the DV. The first block analyzed covariates and the second block analyzed independent variables.

Descriptive statistics are conducted pertaining to cohort membership, gender, race, place of residence (rural/urban), Medicare enrollment status, and type of dental coverage (Medicare Advantage plans with dental included, dental coverage through employer, private dental plan, out of pocket). Chi<sup>2</sup> tests, multiple regression analyses and standard logistic regression analyses addressed hypotheses presented in this study. Table 6 displays all five questions being addressed by this study accompanied by the hypotheses and statistical approaches to be utilized.

Table 6: Research Questions, Hypotheses and Statistical Approaches

Question	Hypothesis	Statistical Approach
<p><b>1.</b> What percentage of older patients have dental coverage, what type is it, and how does this vary by cohort?</p>	<p><b>H1a:</b> Cohort 3-Baby Boom will display a higher percentage of dental coverage.</p> <p><b>H1b:</b> Employer provided dental insurance will be the most prevalent type of dental insurance coverage.</p>	<p><b>Descriptive statistics</b> used to indicate percentage of patients in each cohort with dental coverage. Determine whether type of dental insurance coverage varies by cohort using contingency table and chi-square test.</p>

Table 6 Continued: Research Questions, Hypotheses and Statistical Approaches

<p>2. Does cohort membership predict the existence of dental coverage among older patients?</p>	<p><b>H2a:</b> Members of Cohort 1- Greatest Generation are less likely to have dental coverage than members of Cohort 2- Silent Generation.</p> <p><b>H2b:</b> Members of Cohort 2- Silent Generation are less likely to have dental coverage than members of cohort 3-Baby Boom Generation</p>	<p><b>Standard Logistic Regression</b>, with statistical significance tests for individual variables and for the model as a whole.</p> <p><b>DV</b> = Dental Coverage (Dichotomous Yes/No)  <b>IV</b> = Cohort membership defined as 1-Greatest, 2-Silent, 3-Baby Boom  <b>Controls</b> = Race, Gender, Residence (defined Urban or Rural), Routine adult dental prophylaxis, Medicare enrollment</p> <p>Dental Coverage = f(cohort (dummy), race, gender, residence, routine adult prophylaxis, Medicare enrollment).</p> <p>*Dummy variables for 2 of the 3 cohort categories</p>
<p>3. Does cohort membership predict the total utilization of dental services among older patients?</p>	<p><b>H3a:</b> Members of Cohort 1- Greatest Generation will utilize less dental services than members of Cohort 2-Silent Generation.</p> <p><b>H3b:</b> Members of Cohort 2- Silent Generation will utilize less dental services than members of Cohort 3-Baby Boom Generation.</p>	<p><b>Multiple Regression</b></p> <p><b>DV</b> = Utilization defined - total amount spent(Continuous)  <b>IV</b> = Cohort membership defined as 1-Greatest, 2- Silent, 3-Baby Boom  <b>Controls</b> = Race, Gender, Residence defined Urban or Rural, Medicare enrollment status, Dental Coverage-dichotomous, Routine adult dental prophylaxis</p> <p>Utilization= f(dental coverage, cohort (dummy), race, gender, residence, Medicare enrollment status, Routine adult dental prophylaxis).</p> <p>*Dummy variables for 2 of the 3 cohort categories.</p>

Table 6 Continued: Research Questions, Hypotheses and Statistical Approaches

<p><b>4.</b> Will older adults with dental coverage pay higher amounts for dental services and display more utilization of routine adult dental prophylaxis procedures than those without?</p>	<p><b>4a:</b> Older adults with dental coverage will pay a higher amount for dental services than those without.</p> <p><b>H4b:</b> Older adults with dental coverage will display more utilization of adult dental prophylaxis procedures than those without.</p>	<p><b>Multiple Regression.</b></p> <p><b>DV:</b> Utilization:Financial - Total Amount spent for services rendered in 2011</p> <p><b>IV:</b> Coverage (Dichotomous: Yes/No)</p> <p><b>Controls:</b> Age (continuous), Race, Gender, Residence defined Urban or Rural, Routine adult dental prophylaxis</p> <p>Utilization:Financial = f(Dental Coverage (dichotomous), Age (continuous), race, gender, residence, Routine adult dental prophylaxis).</p> <p><b>Standard Logistic Regression</b></p> <p><b>DV</b> = Utilization:Procedural - Routine adult dental prophylaxis in 2011 (Dichotomous: Yes/No)</p> <p><b>IV</b> = Coverage (Dichotomous: Yes/No)</p> <p><b>Controls</b> = Age (continuous), Race, Gender, Residence defined Urban or Rural</p> <p>Utilization:Procedural = f(Dental Coverage (dichotomous), Age, Race, gender, residence)</p>
<p><b>5.</b> Does cohort membership predict the utilization of routine adult dental prophylaxis?</p>	<p><b>H5a:</b> Members of Cohort 1-Greatest will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 2-Silent Generation.</p> <p><b>H5b:</b> Members of Cohort 2-Silent Generation will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 3-Baby Boom Generation.</p>	<p><b>Standard Logistic Regression</b></p> <p><b>DV</b> = Utilization defined as Routine Adult Dental Prophylaxis Procedure (Dichotomous Yes/No)</p> <p><b>IV</b> = Cohort membership defined as 1- Greatest, 2-Silent, 3-Baby Boom</p> <p><b>Controls</b> = Dental Coverage (dichotomous), Race, Gender, Residence (Urban or Rural), Medicare enrollment status</p> <p>Utilization: Procedural = f(Cohort (dummy variable), Dental Coverage- (dichotomous), Race, Gender, Residence, Medicare Enrollment status).</p>



Descriptive statistics are used to indicate percentage of patients in each cohort with dental coverage. A chi-square test is used to determine whether type of dental insurance coverage varies by cohort. A variable equal to 1, 2 or 3 for cohorts was used. A variable indicating dental coverage type defined as 1-Medicare Advantage Plan with dental coverage, 2- Employer provided dental coverage, 3-Private dental plan, and 4-Out of pocket payment is used. Table 7 provides a sample of a contingency table used.

Table 7: Contingency Table used

Cohort	Medicare Advantage	Employer Provided	Private Plan	Out of Pocket	Total
1					
2					
3					
Total					

Standard Logistic Regression, with statistical significance tests for individual variables and for the model as a whole address H2a and H2b. Multicollinearity was checked using a correlation matrix, as well as VIF and tolerance estimates. The model will have dummy variables for two of the three cohort categories.

DV = Dental Coverage (Dichotomous Yes/No)

IVs = Cohort membership defined by birth year as 1-Greatest, 2-Silent, 3- Baby Boom

Controls = Race, Gender, Residence defined as Urban or Rural, Medicare enrollment status (dichotomous), adult dental prophylaxis

Dental Coverage = f(cohort (dummy), race, gender, Medicare enrollment status,

residence, adult dental prophylaxis).

When using Multiple Regression as the statistical approach to address H3a and H3b, outliers are addressed and VIF as well as tolerance estimates were used to check multicollinearity. A dummy variable is created for two of the three cohort categories. The intercept represents the mean for the omitted category. The coefficients on these dummy variables will then give the difference in mean usage controlling for other control variables.

$$\text{Equation: } Y' = a + b_1X_1 + b_2X_2 + \dots + b_kX_k + e_i$$

Where  $Y'$  = Utilization defined as total amount spent

$a$  = intercept constant

$b_1X_1$  = Cohort Membership

$b_2X_2$  = Race,

$b_3X_3$  = Gender

$b_4X_4$  = Residence defined as urban or rural

$b_5X_5$  = Medicare Enrollment

$b_6X_6$  = Dental Coverage (Dichotomous)

$b_7X_7$  = Routine Adult Prophylaxis procedure

$e_i$  = Error term

Multiple Regression is used to address H4a, with age serving as a continuous variable.

Multicollinearity is checked using VIF and tolerance estimates.

DV: Utilization: Financial - Total Amount spent for services rendered in 2011

IV: Coverage (Dichotomous: Yes/No)

Controls: Age (dummy), Race, Gender, Residence - defined Urban or Rural, routine adult dental prophylaxis

$$\text{Equation: } Y' = a + b_1X_1 + b_2X_2 + \dots + b_kX_k + e_i$$

Where  $Y'$  = Utilization defined as total amount spent

$a$  = intercept constant

$b_1X_1$  = Dental Coverage (Dichotomous)

$b_2X_2$  = Age

$b_3X_3$  = Race

$b_4X_4$  = Residence defined as urban or rural

$b_5X_5$  = Gender

$b_6X_6$  = Routine Adult Prophylaxis procedure

$e_i$  = Error term

As stated in the previous table, Standard Logistic Regression is used to address H4b, with statistical significance tests for individual variables and for the model as a whole.

Multicollinearity is checked using a correlation matrix.

DV = Utilization: Procedural - Routine adult dental prophylaxis in 2011

(Dichotomous: Yes/No)

IV = Coverage (Dichotomous: Yes/No)

Controls = Age (dummy), Race, Gender, Residence defined Urban or Rural

Utilization: Procedural =  $f(\text{Coverage (dichotomous), Age (dummy), Race, Gender, Residence (urban or rural)})$ .

Standard Logistic Regression is also used to address H5a and H5b, with statistical significance tests for individual variables and for the model as a whole. Multicollinearity is checked using a correlation matrix.

DV = Utilization defined as Routine Adult Dental Prophylaxis Procedure

(Dichotomous Yes/No)

IV = Cohort membership, defined as 1- Greatest, 2-Silent, 3-Baby Boom

Controls = Dental coverage (dichotomous), Race, Gender, Residence (Urban or Rural), Medicare enrollment status

Utilization of dental services = f(cohort (dummy variable), dental coverage (dichotomous), race, gender, Medicare Enrollment status, residence.

This study design and methodology enables an evaluation of the associations between cohort membership, type of dental coverage, and utilization of dental care services in adults age 47 and over who receive dental care at Virginia Commonwealth University's (VCU) School of Dentistry.

### **Limitations**

The study design presents a truncated dependent variable because only individuals who utilize dental services are used in analyses. Individuals who do not come in to utilize dental services are not included. Also, the variable dental coverage is serving a dual role of either a dependent variable or an independent variable, depending on the analysis being conducted. This is inherent in this design created to address the hypotheses presented.

A potential weakness of the data source is incorrect data entry. Data collection is conducted by administrative staff, faculty, or pre-doc students or residents. The data being collected is straight forward. Therefore, misleading information in terms of the variable utilization as the amount spent and utilization and as routine adult dental prophylaxis procedure would be screened and corrected when payment was collected for dental services rendered. The variable of residence as urban or rural, is based on patient self-reports, may be entered incorrectly into the

data system. However, accuracy is supported when some type of dental insurance is used to aid with covering costs as policy addresses usually coincide with address of residence.

