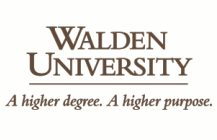


2018

Emergency Department Use for Nontraumatic Dental Conditions and Adult Oral Health

Cheryl Anne Lassiter-Edwards
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral dissertation by

Cheryl Lassiter-Edwards

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Sriya Krishnamoorthy, Committee Chairperson, Public Health Faculty
Dr. Jennifer Oliphant, Committee Member, Public Health Faculty
Dr. LaToya Johnson, University Reviewer, Public Health Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2018

Abstract

Emergency Department Use for Nontraumatic Dental Conditions and Adult Oral Health

by

Cheryl Lassiter-Edwards

MSW, Southern Connecticut State University, 1986

BA, University of Connecticut, 1980

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

May 2018

Abstract

Nontraumatic dental-related emergency department visits has resulted in a financial burden to hospitals across the United States. This study investigated whether there is a relationship between adult preventive dental care and emergency department visits for nontraumatic dental conditions by comparing specific states. Guided by Andersen's behavioral model of health services utilization, this retrospective quantitative study also investigated associations between state-specific community water fluoridation and dental-related emergency department visits. The population of interest was adult Medicaid enrollees who visited the emergency department for non-trauma-related dental conditions in the top 5 most populous states as identified in the 2012 NHAMCS survey. These top 5 states represented 52% of emergency department visits. Among these visits, 2.4% were for adults with nontraumatic dental conditions. Two binary regression models were constructed, and statistically significant relationships were found between emergency department visits and age, gender, race/ethnicity, and Medicaid as a payment source (n=18,112). State-specific community water fluoridation did not emerge as a statistically significant predictor of emergency department visits. Social change implication may allow taxpayers and public health policy leaders to identify new strategies in promoting oral health. New approaches include reeducating the public on policies in support of community water fluoridation as a preventive strategy and understanding how to encourage adult Medicaid enrollees to use preventive dental care in their community and avoid the emergency department for dental care.

Emergency Department Use for Nontraumatic Dental Conditions and Adult Oral Health

by

Cheryl Lassiter-Edwards

MSW, Southern Connecticut State University, 1986

BA, University of Connecticut, 1980

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

May 2018

Acknowledgments

I want to thank my husband, children, and grandchildren who willingly sacrificed family time so that I could achieve this lifelong dream. I want to thank my Committee Chair, Dr. Krishnamoorthy, who provided tireless expert advice, encouragement, and the most amazing guidance throughout this dissertation journey, and Dr. Oliphant, my Committee Member who provided guidance on methodology as well as emotional support to keep going. I also want to acknowledge my father who had one of his happiest moments the day he was able to pay for periodontal care at a time when this was reserved for very few. Lastly, I want to acknowledge the public health and oral health professionals around the globe who carry the torch for parity of dental and physical health regardless of age or socioeconomic status.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

In the year 2000, the U. S. Surgeon General Satcha addressed the importance of oral health being equal to physical health for all people in the United States (Satcha, 2000). Satcha (2000) stated that oral health goes beyond the teeth and is a gateway to the early identification of chronic disease, vision problems, cancer, low-birth-weight babies, and other infections or immune disorders. Satcha communicated a range of information to the public health community, from the successes of public health initiatives like community water fluoridation in preventing and reducing dental caries (cavities) to the prevalence of gaps in oral health care coverage across the United States. Despite calling upon public health leaders to embrace preventive oral health coverage for all individuals, after more than 15 years, the United States has fallen short in fulfilling the oral health strategy laid out in the Surgeon General's report.

Poor oral health in childhood continues into adulthood and can lead to a lack of oral health coverage, low socioeconomic status, and poor oral health literacy (Patrick et al., 2006). Adults with untreated dental pain may not have dental insurance or see a local dental practitioner for routine oral health exams. This behavior may result in missed days at work, difficulty eating, potential tooth loss, and pain relief in the emergency department (ED) for preventable, nontraumatic dental conditions (NTDCs; Nakao, Scott, Masterson, & Chi, 2015).

The epidemiology of NTDCs is untreated transmissible bacterial infections in the oral cavity that progress to the point of intense pain (Allareddy, Rampa, Lee, Allareddy, & Nalliah, 2014). ED visits for the treatment and alleviation of oral-related pain have more than doubled from 2000 to 2012 (Wall & Vujicic, 2015). ED is the least efficient level of care to address non-

trauma-related oral pain and discomfort (Allareddy, Rampa, Lee, Allareddy, & Nalliah, 2014). NTDCs are preventable and would be best treated in a dental practice (Lewis, McKinney, Lee, Melbye, & Rue, 2015). Medicaid oral health coverage across the United States for adults is an optional benefit. Frequent users of the ED for NTDCs are Medicaid enrollees and the uninsured (Singhal et al., 2015; Trikhacheva et al., 2015). This research may lead to positive social change by outlining policy makers' perceptions about how preventive oral healthcare is not equal to medical care.

Background

The occurrence of untreated dental caries (cavities) and the loss of teeth are indices of poor oral health among adults (Dye et al., 2007). In 2012, as many as 91% of adults in the United States had untreated dental caries and 27% had untreated tooth decay that can lead to tooth loss (CDC, 2015). At the close of 2016, 114 million people in the United States did not have any dental coverage, and 67.7 million of these people were under the age of 65 years, nearly twice the number of medically uninsured (NADP, 2016). Little movement has been made in the call to action espoused by the Surgeon General.

Public health policies have been successful in targeting oral health prevention among at-risk populations including children, the disabled, and pregnant women (Office of Disease Prevention and Health Promotion, 2016; Petersen, Bourgeois, Ogawa, Estupinan-Day, & Ndiaye, 2005; Satcha, 2000). While ensuring these at-risk individuals receive preventive dental services, others across the population spectrum (young adults to the elderly) are often left without adequate preventive dental coverage, leading to the high incidence of dental caries and potential for tooth loss (Locker, Maggirias, & Quiñonez, 2011). Preventable oral diseases have been

referred to as the “silent epidemic” (Benjamin, 2010) or the “hidden crisis” (Zabos et al., 2008) facing public health departments across the United States; however, support for adult preventive dental coverage is not universal in the United States.