Medicare enrollment was captured on a minimal number of patients because Medicare does not cover routine dental care. In some instances determined as required oral surgery, such as extractions, Medicare may provide some monetary assistance. Today, virtually all people in U.S. age 65 and over are covered by Medicare. (Kaiser Family Foundation, 2008). Coverage starts first day of birthday month (CMS, 2011). According to the US Census Bureau, the number of adults age 65 and over in Virginia is approximately 976,124 (U.S. Census Bureau, 2012). According to CMS, the total number of adults age 65 and over on Medicare in Virginia is 973,135 meaning 2,989 adults 65 and over are not enrolled (CMS, 2012). Approximately .03% of adults age 65 and over in Virginia are not enrolled in Medicare. This data supports the assumption that all born in 1946 and earlier are enrolled in Medicare.

Overall, records obtained at the VCU School of Dentistry are representative of the patient population who received dental care at the school in 2011. However, patient income and level of education are items that are not captured in dental school patient records. This limits determining how representative this target population is of the general population.

There are two issues that limit generalizability. This exploratory study is only analyzing adults age 47 and over who utilize dental services at the VCU School of Dentistry. Therefore, inferences cannot be made about the population of adults age 47 and over because those who do not utilize dental care services are not included. Furthermore, the sample will not be nationally representative of even those age 47 and over who use dental services because it is only drawn from one dental facility in one metropolitan area. Nevertheless, there is sufficient variation in

the target population of this study so that useful inferences can still be drawn about the relationship between cohort membership, dental care coverage and utilization of dental services.

### **Conclusion**

This chapter provided the design and methods utilized in this exploratory study to evaluate the associations between cohort membership, type of dental coverage, and utilization of dental care services in adults age 47 and over who receive dental care at Virginia Commonwealth University's (VCU) School of Dentistry. Chapter 4 tests multiple hypotheses related to these associations. The results of the analyses described are discussed in Chapter 5.

## Chapter 4: Results

Chapter Four describes the data preparation and results of the statistical analysis addressing the hypotheses presented in this exploratory research study. The purpose of this study is to evaluate differences in dental coverage and utilization of dental services displayed by the members of the Baby Boom, Silent Generation, and Greatest Generation Cohorts who received dental care at the VCU School of Dentistry in 2011. Differences displayed were evaluated to determine if cohort succession supports lag in the Medicare policy.

### Study Population Characteristics

Patients' ages ranged from 47 to 101 years of age, ( $M = 62.22$ ,  $SD = 10.078$ ). Based upon their age as of December 31, 2011, patients were placed into the following age cohorts: 1. Greatest Generation (born 1901-1924, Ages 87 to 110), 2. Silent Generation (born 1925-1945, Ages 66 to 86), and 3. Baby Boom (born 1946-1964, Ages 47 to 65). Secondary data was extracted on 11,297 patients. This number consisted of all patients aged 47 and over who received dental care at the VCU School of Dentistry in 2011. From Cohort 1, there were 166 patients, representing 1.44% of study population. From Cohort 2, there were 3,803 patients, representing 33.69% of the study population. From Cohort 3, there were 7,328 patients, representing 64.87% of the study population. Gender was not indicated on 19 of the patients, therefore these patients are excluded from analysis. The female gender makes up 65% of this population. There are 844 patients from this study population that reside in rural areas of

Virginia, as designated by the U.S. Census Bureau. Twenty nine of the patients from this study population reside outside the state of Virginia and these patients were excluded when models were tested. There was no zip code provided on 48 patients, therefore there was no means to indicate rural or urban residency. These patients were also excluded when the models were tested. Race was captured on less than .002%, because only 29 of the patients from this population of 11,297 had a race indicated, therefore race is not included in the analytical models of this research study. Figure 2 provides a breakdown of patients excluded from the study.

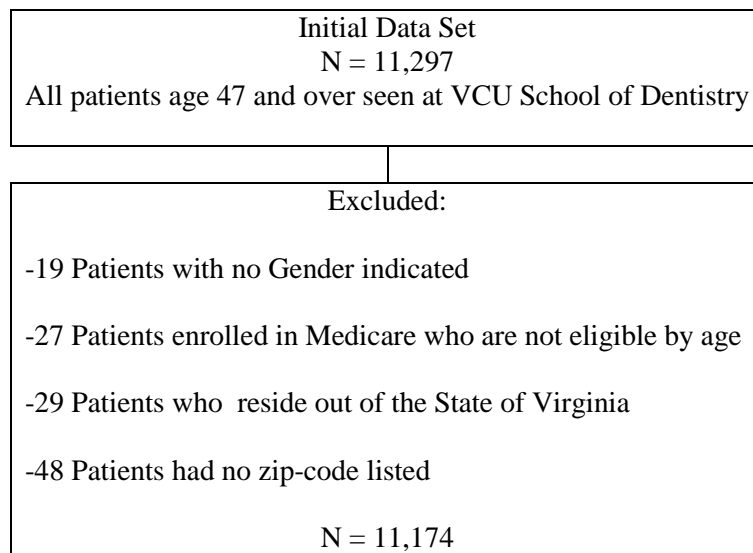


Figure 2. Data Tree

Medicare enrollment status was also a variable that was only captured on a minimal number of patients because Medicare does not cover routine dental care. In instances deemed medically necessary, such as oral surgery or extractions, Medicare will provide some monetary assistance. Five patients had dental services covered by Medicare because they met this eligibility requirement. These patients are included in the models because they were eligible by age to be enrolled in Medicare. Twenty-seven patients had data captured that indicated they are enrolled in Medicare, however they did not meet the age eligibility requirement (age 65)



established for this study. These patients are excluded from the models. For study purposes, all patients in Cohort 1-Greatest Generation and Cohort 2-Silent Generation were indicated as being enrolled in Medicare. From Cohort 3-Baby Boom Generation, 375 out of 7,328 patients are indicated as being enrolled in Medicare, based upon age of eligibility. Medicare enrollment is not captured on every patient seen at the VCU Dental School. Therefore, findings from this study are stemming from an assumption supported by previous statistical findings, not a direct measurement of data collected from the studied population. Based upon this age assumption, that all individuals born in 1946 and earlier are enrolled in Medicare, 4,345 patients in this study population are enrolled in Medicare. Based on assumption, approximately 38% of patients in this study are enrolled in Medicare.

### **Data and Preliminaries**

Secondary data, on patients age 47 and over seen in 2011 at the VCU School of Dentistry, was extracted from Axiom, the VCU Dentistry Clinical Database system. This data was entered into the PASW/SPSS 19 program and analyzed. Frequency tables identified misclassified or improperly coded data. Histograms were used for screening of outliers and checking normality. Diagnostics included Pearson Correlations, the Variance Inflation Factor (VIF), and tolerance values to assess intercorrelations and multicollinearity. Multicollinearity exists when independent variables are highly correlated. Correlations in the Pearson coefficient matrix were examined to determine if the correlation coefficient between two explanatory variables is .75 or higher (Tabachnick & Fidell, 2007). The VIF rule of thumb stating 10 or higher or equivalently, tolerances of .10 or less and not greater than 1 was also used to address multicollinearity (Hair, Anderson, Tatham & Black, 1995; Multicollinearity, 2012).

A histogram revealed the dependent variable utilization, defined as total amount spent, was not normally distributed (See Appendix A). Log transformation was used, because using the natural log (ln) makes the variable normally distributed and the models were estimated using the log transformation as the dependent variable. Using the natural log, the transformed variable, Total Amount Spent is normally distributed. There are some zeros defined as total amount spent by some patients. These amounts were included because they are amounts patients paid for dental care received. The natural log of zero cannot be computed because it will be undefined. When computing the natural log of zero, a non-zero constant of one was added. The natural log of 1 is zero. This is why zeros are displayed in the histogram (See Appendix B). Because \$5.00 is the next lowest amount defined as a total amount spent, after zero, the number one can be used as the non-zero constant. Histograms revealed that all other variables were normally distributed.

Multicollinearity can exist when independent variables are very highly correlated (Polit & Beck, 2008). Multicollinearity increases sampling error of coefficients, thereby decreasing the power of significance tests. For this study, correlations were first examined using Pearson Correlations. With Pearson correlation, the closer the coefficient is to either  $-1$  or  $1$ , the stronger the correlation between the variables. Any correlation above  $.90$  is considered a very strong one (Tabachnick & Fidell, 2007). Table 8 shows a very strong positive correlation between Medicare enrollment and Cohort 2-Silent Generation ( $r = .90$ ). A very strong negative correlation is also shown between Medicare enrollment and Cohort 3-Baby Boom Generation ( $r = -.93$ ).

As shown in Table 8, there is not a strong correlation between the two continuous variables, age and total amount spent ( $r = -.004$ ) or between age and log of total amount spent ( $r = -.008$ ). Members of Cohort 1-Greatest Generation and Cohort 2-Silent Generation are all

Table 8. Intercorrelations (Pearson)

	1	2	3	4	5	6	7	8	9	10	11
Age	1	.127	.824	-.082	.074	.041	.338	.743	-.821	.013	-.008
Prophy in 2011	.127	1	.115	.090	-.059	-.033	-.003	.121	-.119	-.018	.166
Medicare Enroll	.824	.115	1	-.086	.079	.053	.154	.901	-.931	.019	-.006
Dental Coverage	-.082	.090	-.086	1	-.255	.005	-.036	-.081	.089	-.005	.232
Payment Source	.074	-.059	.079	-.255	1	.003	.080	.059	-.079	.011	-.024
Male	.041	-.033	.053	.005	.003	1	-.009	.052	-.049	.005	.013
Cohort 1	.338	-.003	.154**	-.036	.080	-.009	1	-.087	-.166	-.018	-.020
Cohort 2	.743	.121	.901**	-.081	.059	.052	-.087	1	-.968	.017	.001
Cohort 3	.821	-.119	-.931**	.089	-.079	-.049	-.166	-.968	1	-.012	.004
Rural	.013	-.018	.019	-.005	.011	.005	-.018	.017	-.012	1	-.008
Log Amnt Spent	-.008	.166	.066	.232	-.024	.013	-.020	.001	.004	-.008	1

Note. 1= Age, 2 = Prophy in 2011, 3 = Medicare Enrollment, 4 = Dental Coverage, 5 = Payment Source, 6 = Male, 7 = Cohort 1, 8 = Cohort 2, 9 = Cohort 3, 10 = Rural, 11 = Log total amount Spent  
 \*\* p < 0.01

eligible for Medicare and there are 375 patients eligible, by age, for Medicare enrollment in Cohort 3-Baby Boom Generation. Results in Table 8 also shows a strong correlation between Age and Medicare Enrollment Status ( $r = .824$ ). This is expected due to eligibility of Medicare enrollment based primarily on reaching the age of 65.

The use of redundant variables in the same analysis inflates the size of error terms and weaken the analysis (Tabachnick & Fidell, 20001). Virtually all patients in Cohort 1-Greatest Generation and Cohort 2-Silent Generation are enrolled in Medicare. There is a very small number of patients in Cohort 3-Baby Boom Generation enrolled in Medicare. The results from the Person correlations support the need to further investigate collinearity between Medicare

enrollment and Cohort membership. For further investigation, control and independent variables were entered in separate blocks for both logistic and linear regression models to evaluate multicollinearity. Results revealed Medicare enrollment was not negative and significant in Block 1 of covariates when running logistic regression models. Also, for the hypotheses in which multiple regression analysis was used, control and independent variables were entered in separate blocks. The tolerance value for Medicare enrollment was not negative and greater than one or less than .10 and the VIF was not more than 10 in Block 1 or Block 2. These findings indicate there is not a significant correlation between Cohort membership and Medicare enrollment that warrants the removal of Medicare enrollment status from statistical models.

Descriptive statistics reflect cohort membership, gender, race, place of residence (rural/urban), Medicare enrollment status, and type of dental coverage (Medicare Advantage plans with dental included, dental coverage through employer, private dental plan, out of pocket). Chi<sup>2</sup> tests, multiple regression analyses and logistic regression analyses addressed study hypotheses.

### **Results Related to Hypothesis One**

**H1a: Cohort 3-Baby Boom Generation will display a higher percentage of dental coverage.** This hypothesis is accepted. Dental coverage was tabulated, by cohort, using a 3 x 2 cross tabulation to reveal the observed and predicted frequencies of dental coverage within cohorts,  $\chi^2(2) = 97.19, p < .01$ . The predicted counts/frequencies are projected on the basis of no relationship between the variables. The predicted counts/frequencies are calculated using the Column and Row totals of observed frequencies. The Row Total is multiplied by the Column Total and this amount is then divided by the total number of observations, Predicted Cell Frequency = (Row Total \* Column Total) / N). Cohort 3 is different from both Cohorts 1 and 2

because it displays a higher frequency of observed dental coverage and a higher observed percentage of dental coverage. The results support previous research findings which indicate that members of Cohort 3-Baby Boomer Generation have higher rates of dental coverage (Manski, Goodman, Reid, Macek, 2004). In contrast, the opposite trend is displayed by Cohort 1 and Cohort 2. The difference between Cohorts 1 and 3 primarily accounts for the statistical significance. There is a difference between the observed and predicted values when comparing Cohorts 1 and 3, but less certain of a difference in these values when comparing Cohorts 2 and 3. Table 9 displays the observed and predicted count along with the expected and observed percentages to show differences among the three Cohorts.

Table 9. Frequency, Expected Percentage of Predicted Dental Coverage Within Cohort, Percentage With Observed Dental Coverage Within Cohort and Percentage Covered Within Total Study Population

Cohort	Dental Coverage Frequencies		Expected Percentage Of Predicted Coverage Within Cohort	Percentage With Observed Dental Coverage Within Cohort	Percentage Covered Within Total Study Population
	Observed Frequency	Predicted Frequency			
1=Greatest Generation	40	63.8	40% $\frac{63.8}{161}$	24%	.004% $\frac{40}{11,174}$
2=Silent Generation	1,279	1,491.9	39% $\frac{1,491.9}{3,781}$	33%	11% $\frac{1,279}{11,174}$
3=Baby Boom Generation	3,089	2,852.3	39% $\frac{2,852.3}{7,232}$	43%	28% $\frac{3,089}{11,174}$
Total	4,408	4,408	-	100%	39% $\frac{4,408}{11,174}$

**H1b: Employer provided dental insurance will be the most prevalent type of dental insurance coverage.** This hypothesis is accepted. Results in Table 10 indicate that employer

Table 10. Frequencies and Percentages of Type of Dental Coverage In Study Population

Payment Source	Frequency	Percent
1 = Medicare Advantage	129	1.15
2 = Employer Provided Dental Coverage	3,127	27.83
3 = Private Dental Plan	1,174	10.45
4 = Out of Pocket	6,808	60.58
Total	11,238	100.00

provided dental coverage is the most prevalent type of dental insurance coverage. However, when out of pocket pay is considered, it is the more common payment source.

A 3 x 4 cross tabulation method was used to reveal the observed and predicted frequencies of payment sources. The predicted count is projected on the basis of a lack of relation between the variables. Results indicate that employer provided insurance coverage is also the most prevalent type of dental coverage displayed by each individual cohort. (See Table 11.) However, when out of pocket is a considered payment source, it is the most prevalent type of payment source in each cohort. For members in Cohort 1-Greatest Generation, employer provided coverage is stemming from Federal Government pension packages for 15 members, and military pension packages for five members. Six from Cohort 1 are covered by pension plans provided by former employers.

In table 11, examinations of the observed and predicted counts and percentages, show that the largest discrepancies are related to the patients who have Medicare Advantage. Observed values are substantially higher than predicted for Cohorts 1 and 2, while observed values for Cohort 3 are considerably less than predicted. This finding is logical since fewer

Table 11: Prevalence of Type of Coverage By Cohort <sup>a</sup>

Cohort		Medicare Advantage	Employer Provided	Private Plan	Out of Pocket
1	Count	6	26	8	119
	Predicted Count	1.9	44.9	16.9	97.4
	% Count Within Cohort	3.7%	16%	4.9%	71.6%
	% Predicted Within Cohort	$\frac{1.9}{161}$ 1.1%	$\frac{44.9}{161}$ 27.8%	$\frac{16.9}{161}$ 10.4%	$\frac{97.4}{161}$ 60.4%
2	Count	116	827	342	2,478
	Predicted Count	43.6	1,050.4	395.7	2,278.4
	% Count Within Cohort	3.1%	21.8%	9.0%	65.4%
	% Predicted Within Cohort	$\frac{43.6}{3,780}$ 1.1%	$\frac{1,050.4}{3,780}$ 27.8%	$\frac{395.7}{3,780}$ 10.46%	$\frac{2,278.4}{3,780}$ 60.2%
3	Count	7	2,258	822	4,154
	Predicted Count	83.6	2,015.7	759.4	4,372.2
	% Count Within Cohort	.1%	31.1%	11.3%	57.1%
	% Predicted Within Cohort	$\frac{83.6}{7,233}$ 1.1%	$\frac{2,015.7}{7,233}$ 27.8%	$\frac{759.4}{7,233}$ 10.4%	$\frac{4,372.2}{7,233}$ 10.4%

Note.  $\chi^2(10) = 452.01, p < .01$

<sup>a</sup> 3 cells (16.7%) have predicted count less than 5. The minimum predicted count is .39.

members from Cohort 3 are eligible for Medicare coverage, but this is a large sized cohort. With respect to Employer Provided vs. Out of Pocket coverage, members of Cohort 3 are more evenly distributed between these two types, while members of Cohorts 1 and 2 are much less likely to have Employer Provided coverage. This differential is even more exaggerated when examining Cohort 1.

## Results Relating to Hypothesis Two

Control and independent variables were entered in separate blocks to determine the effect of the IVs and the covariates on the DV. The Omnibus Tests of Model Coefficients is statistically significant for Block 1 with just the covariates,  $\chi^2(4) = 201.26; p < .05$ , and Block 2 with IVs included,  $\chi^2(6) = 233.15; p < .05$ . In this logistic regression model, a dummy variable was created for 2 of the 3 Cohort categories, Cohort 1 and Cohort 3. Holding all other variables constant, the "Constant" term below is the value for Cohort 2 and is the "baseline" cohort. The term "Constant" is equivalent to the "Intercept".

**H2a: Members of Cohort 1-Greatest Generation are less likely to have dental coverage than members of Cohort 2-Silent Generation.** This hypothesis is accepted. The coefficients for Cohort 1 and Cohort 3 are both significant ( $p$ -values = .030 and .004 respectively), indicating that Cohort 1 is significantly different from Cohort 2. Since the coefficient for Cohort 1 is negative, then the average response for Cohort 1 is less than the average response for Cohort 2, holding everything else constant ( $b = -.399, p < .05$ ).

Results show that the odds of having dental insurance are approximately .671 times less for Cohort 1-Greatest Generation when compared to Cohort 2-Silent Generation. Cohort 1 is 33% less likely to have dental coverage than Cohort 2.

Results from this model also show that Gender, place of residence and Medicare enrollment status do not have a significant influence on the likelihood of dental coverage. However, there is a significant association between having an adult dental prophylaxis procedure and having dental coverage ( $b = .422, p < .001$ ). Odds of having dental coverage are 1.52 times more likely for those who have routine adult dental prophylaxis procedures than those who do



not. Restated, 52% of the patients who have a routine adult dental prophylaxis procedure have dental coverage. Results are shown in Table 12.

Table 12. Likelihood of Dental Coverage By Cohort (Medicare Enrollment Included)

Dental coverage	<i>b</i>	<i>SE</i>	Wald	<i>p</i>	<i>OR</i>	95% CI	
						LL	UL
Cohort 1	-.399	.184	4.690	.030	.671	.468	.963
Cohort 3	.324	.111	8.447	.004	1.382	1.111	1.720
Male	.055	.039	1.930	.165	1.056	.978	1.141
Rural	-.020	.074	.070	.792	.981	.848	1.134
Prophy in 2011	.422	.039	114.824	.001	1.526	1.412	1.648
Medicare	-.118	.109	1.171	.279	.889	.718	1.100
Constant	-.822	.117	49.062	.001	.439		

Note. *df* = 1,  $R^2 = .019$

**H2b: Members of Cohort 2-Silent Generation are less likely to have dental coverage than members of Cohort 3-Baby Boom Generation.** This hypothesis is accepted by results previously shown in Table 12. Control and independent variables were entered in separate blocks to determine the effect of the IVs and the covariates on the DV. In Table 12, the coefficient on Cohort 3 is positive and statistically significant ( $b = .324, p < .005$ ). Therefore, it can be concluded that members of Cohort 3 are more likely to have dental coverage than members of Cohort 2. The odds of having dental coverage are 1.38 times more likely for Cohort 3-Baby Boomer Generation compared to Cohort 2-Silent Generation. Restated, Cohort 3 is 38% more likely to have dental coverage than Cohort 2.