Public health departments eliminate or reduce oral health coverage for adults when faced with fiscal budget balancing (Cohen, Manski, & Hooper, 1996; Fingar et al., 2015). From the lens of positive social change, I addressed the Surgeon General’s public health action steps by raising the awareness of policy makers around the importance of preventive oral health coverage for adults and by adding to the scientific body of knowledge evidence that supports improvements in oral health policies. Public health policy is not adequately prioritizing the early identification and prevention of oral diseases amongst adults because individual states can elect or reject adult preventive coverage.

Adults who seek care in EDs for oral pain can cause financial hardships on hospitals and take time away from their staff attending to more urgent patients (Uscher-Pines, Mehrotra, & Chari, 2013). ED visits for the treatment and alleviation of NTDCs increased from 2000 to 2012 (Wall & Vujicic, 2015). The average cost of an ED visit for NTDCs in 2012 was $749, and the total cost to the U.S. health system for ED visits due to NTDCs was more than $1.6 billion (Wall & Vujicic, 2015). The ED is the least efficient level of care to address the presenting problems of oral pain and discomfort.

A research gap exists on (a) state adult Medicaid enrollees receiving preventive oral health care coverage with states that do not provide this coverage, (b) ED visits for preventable dental conditions, and (c) community water fluoridation. In this study, I sought to fill a gap in the scientific body of knowledge by comparing the rates of ED visits for NTDCs in states that

provide preventive oral health coverage for adult Medicaid enrollees with states that do not. I compared ED visits for NTDCs in states that have >79.6% of their community water systems fluoridated (the recommended percent of public water systems with fluoride added per the Center for Disease Control and Prevention [CDC]) with states that have less than <79.6% of their water community water systems fluoridated (CDC, 2016).

Problem Statement

National visits for dental conditions presenting in the ED increased 4% annually; in some situations, this rate was higher than physical conditions presenting to the ED (Allareddy et al., 2014; American Dental Association, 2015; Cohen, Manski, Magder, & Mullins, 2002; Lee, Lewis, Saltzman, & Starks, 2012; Okunseri, 2015; Okunseri et al., 2012). The financial burden of these nonurgent, dental-related ED visits across the United States has more than doubled since 2000, with costs greater than $1.6 billion dollars (American Dental Association, 2015; Seu et al., 2012; Stein, Kim, Adkins, & Stearley, 2014a). More than 40% of NTDCs that present to the ED result from preventable, yet untreated, dental caries (Douglass & Douglass, 2003). NTDCs are best suited for community-based dental practices and should not be burdening the EDs (Lewis et al., 2015). Medicaid enrollees and the uninsured are the most frequent users of the ED for NTDCs (Singhal et al., 2015; Trikhacheva et al., 2015), and Medicaid beneficiaries have been found to underuse oral health services (Doty & Weech-Maldonado, 2003). Medicaid does not cover preventive care services for adults in most states, as this is an optional benefit. There are four states that do not provide any oral health coverage to Medicaid enrollees, and the remainder either provide preventive care, emergency care only, or a combination of coverage (The Kaiser Family Foundation, 2016).

Purpose of the Study

I used a retrospective, nonexperimental, quantitative, correlational research approach to investigate the associations between geographic location and ED visits for NTDCs. I wished to identify relationships between states that provide coverage for preventive adult oral health care services under Medicaid and their volume of emergency department visits for NTDCs (as defined by the International Classification of Diseases and Related Health Problems, Ninth Revision (ICD9) coding from ED discharge data) with states that do not provide this coverage and their volume of ED visits for NTDCs. Additionally, I looked at the aggregate percent of community water systems in the top five most populous states (per the 2012 The National Hospital Ambulatory Medical Care Survey (NHAMCS) that were fluoridated in comparison to the recommendation by the CDC.

Research Questions and Hypotheses

Research questions for this study were

RQ1: Does Medicaid adult preventive dental coverage, along with other patient characteristics, reduce ED visits for NTDCs?

$H_0$1: There is a relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower nontraumatic dental condition ED rates.

H_a1: There is no relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower nontraumatic dental condition ED rates.

RQ2: Does community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, play a role in reducing ED visits for NTDCs?

$H_0$2: There is a relationship between community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

H_a2: There is no relationship between community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

Theoretical Framework

The theoretical framework for this study was Andersen's behavioral model of health services utilization. This model has been used in other oral health research (Kaylor, Polivka, Chaudry, Salsberry, & Wee, 2011). This framework includes a systems approach and provides information on how a person makes choices on whether to use health care services, and it also addresses oral health outcomes (Baker, 2009). The framework includes on several factors, including ethnicity, age, issues that influence oral health and oral health outcomes, and policy review (Andersen & Davidson, 1997). Each of these factors was included in the secondary data source and the variables being studied. For this study, individuals experiencing NTDCs made decisions about using the oral health delivery system by seeking preventive care from a dentist or delayed care until the pain became an unbearable stress and they sought help in an ED.

An individual may experience the onset of dental pain and make a decision to seek oral health services from a community-based dentist, use a home remedy, seek care in an urgent care setting, or ignore the symptoms. This cycle can be repeated until the individual reaches a severe pain threshold, rendering him or her unable to function. I hypothesized that individuals experiencing NTDCs made choices about using the oral health delivery system. They chose to seek care from a dentist, or they chose to delay or avoid care until the pain became a source of

unbearable stress resulting in an ED visit. A more detailed explanation of this theory and comparisons to other theoretical considerations is provided in Chapter 2.

Nature of the Study

This research was a retrospective, nonexperimental, quantitative, correlational design that investigated associations between geographic location and ED visits for NTDCs, consistent with research conducted and discussed in Chapter 2. A correlational approach was selected because I examined associations that might have existed between independent variables and the dependent variable. It was an ideal choice for working with the selected secondary data as relationships could be evaluated while not inferring causality (Frankfort-Nachmias & Nachmias, 2008). This research served as a foundation for more detailed, in-person qualitative research whereby patients in the ED can be surveyed as to why they chose to go to the ED if they have a dentist in the community, as well as clarify their possible fears around dentistry.