### Results Relating to Hypothesis Three

For this hypothesis, utilization: financial - defined as the total amount spent with the transformed variable, Natural Log of Total Amount Spent, used to address normality issues. In a multiple regression model, a dummy variable was created for 2 of the 3 Cohort categories.

Control and independent variables were entered in separate blocks to determine the effect of the

IVs and the covariates on the DV. This evaluates how much the IVs contribute to the variation in the DV when controlling for other variables. As IVs in this method, Cohort 1 ( $t = -.992, p > .05$ ), Cohort 2 ( $t = 1.21, p > .05$ ) and Cohort 3 ( $t = -.748, p > .05$ ) were excluded because they did not display a significant effect on utilization defined as total amount spent.

**H3a: Members of Cohort 1-Greatest Generation will utilize less dental services than members of Cohort 2-Silent Generation.** Hypothesis H3a is rejected. Results revealed that it cannot be concluded that members of Cohort 1 ( $\beta = -.009, p > .05$ ) display less utilization of dental services, defined as total amount spent, than members of Cohort 2. However, with a very low R-square value ( $R^2 = 0.074, 7\%$ ), this model explains marginal variation. The inclusion of a level of income for each patient may have aided with explaining variation.

There is a significant relationship between adult dental prophylaxis procedure and utilization, defined as total amount spent ( $\beta = .145, p < .005$ ). It can be inferred that fees for prophylactic procedures performed make up the majority of the total amount spent. There is also a significant relationship between dental coverage and utilization, defined as total amount spent ( $\beta = .215, p < .005$ ). It can be inferred that those with dental coverage utilize more dental care when defined as total amount spent. Results are displayed in Table 13.

**H3b: Members of Cohort 2-Silent Generation will utilize less dental services than members of Cohort 3-Baby Boom Generation.** Hypothesis H3b is rejected. Results revealed that members of Cohort 2 do not significantly utilize less dental services, defined as total amount spent, than members of Cohort 3 ( $\beta = -.019, p > .05$ ). However, with a very low R-square value ( $R^2 = 0.074, 7\%$ ), this model explains marginal variation. The inclusion of a level of income for each patient may have aided with explaining variation. See Table 13.

Table 13. Predictors of Dental Utilization, Defined as Total Amount Spent  
(testing for predictive value of Cohorts)

Log total Amount Spent	Standardized Coefficient Beta	Standard Error	t	Sig
Constant	--	.026	214.420	.001
Male	.018	.027	1.963	.050
Rural	-.006	.050	-.653	.514
Prophy in 2011	.145	.027	15.763	.001
Dental Coverage	.215	.027	23.640	.001
Medicare enrollment	-.005	.028	-.576	.565

Note. CI = 95%,  $R^2 = 0.074$

#### Results Relating to Hypothesis Four

**H4a: Older adults with dental coverage will pay a higher amount for dental services than those without.** This hypothesis is accepted by results from a standard multiple regression analysis. Control and independent variables were entered in separate blocks to determine the effect of the IV and the covariates on the DV. As an IV in this approach, dental coverage is significant ( $t = 23.635, p < .01$ ) and was not excluded because it displays a significant effect on utilization, defined as total amount spent. There is a significant relationship between dental coverage and utilization, defined as total amount spent ( $\beta = .217, p < .01$ ). It can be inferred that those with dental coverage spend more on dental care, when utilization is defined as total amount spent. However, with a very low R-square value ( $R^2 = 0.074, 7\%$ ), this model explains marginal variation. The inclusion of a level of income for each patient may have aided with explaining variation. The R-square for Block 1, that tested only the covariates, was also low ( $R^2 = 0.027, 2\%$ ). Findings support that having dental coverage impacts dental utilization, when defined as the total amount spent. The R-square change for model one, including covariates only ( $R^2$  change = .028) compared to the R-square change for model two, including dental coverage as the

IV ( $R^2$  change = .046) shows that the addition of dental coverage adds more explained variance to the model. See results in Table 14.

Table 14. Amount of Utilization, defined as total amount spent

Log Total Amount Spent	Standardized Coefficient Beta	Standard Error	t	Sig
Constant	--	.085	66.084	.001
Dental Coverage	.217	.027	23.635	.001
Age	-.008	.001	-.833	.405
Male	.018	.027	1.969	.049
Rural	-.006	.050	-.651	.515
Prophy in 2011	.144	.027	15.595	.001

Note. CI = 95%,  $R^2 = 0.074$

Age is defined as numerical age. The coefficient for age is negative but not significant ( $\beta = -.008$ ,  $p > .05$ ). It can be inferred that age has no statistically significant effect on utilization, defined as total amount spent. It can be inferred from this model that males are more likely to incur dental expenses, when utilization is defined as total amount spent ( $\beta = .018$ ,  $p < .05$ ). There is a significant relationship between routine adult dental prophylaxis procedure and utilization, defined as total amount spent ( $\beta = .144$ ,  $p < .01$ ). It can be inferred that fees for prophylaxis procedures performed make up the majority of the total amount spent.

**H4b: Older adults with dental coverage will display more utilization of adult dental prophylaxis procedures than those without.** This hypothesis is accepted using a logistic regression model. Control and independent variables were entered in separate blocks to determine the effect of the IVs and the covariates on the DV. This evaluates how much the IVs contribute to the variance in the DV when controlling for other variables. The Omnibus Tests of

Model Coefficients are statistically significant for Block 1, with just the covariates included,  $\chi^2(3) = 202.07, p < .01$ , and Block 2, with the IV included,  $\chi^2(4) = 315.24, p < .01$ . The IV, dental coverage, was not excluded because it displays a significant effect on utilization, defined as total amount spent ( $b = .419, p < .001$ ). Those with dental coverage utilize more dental care, when defined as a routine adult dental prophylaxis procedure, than those without ( $OR = 1.520, p < .01$ ). Restated, patients with dental coverage utilize dental care, when defined as a routine adult dental prophylaxis, 52% more than patients without dental coverage. However, with a very low Nagelkerke R-square value ( $R^2 = 0.037, 3.7\%$ ), this model explains marginal variation. The inclusion of the periodontal status for each patient may have aided with explaining variation in utilization (when defined as Procedural-Routine adult dental prophylaxis).

Age is defined as numerical age and with every additional year, or unit increase, the odds of utilizing dental care, defined as a routine adult dental prophylaxis procedure, increases by 2.8% ( $OR = 1.028$ ). It can be inferred that age has a statistically significant effect on utilization, defined as a routine adult dental prophylaxis procedure. Each year a person ages they are 2.8% more likely to have a routine adult dental prophylaxis procedure.

Results indicate that men utilize less dental care, when defined as a routine adult dental prophylaxis procedures, than women ( $OR = .852, p < .005$ ). Restated, women are 15% more likely to utilize dental care, when defined as a routine adult dental prophylaxis, than men. Also, fewer patients residing in rural areas utilize routine adult dental prophylaxis procedures at the VCU School of Dentistry than patients residing in urban areas ( $OR = .850, p < .05$ ). Patients who reside in urban areas are 15% more likely to utilize dental care, when defined as a routine adult dental prophylaxis, than those who reside in rural areas. Results are displayed in Table 15.

Table 15. Amount of Utilization, Defined as Having an Adult Dental Prophylaxis Procedure in 2011

Prophylaxis in 2011	<i>b</i>	<i>SE</i>	Wald	<i>p</i>	<i>OR</i>	95% CI	
						LL	UL
Age	.028	.002	206.315	.001	1.028	1.024	1.032
Male	-.161	.039	17.089	.001	.852	.789	.919
Rural	-.163	.073	4.924	.026	.850	.736	.981
Dental Coverage	.419	.039	112.517	.001	1.520	1.407	1.643
Constant	-1.948	.125	241.112	.001	.143		

Note. *df* = 1

### Results Relating to Hypothesis Five

Control and independent variables were entered in separate blocks to determine the effect of the IVs and the covariates on the DV. The Omnibus Tests of Model Coefficients is statistically significant for Block 1 with just the covariates,  $\chi^2(4) = 281.40, p < .01$ , and Block 2 with IVs included,  $\chi^2(6) = 300.02, p < .01$ . In this logistic regression model, a dummy variable was created for 2 of the 3 Cohort categories, Cohort 1 and Cohort 3.

#### **H5a: Members of Cohort 1-Greatest Generation will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 2-Silent**

**Generation.** This hypothesis is accepted. The coefficient for Cohort 1 dummy variable is negative and significant ( $b = -.419, p < .01$ ). It can be inferred that members of Cohort 1 are less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 2. Odds of utilization, defined as a routine adult dental prophylaxis are .658 times less for Cohort 1-Greatest Generation than Cohort 2-Silent Generation. Restated, Cohort 1 is 34% less likely to have a routine adult dental prophylaxis procedure than Cohort 2.

There is a significant association between having an adult dental prophylaxis procedure and dental coverage ( $b = .419, p < .01$ ). Those with dental coverage utilize more dental care,

when defined as a routine adult dental prophylaxis procedure, than those without ( $OR = 1.520$ ,  $p < .01$ ). Patients with dental coverage utilize dental care, when defined as a routine adult dental prophylaxis 52% more often than patients without dental coverage.

Results indicate that men utilize less dental care, when defined as a routine adult dental prophylaxis procedures, than women ( $OR = .847$ ,  $p < .001$ ). Women utilize dental care, when defined as a routine adult dental prophylaxis, 15% more often than men. Also, fewer patients residing in rural areas utilize routine adult dental prophylaxis procedures at the VCU School of Dentistry than patients residing in urban areas ( $OR = .846$ ,  $p < .05$ ). Patients who reside in urban areas utilize dental care, when defined as a routine adult dental prophylaxis, 15% more often than those who reside in rural areas. However, with a very low Nagelkerke R-square value ( $R^2 = 0.035$ , 3.5%), this model explains marginal variation in utilization (when defined as Procedural-Routine adult dental prophylaxis). The inclusion of the periodontal status for each patient may have aided with explaining variation in utilization (when defined as Procedural-Routine adult dental prophylaxis). Results are shown in Table 16.

**H5b: Members of Cohort 2-Silent Generation will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 3-Baby Boom Generation.** This hypothesis is rejected. In Table 16, the coefficient on Cohort 3 is negative and statistically significant ( $b = .394$ ,  $p < .001$ ). In comparison to the omitted Cohort 2, it can be concluded that members of Cohort 3 are less likely to utilize dental services than members of Cohort 2. It can not be concluded that members of Cohort 2 display less utilization, when defined as routine adult dental prophylaxis procedures, than members of Cohort 3. Refer to Table 16.