The key independent variables of the study included the variables that encompass the top five most populous states per the 2012 NHAMCS survey. These were Medicaid insurance coverage, the presence of adult preventative dental care in a state, age, gender, race/ethnicity, and the percent of water systems that were fluoridated in these five states. The dependent variable was the adult ED visit for a NTDC. The selected secondary data source was the online, publicly accessed 2012 NHAMCS survey produced by the CDC. This survey has been conducted annually since 1992 and is a highly regarded and credible source of U.S. ED use data. The 2012 survey contained 29,453-hospital ED patient records, which when computed using a weighting factor equated to 130,869,572 ED visits. An a priori power analysis was calculated via the G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) program for a multiple linear regression to

determine the minimum sample size needed for this investigation. The minimum sample size was determined to be an $N = 107$, which was well exceeded by the final sample size of 18,112. Additional details are discussed in Chapter 3.

Definition of Terms

The NHAMCS 2012 Micro-Data File Documentation was the source for the definition of terms and variables contained in the survey.

Age: In the NHAMCS 2012 survey was coded in six age categories: under 15 years of age, 15 to 24 years of age, 25-44 years of age, 45-64 years of age, 65-74 years of age, and 75 years of age and over. For the current investigation, age was restricted for patient records for the 19 to 64 years of age.

Dental caries: Cavities in the tooth resulting from untreated tooth decay.

Emergency department (ED): The place in a hospital staffed 24 hours a day where a patient can be treated for an unscheduled, urgent outpatient service.

Ethnicity: Categorized as Non-Hispanic White; Non-Hispanic Black; Hispanic (a person of Cuban, Mexican, Puerto Rican, South or Central American or other Spanish culture or origin, regardless of race), and all others.

Gender: Was categorized as female or male.

Geographic locations: Hospitals identified by the U.S. Bureau of the Census.

Hospital: All hospitals that are nonfederal, short-stay (less than 30 days) hospitals or hospital who specialize in general medical or surgical practice and/or children's general practice and are eligible for inclusion in the NHAMCS survey.

Insurance coverage: Was captured under "expected primary source of payment for this visit."

International Classification of Diseases and Related Health Problems, Ninth Revision (ICD9): The international diagnostic classification system maintained by the World Health Organization (WHO). The ICD9 diagnosis codes used for nontrauma related dental conditions were 521-521.9, 522-522.9, 523-523.9, 524-524.9, 525-525.9, 526-526.9, 528-528.9, and 78492.

Patient: The person seeking health care services in the ED.

Race: Categorized as White, Black or African American, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, Asian, or other.

Visit: A direct interpersonal experience that occurred between the patient and the staff physician (or staff operating under the supervision of the physician) in the ambulatory care setting (ED).

Dependent Variable

The ED patient records for ICD9 diagnosis codes 521-521.9, 522-522.9, 523-523.9, 524-524.9, 525-525.9, 526-526.9, 528-528.9, and 78492 were used to construct the dependent variable for this study.

Independent Variables

The independent variables within the dataset included age, race/ethnicity, gender, state of residence, expected source of payment, whether adult preventative care was present within a state, and the percent of community water systems that were fluoridated.

Assumptions

The first assumption was that the 2012 NHAMCS secondary dataset is well respected in

the scientific community, used a reliable survey instrument with a consistent protocol for training the interviewers, and the data had meta-data documentation. This assumption was made because the survey has been conducted annually for more than 25 years and has been the data source for more than 500 published research articles. The second assumption was that the coding for the variables contained within the instrument would be consistent across the participant hospitals limiting potential for coding errors. The third assumption was that the multistage probability design and sampling process would minimize bias. The fourth assumption was that adults presenting to the ED for NTDCs made a choice to seek care in a hospital setting rather than seeking out a community-based dentist, and while choice was not documented in the dataset, comparison of the state adult oral health programs an assumption was made that it would offer some associations.

Scope and Delimitations

This study was limited to dental conditions as reported by adults who were evaluated and treated in the ED. I did not consider medical conditions that brought individuals into the ED exclusive of a NTDC. Although the dataset contained data related to drugs administered during the evaluation and treatment phase of the patient visit regardless of whether the reason was medical or dental, this was out of the scope for this study. I did not explore temporality, and my study was limited to the 2012 NHAMSC survey. The study results cannot be interpreted as population-based because the survey is founded on patient encounters or visits to the ED; therefore, incidence and prevalence cannot be drawn from the results. An assumption was made that the dataset could be used for state-specific analytics contained within the survey data for the

top five most populous states (California, Illinois, New York, Florida, and Texas), and the results could be used for national estimates.

Limitations

There are several limitations when a researchers relies upon secondary data collected by another entity (Frankfort-Nachmias & Nachmias, 2008). One of the most significant limitations in this study was the survey itself, as I was limited to the questions asked and not at liberty to pick and choose questions for the survey. A second limitation of the data was the lack of context surrounding the visit to the ED; namely, anything the patient may have tried before going to the ED to mitigate his or her dental condition was not codified in the patient record form.

I chose the survey results from 2012, which could be a limitation; however, this was a decision made for several reasons: (a) it was the first year that the data were collected electronically rather than by paper, resulting in 97% of the data entries occurring by the interviewer rather than hospital personnel, limiting data entry errors; (b) the data used ICD9 classifications thereby eliminating the need to crosswalk from ICD 9 to current ICD10 diagnostic classifications and offered consistency with prior research; and (c) there was an extended sampling out to the top five most populous states, resulting in more than 52% of ED visits in the survey being from these five states, offering a greater opportunity to analyze states and their respective percent of community water systems that were fluoridated.

Another noted limitation was that the same person could have presented to the ED on multiple occasions and each visit was identified as a separate patient record. This was not a significant issue as I looked at encounters in the ED and not individual unique patient visits to the ED. Lastly, the presence or absence of dental insurance was not a captured metric yet posed a

limitation in knowing if the individual bypassed alternate resources for help due to cost or access. This was a known limitation in other studies and serves as a reminder for future research that engages a dialogue with the actual patient in the ED.

Significance

Social Change

The Surgeon General stated that the mouth is the gateway to infections and diseases, and every effort should be made to reduce the impact of untreated oral disease (Satcha, 2000). With more than 100 different types of diseases detectable during a routine oral exam (The Arizona Dental Association, 2016), on a national level, the United States does not have consistent preventive oral health coverage for adults. Calling upon public health professionals, state government, and health care providers to realign their foci of health to include both oral and physical health, the Surgeon General also encouraged communities to fluoridate their water systems to prevent tooth decay and dental caries (Satcha, 2000). This research supported positive social change by taking two of the Surgeon General's recommendations and applying it to surveillance data. First, I promoted the perception among policy makers that preventive oral health care should be on par with medical care, and second, as a way to add to the science and evidence aimed at improving oral health (Satcha, 2000) for all individuals regardless of age, gender, income, insurance coverage, or geographical location.

Gap in Literature

I addressed a gap in the literature by comparing ED visits for NTDCs in states that provide preventive oral health coverage for adult Medicaid enrollees with states that did not, and I compared ED visits for NTDCs in states that have >79.6% of their community water systems

fluoridated (the guideline per the CDC) with states that have less than 79.6% of their community water systems fluoridated (Kentucky had 99.9% fluoridation). Satcha (2009) heralded the introduction of fluoride into community water systems as one of the greatest public health initiatives of our time. However, the gap in the scientific body of knowledge is the application of Satcha's recommendation to expand community water fluoridation and comparing states with and without preventive oral health care coverage for adult Medicaid enrollees and their ED visitation for preventable dental conditions. I sought to contribute to the discipline of dental epidemiology and oral public health additional evidence that can be used to close the gaps that exist in public health policies between adult preventive care for physical health and adult preventive oral health.

Summary

Oral diseases are both the leading chronic disease across the globe and the most highly preventable (Benjamin, 2010; Vargas & Arevalo, 2009; Watt, 2005). Poor oral health can lead to the onset of oral diseases that result in an individual losing their teeth, a key indicator of systemic bone loss (Krall, Garcia, & Dawson-Hughes, 1996). Oral pain and possible tooth loss can impact the ability to eat and maintain daily nutrition. It can affect how an individual sees him or herself in their social circle leading to embarrassment and social withdrawal, and it can cause an employed individual to lose days at work, resulting in possible unemployment and income deprivation (Hollister & Weintraub, 1993).

Comprehensive oral exams can serve as an early identifier for periodontal diseases (Eke, Dye, Wei, Thornton-Evans, & Genco, 2012). Many chronic illnesses share the same risk factors as oral diseases, including cardiovascular disease (Kapellas et al., 2014), diabetes mellitus

(Bascones-Martínez, Arias-Herrera, Criado-Cámara, Bascones-Ilundáin, & Bascones-Ilundáin, 2013), oral cancers, (Jacobson et al., 2012), Alzheimer's disease, (Kamer et al., 2016), oral human papillomavirus (HPV) infection (Chung, Bagheri, & D'Souza, 2014), and a host of other inflammatory conditions (Gurenlian, 2009).

In Chapter 2, I highlight the scientific literature that supports the call for public health practitioners and policy makers to champion adult oral health as equal to physical health in preventing the proliferation of chronic disease. Chapter 3 provides details of the research study, a description of the research approach including the study design, selection of an established national database as the secondary data source, data collection, instrumentation, sample, target population, data analysis, and a discussion of ethical considerations. Chapter 4 provides details of the research study results, and Chapter 5 summarizes the study, recommendations for public health policy and future research studies.

Chapter 2: Literature Review

Introduction

ED use is an expensive resource for nonurgent medical and dental care, specifically among adult Medicaid beneficiaries (Bamezai, Melnick, & Nawathe, 2005; Tang, Stein, Hsia, Maselli, & Gonzales, 2010; The Pew Center on the States, 2012; Wall, Vujicic, & Nasseh, 2012). The purpose of this study was to identify associations between preventive oral health and rates of NTDCs presenting to the ED among the adult Medicaid population. I compared ED visits for NTDCs in states that provide preventive adult oral health care services to their Medicaid beneficiaries with states that did not provide this coverage. Additionally, I compared ED use for NTDCs and the overall percent of community water systems that were fluoridated as a public health initiative to prevent tooth decay.

This literature review is organized into the following sections:

1. Description and etiology of NTDCs
2. An overview of the problem and incidence rates at the national and state levels as articulated by leading authors
3. A comparison of ED use for NTDCs in states that do and do not fund preventive oral health for adult Medicaid beneficiaries
4. A comparison of states that add fluoride to community water systems to prevent dental caries and their ED use for NTDCs
5. A summary of the controversy about water fluoridation

Literature Search Strategy

The search strategy included Internet searches of government websites, including the CDC, The National Cranial and Dental Health Organization, and the Centers for Medicare and Medicaid Services, and organization websites including The Henry Kellogg Foundation, The Kaiser Foundation, and The Pew Center. The search period ranged from the early 1990s through to 2016; however, I focused on studies from 2011 to 2016.

The following research databases were used to pull empirical literature: EBSCO, ProQuest, Academic Search Premier, PubMed, Google Scholar, and Medline. Key terms used in the search criteria included any one or a combination of these terms: *NTDCs, oral health, oral disease, emergency room visits for dental conditions, dental emergencies, adult Medicaid dental benefits by state, oral health policy, oral health programs, state oral health prevention, dental caries and infectious disease, oral health status and vulnerable populations, oral health and underserved populations, access to oral health care, oral health disparities, community water fluoridation, oral health trends, dental care utilization, barriers to oral health, income and oral health utilization, and inequality in dental care utilization.*

A substantial number of articles were found on the topic of NTDCs in the ED and state-specific exposure to adult Medicaid beneficiaries visiting the ED for NTDCs with publication dates as early as the 1980s. There was, however, limited research on the topic of community water fluoridation, and no research was found on the topic of community water fluoridation, preventive oral health care among adult Medicaid beneficiaries, and their relation to ED visits for NTDCs.