Table 16. Likelihood of Routine Adult Dental Prophylaxis Procedure in 2011 By Cohort

Dental Prophylaxis In 2011	<i>b</i>	<i>SE</i>	Wald	<i>p</i>	<i>OR</i>	95% CI	
						LL	UL
Dental Coverage	.419	.040	112.144	.001	1.520	1.407	1.642
Male	-.167	.039	18.400	.001	.847	.784	.913
Rural	-.167	.073	5.207	.022	.846	.733	.977
Medicare Enroll	.182	.108	2.865	.091	1.200	.972	1.482
Cohort 1	-.419	.162	6.669	.011	.658	.479	.904
Cohort 3	-.394	.110	12.839	.001	.674	.544	.837
Constant	-.019	.115	.028	.001	.981		

Note. *df* = 1

Odds of utilization, defined as a routine adult dental prophylaxis are .674 times less for Cohort 3 –Baby Boom Generation than Cohort 2-Silent Generation. Cohort 3 is 33% less likely to have a routine adult dental prophylaxis procedure than Cohort 2. However, with a very low Nagelkerke R-square value ( $R^2 = 0.035$ , 3.5%), this model explains marginal variation in utilization (when defined as Procedural-Routine adult dental prophylaxis). The inclusion of the periodontal status for each patient may have aided with explaining variation in utilization (when defined as Procedural-Routine adult dental prophylaxis).

Results, from analysis performed in this study, reveal both expected and unexpected findings. Results from this study are supported by previous research and encourage future research addressing the association between cohort membership, dental care coverage and utilization of dental services in the older adult population. Table 17 provides a summary of the hypotheses that were accepted and rejected stemming from analysis conducted in this study.



Table 17. Accepted and Rejected Hypotheses

Hypotheses Tested	Accepted or Rejected
<b>H1a:</b> Cohort 3-Baby Boom Generation will display a higher percentage of dental coverage.	Accepted
<b>H1b:</b> Employer provided dental insurance will be the most prevalent type of dental insurance coverage.	Accepted
<b>H2a:</b> Members of Cohort 1-Greatest Generation are less likely to have dental coverage than members of Cohort 2-Silent Generation.	Accepted
<b>H2b:</b> Members of Cohort 2-Silent Generation are less likely to have dental coverage than members of cohort 3-Baby Boom Generation .	Accepted
<b>H3a:</b> Members of Cohort 1-Greatest Generation will display less dental utilization than members of Cohort 2-Silent Generation.	Rejected
<b>H3b:</b> Members of Cohort 2-Silent Generation will display less dental utilization than members of Cohort 3-Baby Boom Generation.	Rejected
<b>H4a:</b> Older adults with dental coverage will pay a higher amount for dental services than those without.	Accepted
<b>H4b:</b> Older adults with dental coverage will display more utilization of adult dental prophylaxis procedures than those without.	Accepted
<b>H5a:</b> Members of Cohort 1-Greatest will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 2-Silent Generation.	Accepted
<b>H5b:</b> Members of Cohort 2-Silent Generation will be less likely to have a routine adult dental prophylaxis procedure performed than members of Cohort 3-Baby Boom Generation.	Rejected

## Conclusion

Chapter 4 presents the results stemming from analytical approaches used to address ten different hypotheses presented in this study. These hypotheses explored differences in dental coverage and utilization of dental services displayed by Cohort 1-Greatest Generation, Cohort 2-Silent Generation and Cohort 3-Baby Boom Generation. The Baby Boom Generation displayed the highest percentage of dental coverage. For all three of the cohorts evaluated, Employer Provided Dental Coverage was the most prevalent type of dental coverage. However, when considered a payment source, Out of Pocket Funding is the primary source of payment for dental services in all three cohorts. Findings from this study reveal that the Greatest Generation utilized the most dental services (when defined as Financial: Total Amount Spent). Results also indicate that the Silent Generation utilized the most dental services (when defined as Procedural: Routine Adult Prophylaxis).

Chapter 5 evaluates the implications of the study results and addresses applications to the theoretical framework. Differences in cohort attitude toward dental care can affect utilization of dental services. Chapter 5 provides discussion on the attitudes of different cohorts toward dental care that impact the utilization of dental services and how findings from this study support this impact. Discussion also addresses how findings from this study support a lag in the Medicare policy that needs to be addressed.

## Chapter 5: Discussion

### Introduction

The effects of membership in three cohorts (1-Greatest Generation, 2-Silent Generation and 3-Baby Boom Generation), were explored. Because they have experienced different social, political, economic, and technological changes at different times in their life course, new cohorts of older people differ from previous ones. For this study, cohort refers to generational groups made up of members sharing similar beliefs and attitudes pertaining to dental care. Prior to WWII there was limited focus on maintaining oral health as part of overall health, life spans were shorter and there were fewer dentate older adults. The idea that dental services were not needed at older ages impacted the attitudes of members of the Greatest and Silent Generation cohorts. In contrast, the majority of the members of the Baby Boom Generation cohort were brought up receiving some form of oral/dental care. Many from this cohort continued dental care throughout their life course as many have, or had, dental insurance through their employer. Because Medicare does not cover dental care, after retiring many of these individuals may lose their dental insurance coverage and may not have the personal funds to continue dental care on their own, impacting needed utilization of dental services.

Impaired oral health may adversely affect diet, nutrition, sleep patterns, psychological status, social interactions and other activities of life in some older adults (Gluck & Morganstein, 2003). Research suggests that the improvement of oral health may have a positive impact on

general health and may delay mortality (Padilha, Hilgert, Hugo, Bos & Ferrucci, 2008). Dental health impacts overall health. Research supports links between dental health and cardiovascular disease, diabetes, mental health, rheumatoid arthritis, and pneumonia. All of these chronic conditions are prevalent in the older adult population. Thus, not only has the retention of dentition and the availability of dental services improved over time, but dental care has been recognized as having an important relationship to multiple chronic diseases affecting older persons.

Chapter Five presents a summary of findings and implications stemming from results of this study. Secondary data, on all patients age 47 and over seen in 2011 at the VCU School of Dentistry, was extracted and analyzed. Associations between cohort membership, dental coverage and utilization of dental services in this population were evaluated. Discussion addresses Cohort differences in dental coverage and utilization of dental services defined as Financial: Total amount spent and Procedural: Routine adult prophylaxis procedure. An overview of study limitations is included, along with research ideas that build on this foundational study.

## **Findings**

The purpose of this study was to identify differences in dental coverage and utilization of dental services in members of Cohort 1- Greatest Generation, Cohort 2- Silent Generation and Cohort 3- Baby Boom who received dental care at the VCU School of Dentistry in 2011. Differences were evaluated to determine if cohort succession supports lag in the Medicare policy in adults age 47 and over receiving dental care at the VCU School of Dentistry.

**Coverage.** For this study, coverage was defined as: 1. Medicare Advantage plans with dental coverage included, 2. Employer provided - Dental coverage through place of employment,

and 3. Private Dental Insurance that patient purchased. Out of Pocket funding was also evaluated as a source of dental care coverage.

Based upon previous research findings, it was expected and confirmed that Cohort 3-Baby Boom Generation has a greater percentage of dental coverage than Cohort 1-Greatest Generation and Cohort 2-Silent Generation (Manski, Goodman, Reid, Macek, 2004). Also expected and confirmed, Cohort 2 possesses more dental coverage than Cohort 1. Observed percentages and predicted percentages were also evaluated. Both the observed count and observed percentage of dental coverage are higher than the predicted count and predicted percentage within Cohort 3. This is the opposite of what is displayed by Cohort 1 and Cohort 2. Cohort 1 accounts for the statistical significance. There is a difference between the observed and predicted values when comparing Cohorts 1 and 3, but the difference in these values is less certain when comparing Cohorts 2 and 3.

Findings from this study did not display a significant relationship between Medicare enrollment and dental coverage. But, it must be considered that this study population is a population that utilizes dental care services. Results from this study show that there is a significant relationship between dental coverage and utilization of dental services defined as Procedural: Routine Adult Dental Prophylaxis procedure. Those with dental coverage are 52% more likely to have a routine adult dental prophylaxis procedure than those without dental coverage. Results from this study also show a significant relationship between dental coverage and utilization of dental services defined as Financial: Total Amount Spent. Whether older adults get needed dental care is closely related to dental coverage status (CDC, 2001).

Results did reveal that employer provided dental coverage was the most common type of dental coverage for all three Cohorts in this study. However, the most prevalent type of payment

source for all three Cohorts was out of pocket funding. Observed and predicted counts of dental coverage and percentages of dental coverage were evaluated. Results show that the largest discrepancies between Cohorts are related to the patients who have Medicare Advantage. Observed values are substantially higher than predicted for Cohorts 1 and 2, while observed values for Cohort 3 are considerably less than predicted. This finding is encouraging as it insinuates a high prevalence of participation in Medicare Advantage plans that include dental coverage. However, these findings stem from a population of individuals who utilize dental services. Findings, from this study, also reveal that neither gender nor place of residence significantly impact dental coverage.

**Utilization.** For this study, utilization is defined as financial and procedural.

***Financial: Total Amount Spent and Procedural: Routine Adult Dental Prophylaxis Procedure.*** Many from Cohort 1-Greatest Generation and Cohort 2-Silent Generation lived through or were raised during the Depression. Many members from these two cohorts came to believe that routine dental care was not necessary and had the attitude that a dentist only needed to be seen if mouth pain was experienced (Strayer, 1995; Locker & Jokovic, 1996). Findings from this study, stemming from multiple regression models, indicate that Cohort 1 utilized more dental services when defined as Financial: Total amount spent. This finding suggests that members of Cohort 1 did not seek routine preventative dental care, leading to higher treatment costs when addressing a dental health issue.

Age, not cohort, is used in the analytical approach evaluating whether older adults with dental coverage pay higher amounts for dental services than those without. Because cohort was not relevant to this evaluation, it was not used. Findings, from a multiple regression model, revealed that age itself did not have a significant impact on utilization, defined as Financial:

Total amount spent. This supports the suggestion that it may not be age, but cohort membership differences that affect oral health practices and values (Kiyak, & Reichmuth, 2005). Findings also show no significant relationship between Medicare enrollment and utilization defined as Financial or Procedural.

The previously referenced attitude, expressing limited focus toward dental care, supports results from this study indicating that less preventative dental care was sought by members of Cohort 1, because they also displayed lower utilization of routine adult dental prophylaxis procedures than members of Cohorts 2 and 3. Common patterns of response, definitions and beliefs are a product of cohort members sharing historical experiences, resulting in common norms which become institutionalized in social structure and role (Riley & Riley, Jr., 1994).