Theoretical Foundation

Oral diseases impact nearly 4 billion people globally, with tooth decay or dental caries being responsible for more than 35% of these oral diseases across all ages (Marcenes et al., 2013); yet, scholars have demonstrated an inconsistent or limited use of theoretical frameworks in dental epidemiological studies (Goddard & Smith, 2001; Newton & Bower, 2005; Watt, 2002). Although theoretical frameworks for oral health research have relied upon models focused on access to care like Bandura's social cognitive theory, health belief models, health promotion, and health education models, researchers have inconsistently shown a relationship between these frameworks and oral health outcomes (Singh, Harford, Schuch, Watt, & Peres, 2016; Watt, 2002). These models are limited in their focus on access and risk factors and an inability to directly identify causal pathways between oral disease, oral health, and socioecological factors (Newton & Bower, 2005). For example, although self-efficacy is associated with improved self-care behavior when an individual has both a physical health condition and an oral disease (Kakudate, Morita, Sugai, & Kawanami, 2009), it does not address the influence of social, environmental, or political determinants on oral health decision making (Watt, 2002).

The initial theoretical framework considered for this study was the salutogenic theory because it addresses the process of problem-solving and an individual's capability to use the resources available to them in their immediate environment (da Silva, Mendonça, & Vettore, 2008). Core to salutogenic theory is the concept of sense of coherence (SOC). SOC reflects a person's capability to react to stress as it relates to health decisions (Elyasi et al., 2015), and SOC has historically been a theory of choice among oral health researchers. SOC emphasizes an

individual's interaction within his or her environment and how these social, cognitive, and environmental interactions shape his or her health decisions (Hollister & Anema, 2004). The stronger the individual's SOC, the better he or she is in coping with stressful situations and managing his or her overall health. The SOC is not limited by age, gender, or ethnicity because the fundamental basis is coping with stress. In relation to this study, salutogenic theory did not offer a suitable framework for a retrospective review of secondary data and is better suited for studies aimed at oral health promotion.

A more favorable model in oral health research (Kaylor et al., 2011) and the theoretical framework for this study was Andersen's behavioral model of health services utilization. By using a systems approach, Andersen's behavioral model of health services utilization provides the concepts of how a person makes choices on what health care services to use and when to use them and also addresses oral health outcomes, something missing from other models (Baker, 2009). The framework incorporates multiple factors that influence oral health, oral health outcomes, and policy review (Andersen & Davidson, 1997).

Andersen's model divides these multiple predictive factors into three essential components (Baker, 2009). The first set of predictive factors is predisposing factors, of which one example is income. The second set of predictive factors is enabling resources, an example of which would be health insurance coverage or state-sponsored health coverage. Need is the third set of predictive factors. An example of need would be the actual ED visit, as the individual perceived a need for pain relief on an emergent basis. Table 1 provides an overview of these predictive factors and their linkages to the variables in the 2012 NHAMSC dataset.

Table 1

Example of Variable and NHAMCS Survey Variables

Measured Variable	Example from the NHAMSC Survey
Predisposing factors	Socioeconomic status, age, gender
Enabling Resources	State, private health insurance or state sponsored health coverage
Need	The ED visit is an indicator of need

I hypothesized that individuals experiencing NTDCs must make choices about using the oral health delivery system. They can choose to seek care from a dentist, or they can choose to delay or avoid care until the pain becomes a source of unbearable stress resulting in an ED visit. When an individual experiences an onset of dental pain, a decision must be made to seek oral care from a dentist, use a home remedy, ignore the symptoms, or seek care on an emergent basis. If an individual seeks dental care in his or her community, he or she will receive symptom abatement and will be restored to a state of healthy teeth. The individual can also choose to ignore the symptoms or attempt to relieve the pain using home remedies until the pain worsens to the point of seeking relief in the ED. This cycle can repeat itself numerous times until the person pursues health care resources.

Figure 1 depicts the cycle of oral health decision making by an individual. This cycle may repeat the steps until the symptoms are mitigated either by treatment in the ED, a dentist, or the loss of their tooth. Decisions can be influenced by several factors: (a) the person's environment (availability of dentists), (b) is transportation available to access dental care, (c) can the person afford the out-of-pocket expenses (does the person have an income or insurance), (d) if the person is employed, can they take time off work to seek dental care, (e) is childcare an issue so the individual can go and see a dentist, (f) personal attitudes towards dentists, and (g) potential fears of going to a dentist.

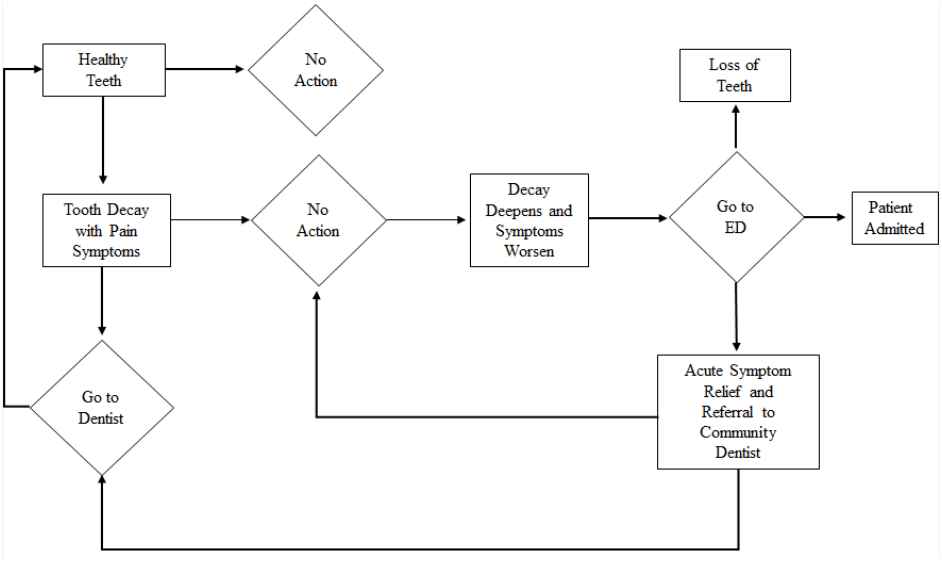


Figure 1. Decision making process to dental pain relief.