Of the three Cohorts, Cohort 2-Silent Generation utilized more dental services, when defined as Procedural (Routine adult dental prophylaxis procedures). This finding is contradictory to the attitudes of Cohorts 1 and 2 toward seeking routine preventative dental care. However, the data did not capture the periodontal conditions of patients in this study. Because of a high prevalence of chronic periodontitis in older adults (Boehm & Scannapieco, 2007), the oral-systemic interaction is an important issue (Barnett, 2006) Individuals with chronic periodontitis (gum disease) are recommended to have more frequent routine adult dental prophylaxis procedures performed. This usually means adult prophylaxis procedures are recommended to be performed more than twice a year and up to as much as 4 times a year. Some of these patients are advised to come in every three months to monitor and maintain periodontal health. Because members of Cohort 2 are older than members of Cohort 3, this uncaptured variable may explain the higher number of routine adult dental prophylaxis procedures displayed by members of Cohort 2. Patients who undergo periodontal therapy are

recommended to come in more frequently for a routine periodontal maintenance cleaning. Periodontal maintenance cleaning fees are higher than routine adult prophylaxis fees. For patients, with a managed periodontal status and who do not have dental insurance, a routine adult dental prophylaxis fee is often charged to help reduce out of pocket costs.

What also should be considered, with regard to these findings, is that many individuals seek dental care at the VCU School of Dentistry because treatment is provided at a lower cost than at private dental practice offices. Findings, from this study, show that Cohort 2 utilizes more dental services when defined as Procedural than Cohorts 1 and 3 and utilizes more dental services when defined as Financial than Cohort 3. This may contribute to results from this study showing that members of Cohort 2 have less dental coverage than Cohort 3. Having less dental coverage supports Cohort 2 seeking dental care at the dental school because lower costs mean less out of pocket funding required for dental services. Many members of Cohort 3 are in the work force and findings from this study show that Cohort 3 has a higher percentage of dental coverage. Therefore, it can be suggested that Cohort 3 members, with dental coverage, in the general population, are seeking dental care at private dental practices because their dental coverage, primarily employer provided, contributes more to the cost of dental care, reducing their out of pocket costs.

**Residence.** Although not a primary focus, this study enabled an evaluation of how the VCU School of Dentistry is serving residents who reside in dental health care shortage areas. These Designated Dental Health Care Professional Shortage Areas in Virginia (HPSA) are defined, by the U.S. Department of Health and Human Services, as having too few dental care providers. Geographic dental HPSAs must meet the following criteria: 1) Have a population to general dental provider weighted ratio greater than 5,000:1 or greater than 4,000:1 with high



needs. A high needs area is determined by high poverty rates (more than 20 percent below poverty) or by low fluoridation rates (more than 50 percent of the population has no fluoridated water). 2) Demonstrate that the dental care professionals in contiguous areas are overutilized with a population to dentist ratio greater than 3,000:1 or these areas must be currently designated as dental HPSAs. If the contiguous areas are not overutilized or designated, it must be demonstrated that barriers to accessing the services of dental professionals in these areas exist due to excessive distance (greater than 40 minutes travel time) or other factors (Virginia Department of Health, 2008). Table 18 provides a list of entire counties in Virginia that have been designated as dental health care professional shortage areas from which patients have been seen at the VCU Dental School. Patients from 21 of the 27 counties designated entirely as shortage areas, have received dental care at the VCU Dental School. This is a good indication that knowledge of care offered at the VCU Dental School is wide spread and sought by those in underserved areas, supporting an increase in access to dental care. With no dental care providers or a minimal number of dental care providers in these areas, it is important that patients from these areas receive dental care at the VCU Dental School as oral health is an important component of overall health.

Table 18. Patients Seen From the Following Designated Dental Care Health Professional Shortage Areas (HPSA) in Virginia

Shortage Areas: Entire Counties Declared as Dental HPSA	
Amherst	Lunenburg
Appomattox	Mecklenburg
Bath	Nelson
Brunswick	Nottoway
Buckingham	Page
Charlotte	Patrick
Cumberland	Rappahannock
Dinwiddie	Russell
Floyd	Shenandoah
Halifax	Wise
Louisa	

The VCU School of Dentistry is located in the City of Richmond, Virginia. According to the US Census Bureau, it is estimated that of all residents, age 47 and over, residing in Richmond, members from the Greatest Generation Cohort make up 5% of that population. This same population makes up 1.4% of the study population consisting of all patients age 47 and over seen at the VCU School of Dentistry. It is estimated that members from the Silent Generation make up approximately 27.6% of adults age 47 and over residing in Richmond, whereas this same population makes up 33.6% of the study population. It is estimated that members from the Baby Boom Generation Cohort make up approximately 67.2% of adults age 47 and over residing in Richmond. This same cohort population makes up 64.8% of the study population consisting of all patients age 47 and over seen at the VCU School of Dentistry in 2011. A slightly higher percentage of patients from Cohort 2-Silent Generation are seen at the Dental School than reside in the city. A slightly lower percentage of patients from Cohort 1-Greatest Generation and Cohort 3-Baby Boom Generation are seen than reside in the City of Richmond. The number of patients from these three different Cohorts seen at the Dental School relates closely to the number of residents from these same three cohorts residing in the City of Richmond, where the dental school is located. This suggests that the VCU School of Dentistry is serving members of the population of adults age 47 and over proportionately to the population of the metropolitan area in which it is located.

### **Implications**

Structural Lag Theory holds that society's institutions lag behind the realities of a healthy and capable older population. Its concepts are used in this study to evaluate lag in Medicare. Structural Lag Theory has two dynamisms of focus. The Dynamism of Changing Lives, which

impacts the Dynamism of Structural Change. The use of Structural Lag Theory suggests that people respond to available dental insurance coverage when pursuing dental care.

For this study, the dynamism of Changing Lives is represented by people living longer and more older adults retaining some or all of their natural teeth, changing the paradigm of dental care services needed by members of the Baby Boom, Silent Generation and Greatest Generation cohorts. The paradigm of dental care for the older adult population has changed from predominantly denture care to an increase periodontal therapy procedures and complex restorative procedures including esthetic dentistry, orthodontics and the placement of implants. Not only has the retained dentition rate and the availability of dental services improved over time, but dental care has been recognized as having an important relationship to multiple chronic diseases affecting older persons. The increase in dentition retention has improved masticatory function, however, the risk for acute and chronic oral disease persists later in life. Oral infections have a more profound effect on older adults compared to other segments of the population (Meurman & Hamalainen, 2005). Without early prevention and control interventions, older adults bear a greater oral disease burden than other age groups (Lamster & Crawford, 2008). Despite this paradigm change, dental care coverage has not been included in the Medicare policy.

The Dynamism of Changing Lives is also represented by cohort differences. In the US, cohorts born in the 1930s, 1950s, and 1980s have widely varying attitudes or views of the purpose, maintenance, and appearance of teeth. Changing lives impact cohort differences. Individuals born in the 1950s and later had access to fluoridated water during tooth development and were influenced by toothpaste commercials with the advent of television. Preventive and esthetic dentistry are concepts that received more public exposure in recent decades. These

events support the suggestion that it may not be age, but cohort differences that affect oral health practices and values. The lack of dental care coverage provided in Medicare is structural lag. Policies have not met the changing needs as presented by changing lives from cohort to cohort. Findings from this study support lag in the Medicare policy.

The Dynamism of Changing Lives, as represented by the varying attitudes toward dental care exhibited by the different cohorts, is reflected in the results of this study. Previous research findings indicate that members of the Greatest and Silent Generations did not seek preventative care and only sought dental care when in pain. This supports the concept that, despite the fewer number of patients from Cohort 1 in this study, many members from this cohort share similar attitudes toward utilizing dental care. Findings from this study, stemming from multiple regression model results with the DV as Total Amount Spent, suggest that members of Cohort 1 did not seek routine preventative dental care, leading to higher treatment costs when addressing a dental health issue. Based upon attitude toward dental care, the dental condition was most likely treated at a later stage in which the condition was more severe and more costly to restore or treat. Attitude toward dental care, which represents the Dynamism of Changing Lives, impacts dental utilization among members of Cohort 1-Greatest Generation.

The Dynamism of Structural Change is represented by the institutions of dental coverage and utilization of dental services. Results from this study, display a significant difference in dental coverage and utilization displayed by the three Cohorts (Cohort 1-Greatest Generation, Cohort 2-Silent Generation and Cohort 3-Baby Boomer Generation). Cohort 3-Baby Boomer generation has more dental care coverage than Cohorts 1 and 2. Cohort 1 utilized more dental services (when defined as Financial: Total amount spent) than Cohort 2, while Cohort 2 utilized more dental services (when defined as Procedure: Routine adult dental prophylaxis procedure)

than Cohorts 1 and 3. In this study, only 375 members out of 7,328 from the Cohort 3-Baby Boom Generation were eligible, by age, for Medicare enrollment. Many from Cohort 3 are still in the workforce, which increases their likelihood of having employer provided dental coverage (Manski et al, 2009).

The Dynamism of Changing Lives, is also represented by need. The need for dental care changes with age. Adults with a chronic periodontal condition (periodontitis) are advised to have more frequent routine visits to maintain or improve their periodontal status. Research studies have shown that the prevalence of periodontitis increases with age. In this study population, results showed members of Cohort 2 utilizing more dental services (when defined as Procedural: Routine adult dental prophylaxis) than members of Cohorts 1 and 3. This finding is contradictory to the attitudes of Cohorts 1 and 2 toward seeking routine preventative dental care. However, this same finding does not create an instance that contradicts The Structural Lag Theory, but instead supports the use of its concepts. It must be considered that this study population consists of dental care utilizes. The increased need for dental care throughout the life course represents the Dynamism of Changing Lives. However, the institution of dental coverage, which represents the Dynamism of Structural Change, has not kept up with the increased need for more periodontal dental care services associated with aging, as Medicare still does not provide dental care coverage. This lag in coverage limits access to care needed to maintain quality of life. Access to care is impacted by available funding. Without the assistance of dental coverage, many older adults will not have adequate out of pocket funding to cover the increase in costs associated with dental care services needed to address periodontal conditions.

Even though Cohort 3-Baby Boom Generation displays the highest percentage of dental coverage of the three Cohorts, this Cohort utilized less dental services (when defined as

Financial: Total amount spent and when defined as Procedural: Routine adult dental prophylaxis) than Cohort 2. However, it must be considered that members of Cohort 3 were exposed early in life to fluoridated water, which aids in decreasing dental restorative needs. Also, as mentioned, because Cohort 3 is younger, members may not be presenting severe periodontal conditions as the prevalence of this conditions increases with age. This variable was not captured, therefore was not used in this study. However, it is inferred that Cohort 2 displayed a higher level of utilization (when defined as Procedural-Routine adult dental prophylaxis) because its members presented with more periodontal issues, which require more frequent routine dental prophylaxis visits. These findings support the use of the Structural Lag Theory because its concepts support the fact that the institution of dental coverage provided in the Medicare policy, representing the Dynamism of Structural Change, has not kept up with the Dynamism of Changing Lives, represented by the increased need for utilization (when defined as Procedural-Routine adult dental prophylaxis). The large influx of members from Cohort 3 enrolling in Medicare, retiring from the work force, losing employer provided dental coverage, and having to address the need to care for their periodontal condition makes the lag in Medicare more apparent. For members of Cohort 3-Baby Boomer Generation, their need for and access to dental care services will become limited due to the lack of dental coverage in the Medicare policy.