There are demonstrated gaps in peer-reviewed research that used theoretical frameworks, and none were found that used Andersen's behavioral model of health services utilization as it pertained to individuals using services in the ED with non-injury-related dental conditions. Mejia et al (2008) applied components of the Andersen model to develop a new framework unique to research on the needs of the Hispanic population and their oral health used in the United States. Baker (2009) applied the model to 1998 secondary dental data in the UK. Baker tested the whole model in an empirical study rather than using components of the model as prior research had done. Addressing both use and outcomes of oral health services, Baker found that the model supported perceived need. Baker concluded that a longitudinal study would be ideal to test the predisposing and enabling variables that determine use practices.

Literature Review and Key Concepts

Description and Etiology of NTDCs

There is no specific definition for NTDCs consistent with the lack of a clear definition of nonurgent care (Honigman, Wiler, Rooks, & Ginde, 2013); however, for purposes of this study, nonurgent dental visits to the ED were defined as dental conditions occurring in the oral cavity that did not result from a trauma, and patients were seen in the ED for urgent oral pain relief and treatment (Manz, 2016; Uscher-Pines, Pines, Kellermann, Gillen, & Mehrotra, 2013; Wall, Nasseh, & Vujicic, 2014). Non--trauma related dental conditions result from untreated infections of the oral cavity that progress to the point of intense pain (Allareddy et al., 2014). The ICD9 classifies these as general oral pain diseases of dental hard tissues and other diseases of the oral cavity related to tooth decay, dental caries, jaw pain, and gingivitis (Fingar, Smith, Davies, McDonald, Stocks, & Raven, 2015). These diagnoses are collected as a part of overall surveillance data submitted by hospital billing (Figueiredo, Singhal, Dempster, Hwang, & Quinonez, 2015). The ICD9 codes captured and reviewed as dental conditions include 520.0 to 526.9, 528.0 to 528.9, 784.92, V52.3, V53.4, V58.5, and V72.2 (Fingar et al., 2015; Okunseri, Fischer, Sadeghi, Xiang, & Szabo, 2013; Tomar, Carden, Dodd, Catalanotto, & Herndon, 2016; Wall & Vujicic, 2015).

Etiology of NTDCs. Infectious diseases, primarily dental caries and periodontal disease, are the primary causes of preventable tooth decay that can progress to the point of an individual seeking pain relief in the ED (Caufield, Li, & Dasanayake, 2005; National Institute of Dental and Craniofacial Research, n.d.; Kutsch & Young, 2011). Bacteria (oral flora) colonizes on the surface of the tooth resulting in decay to the pulp of the tooth causing inflammation, gum

disease, and dental caries (Balakrishnan, Simmonds, & Tagg, 2000; Caufield, Li, & Dasanayake, 2005). When left untreated, the inflammation begins to necrose, and the tooth becomes sensitive to touch, hot, cold, and sugar; an apical abscess can occur (Douglass & Douglass, 2003) resulting in a patient seeking pain relief in the ED. Figure 2 demonstrates the anatomy of a healthy tooth and Figure 3 shows a decaying tooth where caries developed, the pulp is inflamed, and the need for nontraumatic dental intervention would become emergent).

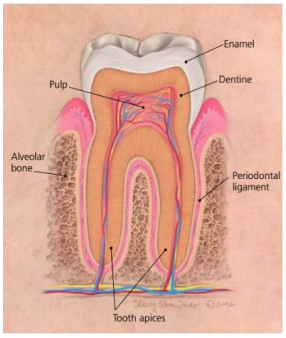


Figure 2. Normal tooth anatomy of a healthy tooth. SOURCE: "Common Dental Emergencies," by A.B. Douglass & J.M. Douglass, 2003, *American Family Physician*, *67*, p. 512. Copyright 2003 by the American Academy of Family Physicians.

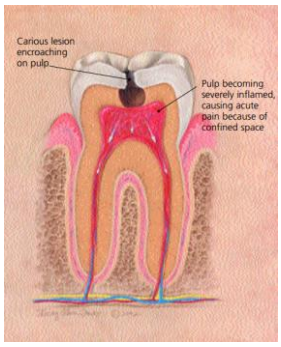


Figure 3. Irreversible pulpitis showing the disease progression of tooth decay. SOURCE: "Common Dental Emergencies," by A.B. Douglass & J.M. Douglass, 2003, *American Family Physician*, *67*, p. 513. Copyright 2003 by the American Academy of Family Physicians.

species can be active at any given time (Kamer et al., 2016). Depending upon the bacteria and the individual's genetics, environment, immune system, medical conditions, oral, and nutritional health, the onset of periodontal disease can occur. Periodontal disease (ICD9 523.0 to 523.9) is caused by polymicrobial infections found in and around the structure of the tooth, including the bone and gum tissue (Bascones-Martínez et al., 2013; Eke et al., 2012; Pihlstrom, Michalowicz, & Johnson, 2005). Periodontal disease is a chronic inflammatory disease affecting up to 90% of the global population (Pihlstrom et al., 2005) and more than 47% (64.7 million) of adults in the United States, specifically older adults (Eke et al., 2012). Periodontal disease has been identified

through research as a primary risk factor for other inflammatory diseases with systemic implications including diabetes and cardiovascular disease (Eke et al., 2012).

Loe (1993) referred to periodontal disease and diabetes mellitus as the sixth complication of diabetes. Periodontal disease and diabetes mellitus have a two way relationship because bacteria triggers inflammation in the oral cavity and systemically (Bascones-Martínez et al., 2013; Bascones-Martínez, Muñoz-Corcuera, & Bascones-Ilundain, 2015; Irani, Wassall, & Preshaw, 2015; Preshaw et al., 2012). Older adults with cardiovascular disease (a chronic inflammatory disease affecting blood vessels and/or the heart) share the same risk factors for developing periodontal disease, including smoking, obesity, and Type 2 diabetes (Kapellas et al., 2014; Nguyen, Kim, Quan, Nguyen, & Tran, 2015; Umeizudike, Iwuala, Ozoh, Ayanbadejo, & Fasanmade, 2016; Xu & Lu, 2011). An additional risk to people with chronic illness is "dry mouth," a side effect of certain drugs like tricyclic antidepressant medications and beta-blockers (Griffin, Jones, Brunson, Griffin, & Bailey, 2012). Saliva and healthy bacteria are not being produced, resulting in a loss of lubrication to the gum tissue and demineralization of the tooth surface, allowing damaging bacteria to decay the tooth. Often without dental coverage to treat their chronic oral disease, older adults may seek pain relief in the ED or ignore the symptoms and eventually lose their teeth (Dolan, Atchison, & Huynh, 2005; Griffin et al., 2012). Untreated oral disease can lead to inpatient hospitalization and even death (Allareddy, Rampa, Lee, Allareddy, & Nalliah, 2014; Cohen, Magder, Manski, & Mullins, 2003).

Incidence of NTDCs in the ED

Historical overview. Pennycook, Makower, Brewer, Moulton, and Crawford (1993) offered one of the earliest research papers on the topic of people with dental problems presenting

to the ED. Pennycook et l. study identified 90 out of 107 patients (82.6%) who presented to the ED for non-trauma-related dental conditions. Pennycook et al. found the frequency of visits occurred primarily on the weekends, and 79% of patients had seen their dentist within the prior 12 months. The most significant findings from this study were the frequency of patient visits, day of the week with peak visits, age ranges of the patients who visited the ED, the limitations of treatment options by the ED physician, and their observation that the attending physicians did not consistently provide a diagnosis for their patient. The declaration that physicians did not consistently or accurately diagnose patients with dental conditions in the ED was significant because it called attention to potential flaws in the quality and accuracy of how physicians record their discharge diagnoses.

National trends. Douglass and Douglass (2003) showed that more than 40% of NTDCs that present to the ED are the result of preventable, yet untreated, dental caries. More than 90% of adults in the United States between the ages of 20 and 64 years have had dental caries (cavities) and 27% have experienced untreated tooth decay. Douglass & Douglass, 2003; Dye, Thornton-Evans, Li, & Iafolla, 2015; National Institute of Dental and Craniofacial Research, 2014). People going to the ED for dental conditions increased 4% annually, often at a higher rate than physical conditions presenting to the ED (Allareddy et al., 2014; American Dental Association, 2015; Lee, Lewis, Saltzman, & Starks, 2012; Okunseri, 2015; Okunseri et al., 2012). Across the United States, costs associated with ED visits for NTDCs has more than doubled since 2000, exceeding $1.6 billion dollars (American Dental Association, 2015; Sun et al., 2015). From 2000 to 2010, Wall and Nasseh (2013) found that dental visits to the ED increased from 1.1 million to 2.1 million, representing an increase from 1.0% to 1.65% of total

ED visits being for dental conditions. Wall and Vujicic (2015) reported that dental ED visits per 1,000 increased from 6.81 to 6.94 in 2012, while dental ED visits as a percent of all ED visits remained the same at 1.62%. Okunseri, Okunseri, Thorpe, Xiang, and Szabo (2012) found that ED visits for NTDCs increased more than 50% over a 10-year period or 4% annually.

State trends. Research data from individual states on the incidence of NTDCs presenting to the ED is limited due to the fact that not all 50 states mandate hospitals to submit discharge records and currently only 29 states submit data to the State ED Databases (Center for Health Care Strategies, Inc., 2015; Cohen, Manski, & Hooper, 1996; Fingar et al., 2015; Tomar, Carden, Dodd, Catalanotto, & Herndon, 2016). State specific research has shown dental-related ED visits ranging from 1% to more than 2.5% of all reported ED visits (Anderson, Cherala, Traore, & Martin, 2010a; Lloyd, DeLia, & Cantor, 2014; National Network for Oral Health Access, 2012; Pew Center on the States, 2013; Stein, Kim, Adkins, & Stearley, 2014; Sun et al., 2015). To date, state level studies have focused on volume of visits and the association between states withdrawing funding for Medicaid adult dental coverage and increased cost and utilization among adult Medicaid beneficiaries going to the ED for NTDCs (Han, Nguyen, Drope, & Jemal, 2015; Lee et al., 2012; McGinn-Shapiro, 2008). This data has shown estimated costs to be at $1.6 billion in 2012, with an average cost per visit of $749 (Anderson et al., 2010b; Tomar, Carden, Dodd, Catalanotto, & Herndon, 2016; Wall & Vujicic, 2015; Wallace et al., 2011).

The Affordable Care Act (ACA) of 2010 did not mandate adult oral health services, and as such, these services are offered at the discretion of the individual state Medicaid plan (Fingar et al., 2015; Han et al., 2015; Medicaid and CHIP Payment and Access Commission, 2015; U.S. Department of Health and Human Services, 2015; Yarbrough, Vujicic, & Nasseh, 2014). The

states offering coverage may change year to year driven by state fiscal decisions (Hinton & Paradise, 2016), and as fiscal situations improve they have reinstated dental coverage for adults (The Kaiser Family Foundation, 2017). There are four states (Alabama, Delaware, Arizona, and Tennessee) that do not provide any oral health coverage to adult Medicaid beneficiaries, even explicitly excluding emergency services (The Kaiser Family Foundation, 2017). The remaining 46 states and the District of Columbia provide either preventive care, emergency care only, or a combination of coverage types (The Kaiser Family Foundation, 2016). Table 2 provides a high-level summary of the states that do and do not provide dental coverage to adult Medicaid beneficiaries. Figure 4 provides a visual of the coverage type by state as of 2016.