Findings from this study suggest that the absence of dental coverage in Medicare increases the gap between current need and current policy for older adults in terms of dental care coverage. Cohort 3-Baby Boom Generation is the largest of the three cohorts evaluated in this study. Cohort size is a type of cohort effect reflecting compositional characteristics. The Baby Boom cohort is a large cohort that may face greater competition for social resources than smaller cohorts (George, 2000). The provision of dental coverage through Medicare needs to be re-

evaluated, not only because of the size of Cohort 3-Baby Boomer, but also because as a society we are moving into a chronic disease condition lifestyle situation with the aging of America.

The majority of members in Cohort 3 are employed and employer provided dental coverage is the most prevalent form of dental coverage. However, the fact still remains that out of pocket funding was responsible for the bulk of dental care services received by this Cohort. When these individuals enroll in Medicare and retire from the work force, many may be unable to afford dental care through out of pocket funding. When applying the dynamism of Changing Lives from the Structural Lag Theory and using the variable Cohort Membership, because older adults are retaining more of their natural dentition and living longer, members of the Baby Boom Generation Cohort will require more dental services than previous senior cohorts. However, when applying the dynamism of Structural Change from the Structural Lag Theory and using the variable dental coverage, their ability to afford these needed services may be limited upon enrolling in Medicare and retiring from the work force (Ferguson, Steinberg & Schwien, 2010). The lack of dental coverage and rising healthcare costs puts less affluent seniors at risk for inadequate access to dental care (Ferguson, Steinberg & Schwien, 2010). This could lead to increased disparity in access to dental care and thus a cascade of health care effects for those who cannot afford dental coverage after retiring and losing employer provided dental coverage. The subject of undefined pension needs to be visited based upon these findings, as individuals need to plan and save for future dental care needs.

What also needs to be considered is that in the current economic condition, more employers are reducing benefits provided to employees, and more workers seem to be losing their dental coverage. This loss of coverage increases out of pocket funding which many will not be able to provide, thereby reducing utilization of dental services. This suggests an increased

need for dental clinic services. Dental services offered at dental clinics are provided at a very reduced rate when compared to private dental practice rates. Therefore, findings from this study aid in advocating for the support of establishing and maintaining dental clinics. If a reduction in dental coverage benefits continues and dental services are not covered by any employer provided coverage plan, structural lag remains applicable because oral health is an important component of overall health.

With the anticipated large influx of members from Cohort 3 enrolling in Medicare and retiring from the work force, dental coverage for this Cohort will decrease. Individuals age 65 years and older generally have the lowest level of dental insurance coverage, in part due to loss of employer-provided insurance at retirement. The age of Medicare enrollment eligibility is 65. Although results from this study indicate that Medicare enrollment status does not have a significant influence on the likelihood of dental coverage, it must be considered that this study population is one of dental care utilizers and findings are based on an assumption pertaining to Medicare enrollment status.

Findings did reveal a significant relationship between dental coverage and utilization (defined as both Procedural and Financial). However, findings show a decrease in dental coverage in the older Cohorts. Cohort 3 has a higher percentage of dental coverage within the total study population. Chi-square results show a difference between the observed and predicted values when comparing Cohorts 1 and 3. Logistic regression results reveal that Cohort 1 has less dental coverage than Cohort 2 and Cohort 2 has less dental coverage than Cohort 3. These findings support a decrease in dental coverage as members of Cohort 3 continue to enroll in Medicare and retire decreasing their dental coverage leading to a decrease in utilization of dental services. Using the constructs of the Structural Lag Theory, these findings support that people



respond to available dental insurance coverage when pursuing dental care. The dynamism of Changing Lives is represented by Members of Cohort 3 utilizing dental services with the assistance of the institution of employer provided dental coverage. However, upon retiring and enrolling in Medicare, members of Cohort 3 will be forced to reduce the institution of utilization of dental services due to the loss of the institution of employer provided dental coverage and lack of dental coverage in the institution of Medicare coverage. The institutions of dental coverage and utilization of dental services represent the dynamism of Structural Change, from the Structural Lag Theory. These institutions are impacted by the dynamism of Changing Lives as members of Cohort 3 move from the work force to the retirement stage of their life course.

Medicare enrollment is anticipated to increase dramatically as more members of the Baby Boom Cohort enroll. The increase in Medicare enrollment supports the idea that cohort succession coupled with the paradigm shift of dental care needs of older adults makes the need to address this policy lag more apparent. It can be implicated that individuals with lower incomes will be the hardest hit, because they may lose their employer provided dental coverage. This coupled with a low income level will contribute to the likelihood of no dental coverage, leading to a reduction in the amount of dental care utilization.

This study evaluates relationships displayed by cohorts. Findings show how cohort succession, with regard to the lack of dental coverage in Medicare, reduces the likelihood of dental care needs and expectations of older adults from being met. As stated, with the Baby Boom cohort being so much larger than the other two cohorts in this study, and with the differences by cohort in dental care background and expectations, findings from this study help make the need to address lag in Medicare more apparent.

Also, results from this study show that women utilize dental care (when defined as Procedural: Routine adult dental prophylaxis), 15% more often than men. The life expectancy for women is greater than that of men, however, women who qualify for Social Security on their own earnings record are likely to receive fewer benefits than men with comparable work histories. This creates a limit to dental health care access that needs to be addressed as a large influx of women from Cohort 3 will be enrolling in Medicare and retiring from the work force.

There are no reports or findings pertaining to reform efforts addressing the addition of dental coverage to Medicare. There has been the development of Medicare Advantage Plans (Part C of Medicare), which are health plans run by Medicare approved private insurance companies. These plans include a variety of plan options that offer additional benefits to traditional Medicare, such as dental, vision and hearing, and/or health and wellness programs. However, these additional benefits are only possible through additional monthly premiums that vary, depending on the plan. For individuals who are socioeconomically challenged, they are unable to afford these plans because of the higher premiums. This means access to dental care will be limited.

Findings from this study aid in recognizing the growing number of seniors and the coverage barriers affecting their access to dental services both now and in the future. These findings make it apparent that the size and dental needs of Cohort 3, accompanied by the importance of the oral-systemic relationship create a need to address the lag presented by Medicare. Older adults have an increased need for care; however, barriers to care cause many elders not to receive care on a routine basis (Stanton & Rutherford, 2003).

## Limitations

This study presents limitations in both design and data sources. The study design presents a truncated dependent variable because only individuals who utilize dental services are included in analyses. While this study will aid in the understanding of the phenomena of interest, there are issues that limit generalizability. This study population is not nationally representative of adults age 47 and over because this exploratory study is only analyzing adults age 47 and over who utilize dental services at the VCU School of Dentistry, only one metropolitan area is represented. Therefore, inferences cannot be made about the overall general population of adults age 47 and over. However, findings from this study make it apparent that the size and dental needs of Cohort 3, accompanied by the importance of the oral-systemic relationship create a need to address the lag in Medicare.

**Medicare enrollment status.** Medicare enrollment status was only captured on a minimal number of patients because Medicare does not cover routine dental care. In some instances (i.e. oral surgery and extractions) Medicare may provide some monetary assistance.

Research findings indicate that virtually all people in the U.S. age 65 and over are covered by Medicare (Kaiser Family Foundation, 2008). Medicare enrollment status, in this study, is based on an assumption because it was not truly captured in the data. For this analysis, all patients born in 1946 and earlier were entered as enrolled in Medicare.

**Race.** Race was only captured on 29 of the patients from this study population. With less than .002% of the patients having a race indicated, race was not included in the analytical models performed in this study. Therefore, inferences are reduced because the impact of this variable was not addressed or controlled in this study.

**Impact of Variables Not Captured.** Patient income and level of education are items that are not captured in dental school patient records. This limits determining how representative this target population is of the general population. Results from multiple regression models run to evaluate Financial utilization as addressed in H3a and H3b, revealed a very low R-square value. This indicates that the models did not explain much variance in utilization, defined as total amount spent, between cohorts. Having level of income as a variable to include would have been helpful with explaining variance in utilization (when defined as Financial: Total amount spent) between cohorts. Thus, further research is needed to find factors which might explain more of the variance in utilization of dental services (when defined as Financial: Total amount spent). Realizing the importance of capturing these variables, with regard to research, has reinforced a change in data collection approaches utilized at the VCU School of Dentistry.

Results from logistic regression models run to evaluate Procedural utilization as addressed in H4b and H5a and H5b, also revealed very low R-square values. These models did not explain much variance in utilization (when defined as Procedural: Routine adult dental prophylaxis) between cohorts. Having variables for dental background and periodontal status to include in these models would have aided in explaining variance in utilization (when defined as Procedural: Routine adult dental prophylaxis) between cohorts. These findings support the need for further research to find factors that may explain more of the variance in utilization of dental services (when defined as Procedural: Routine adult dental prophylaxis).

Also, frailty is a variable that is not captured in VCU Dental School data collection, therefore it was not used in the analysis conducted for this study. Frailty is considered highly prevalent in old age. It has been considered synonymous with disability and comorbidity as well as a barrier to accessing dental care. Having this variable would aid in evaluating utilization of

dental services (when defined as both Financial: Total amount spent and Procedural: Routine adult dental prophylaxis). Frail individuals may need more routine dental care to maintain or improve quality of life. However, frailty may prevent such individuals from utilizing needed dental services.

**Time frame studied.** This study covers the time period of one calendar year, which may be considered a limitation. However, this approach is adequate for the cross sectional study design utilized. Evaluating utilization of cohort members over a year enables charting cohort-wide features at one single point in time, allowing cohort comparison for that designated time. Findings from this study serve as a foundation for a longitudinal study to be conducted by extracting and comparing data from more than one year.

## **Conclusion**

Findings from this exploratory study revealed differences in dental coverage and utilization as displayed by the Baby Boom, Silent Generation and Greatest Generation cohorts. These findings assist with determining that cohort succession supports lag in the Medicare policy when comparing the Baby Boom, Silent Generation and the Greatest Generation cohorts utilizing dental care at the VCU School of Dentistry. This exploratory study lays a foundation for better understanding cohort differences. Findings from this study suggest and support lag in the Medicare policy and how it creates a gap between current need and the policies currently in place. With the lack of dental coverage and the anticipated increase in the number of individuals enrolling in Medicare from Cohort 3-Baby Boomers, there is a need to address policy change, and create and implement various types of dental safety nets to aid in increasing access to dental care for members of the older adult population.

More research is needed to address how transitioning to Medicare impacts dental coverage and utilization using variables not included in this study. Findings from this study support a longitudinal study to be conducted using extracted data from the VCU School of Dentistry. Five years from now, data from more than one year could be extracted and compared. This five year time span would accommodate more members of Cohort 3 enrolling in Medicare, enabling a more thorough evaluation of the effect of transitioning into Medicare. This cohort could be followed and changes in dental care coverage and utilization followed over time. This would enable an evaluation of how the influx of such a large cohort into Medicare impacts dental coverage and utilization of dental services in the older adult population. It is possible that economic ramifications, in terms of health care costs, could be evaluated based upon total amounts spent by patients before and after enrolling in Medicare if all of the previously mentioned variables are captured.

Results from this study also support the need for more primary research, beginning with interviewing individuals about their dental care needs, attitudes and utilization of dental services. Whether an individual plans to stay in the workforce longer to retain employer provided benefits, such as dental coverage, is another variable that could be collected. Collection of these variables would enable the evaluation of how these variables impact utilization of dental services both now and in the future.

Despite the limitations covered, there is sufficient variation in the target population of this study enabling useful inferences to be drawn about the relationship between cohort membership, dental care coverage and utilization of dental services. Findings from this study aid in laying a foundation for future research pertaining to dental care coverage and utilization of dental services in members of the older adult population.

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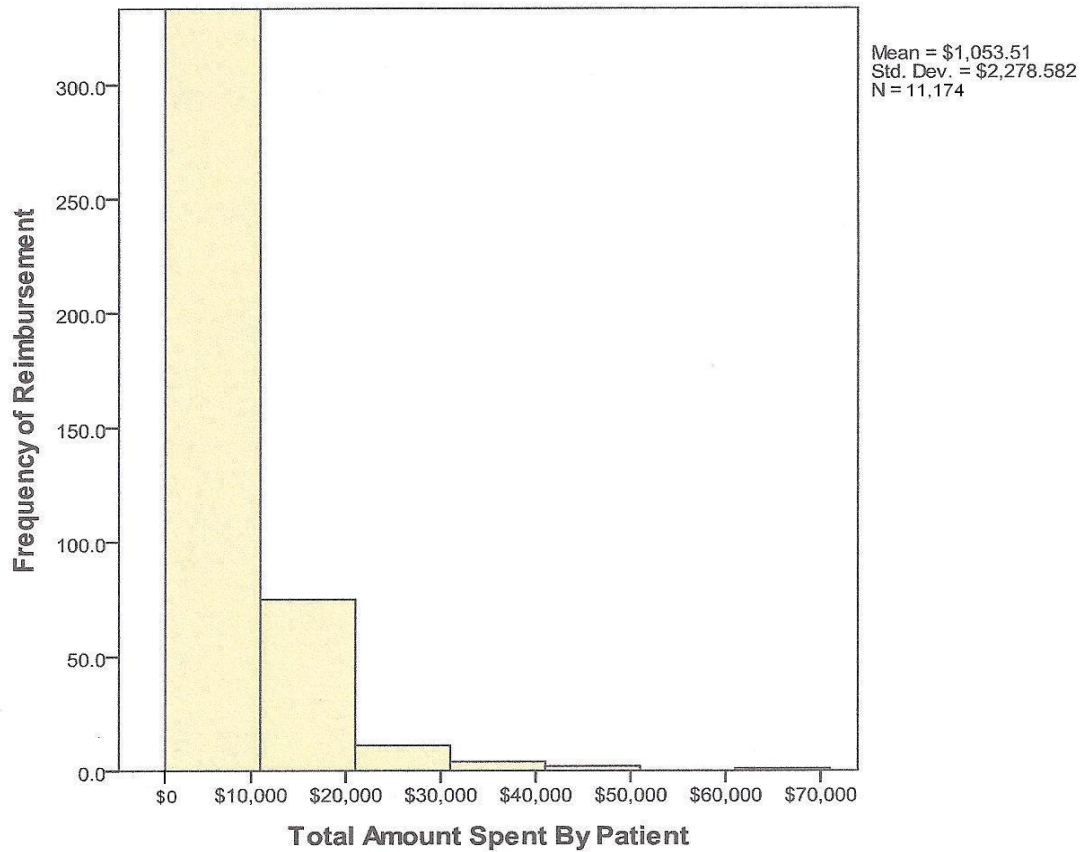
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## Appendix A

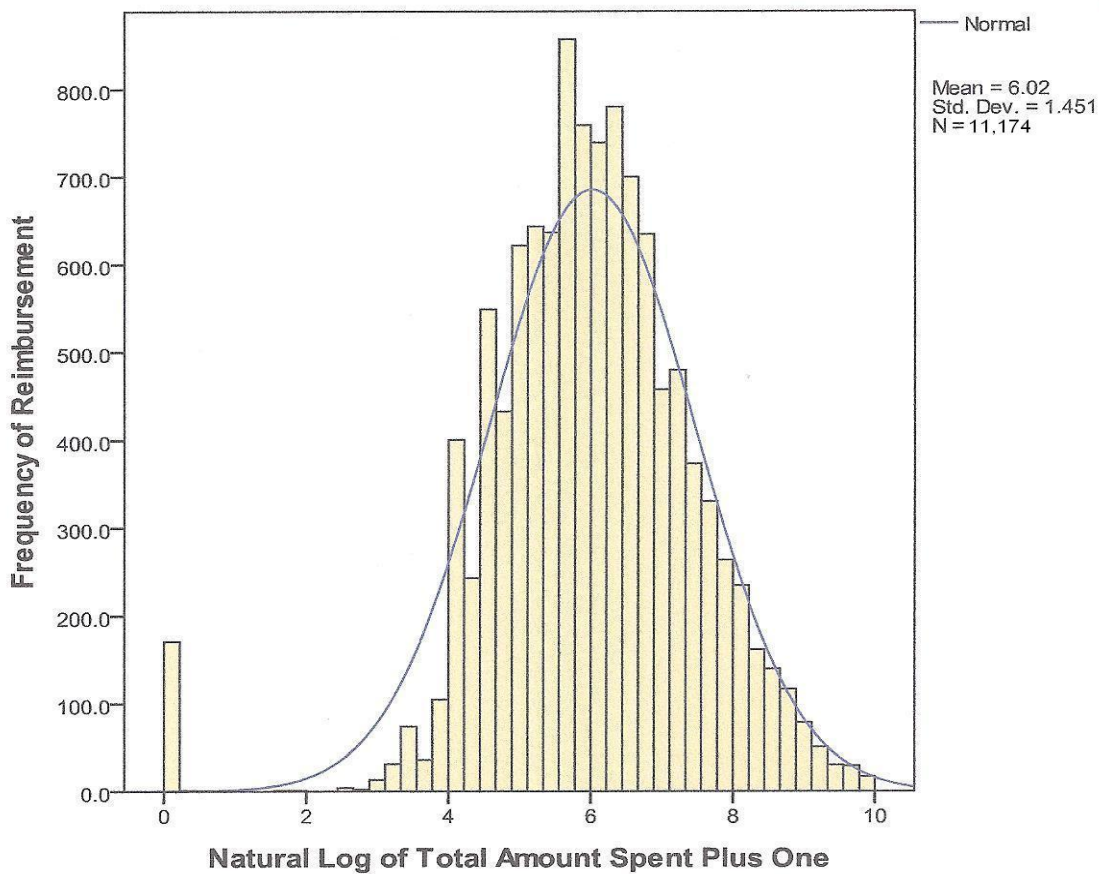
Histogram of Total Amount Spent by Patient



*Note.* This histogram reveals that the dependent variable Utilization: Financial, defined as total amount spent, was not normally distributed. Total Amount Spent includes reimbursement received from the following payment sources: Medicare Advantage, Employer Provided Dental Coverage, Private Dental Plan and Out of Pocket. Included in this histogram is the outlier amount of \$68,731.00 The natural log was used and the resulting normal distribution is displayed in Appendix B.

## Appendix B

Histogram of Natural Log of Total Amount Spent Plus One



*Note.* Using the natural log, the transformed variable, Total Amount Spent Plus One is normally distributed. There are some zeros listed as total amount spent for some patients. These amounts were included because they are amounts patients paid for dental care received. The natural log of zero cannot be computed because it will be undefined. When computing the natural log of zero, a non-zero constant of one was added. The natural log of 1 is zero. This is why zeros are displayed in the histogram. Because \$5.00 is the next lowest amount defined as a total amount spent, after the number zero, the number one can be used as the non zero constant.

## Vita

Patricia Brown Bonwell is the daughter of Gladys Flannagan Brown and the late Aubrey Hampton Brown, Sr. and was raised in Hanover County, Virginia. She is married to William Shawn Bonwell and has a daughter, Maria Isabella Bonwell. Mrs. Bonwell is a Registered Dental Hygienist and a Gerontologist. In 1994, she received, with honors, a Bachelor of Science Degree in Dental Hygiene from the Medical College of Virginia/Virginia Commonwealth University's School of Dentistry. Mrs. Bonwell received a Master of Science Degree in Gerontology in 2009 from Virginia Commonwealth University's School of Allied Health Professions. She was awarded, by the Department of Gerontology, the A.D. Williams Award. In 2009, Mrs. Bonwell was recognized as one of the 40 Outstanding MCV/VCU Dental Hygiene Alumni.

Mrs. Bonwell has a history of working and providing dental care in a variety of health care settings ranging from private dental offices to nursing home facilities to public dental clinics and mobile dental vans. Mrs. Bonwell is an adjunct clinic instructor for the Dental Hygiene Program at Virginia Commonwealth University, School of Dentistry. She also teaches an elective course at the Medical College of Virginia/Virginia Commonwealth University, School of Medicine. Mrs. Bonwell is the Dental Coordinator for Lucy Corr Village, a continuing care retirement community, located in Chesterfield, Virginia.

Mrs. Bonwell is a member of the Gerontological Society of America and is a member of Sigma Phi Omega which is the National Gerontology Academic Honor and Professional Society. She is also an active member of the American Dental Hygienists' Association at both the state and local levels. Mrs. Bonwell's passion lies in improving the provision of and access to oral health care for members of the geriatric population using a multidisciplinary approach.