Table 2

Dental Services Provided to Medicaid Adult Beneficiaries

Service Type	Number of States Providing Coverage	Services Being Provided
Emergency only	18	Emergency extractions, other procedures needed for immediate relief
Extensive	33	
Preventive	28	Exams, cleanings, possibly fluoride application or sealants
Restorative	26	Fillings, crowns, endodontic therapy
Periodontal	19	Periodontal surgery, scaling, root planning (below the gum line)
Dentures	25	Full and partial dentures
Oral surgery	25	Non-emergency extractions, other oral surgical procedures
Orthodontia	2	Braces, headgear, retainers

(Medicaid and CHIP Payment and Access Commission, 2015)

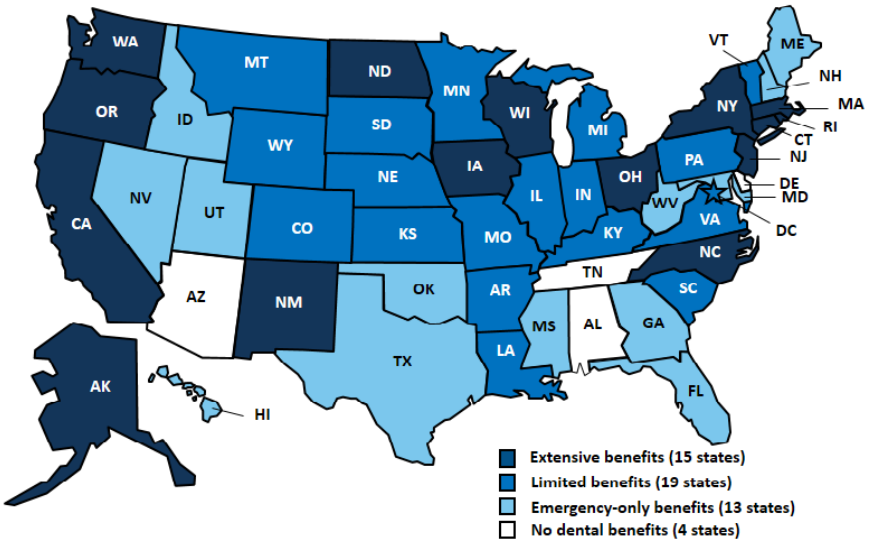


Figure 4. Medicaid Coverage of Adult Dental Benefits
SOURCE: *Medicaid Adult Dental Benefits: An Overview*, Center for Health Care Strategies, Inc. February 2016

The Kaiser Health Foundation (2012) and The Pew Center (2013) have published research on the incidence of preventable dental conditions presenting to the ED, the financial burdens facing the state Medicaid programs due to limited funding of oral health prevention, and the complications that emerge when routine oral health care is not provided. From 2006 to 2009, there were increases in ED dental visits across the United States, placing additional financial hardships on individual states (The Pew Center on the States, 2012). In 2005, Arizona reported that 46% of all dental ED visits were by Medicaid beneficiaries; Nevada's experience showed that ED visits due to tooth decay, gum disease, or abscessed teeth cost an estimated $4 million. North Carolina reported dental visits as the 10th most common reason for an ED visit; Ohio cited Medicaid beneficiaries as the primary consumer of ED visits for dental conditions; and Tennessee experienced more than 55,000 ED dental visits, 5 times greater than visits for burns.

Florida has had one of the most staggering experiences non-traumatic dental visits to the ED. A study looking at 2010 data showed one third of all ED visits were by Medicaid beneficiaries; nearly 50% of all ED visits were dental related; there was a 40% increase in ED dental visits between 2008 and 2010 among Medicaid beneficiaries; and the cost to the state's Medicaid program reached more than $88 million dollars to pay for more than 115,000 ED dental visits (The Pew Center on the States, 2012). Tomar, Carden, Dodd, Catalanotto, and Herndon (2016) conducted research on dental-related trends in Florida's EDs between 2005 and 2014. They found that the volume of visits increased 43.5%, costs increased from $47.7 million in 2005 to $193.4 million in 2014, and the payers were 38% Medicaid and 38% self-pay individuals, with the balance shared among commercial insurance, Medicare, and other sources.

Sociodemographic Variables Associated with Non-Traumatic Dental Visits to the ED

Risk factors**.** There are several risk factors associated with people who frequent the ED for relief of non-trauma related dental pain. These include being a young adult between the ages of 20 and 34 years or over 65 years of age with comorbid health risks, periodontal disease, having a 3 year or longer history of not receiving preventive dental care, untreated dental caries, being unemployed, homeless, living below the poverty level, having access to oral health professionals and affordable preventive oral health care, cultural fears of dentistry, a lack of affordable dentists, a lack of dental insurance, and poor oral health literacy (Nakao et al., 2015; Otto, 2014a; Quiñonez, Ieraci, & Guttmann, 2011; The Kaiser Family Foundation, 2017; T. Wall & Nasseh, 2013).

Age/Race/Gender. Studies have delivered differing results on the characteristics of adults presenting to the ED for preventable dental conditions. The literature has not completely agreed on race as a factor in ED utilization, with some researchers reporting a higher incidence among Blacks and Hispanics, and others not showing any significant variances based on race. Blacks have been found to have a higher incidence of oral disease and lower utilization of preventive dental care services (Kelesidis, 2014), characteristics consistent with utilizing the ED for dental pain. Several studies reported the average age of the adult patient being between the ages of 20 to 34 years of age, white, female, uninsured or a Medicaid beneficiary (C. W. Lewis et al., 2015; C. Okunseri et al., 2012; T. Wall & Nasseh, 2013; T. Wall & Vujicic, 2015). Other research has narrowed the age bands to be 20 to 29 years old and responsible for more than 40% of the total dental ED visits, a 6.1% increase in visits, and ranked fifth among the top reasons for patients going to the ED (C. W. Lewis et al., 2015; C. Okunseri et al., 2012).

Income. There has been extensive research that supports the association between poverty and poor physical and oral health (Chattopadhyay, 2008; Dowling Evans & Gisnes, 2013; B. L. Edelstein, 2006; Burton L. Edelstein, 2002; Scannapieco & Shay, 2014; Vujicic & Nasseh, 2014). More than 40% of adults visiting the ED for dental conditions are Medicaid beneficiaries, live below the federal poverty level, and are unemployed (C. W. Lewis et al., 2015; Patel, Miner, & Miner, 2012; Tang et al., 2010; The Kaiser Family Foundation, 2017). Young adult Medicaid beneficiaries and the uninsured are the most frequent utilizers of the ED for NTDCs (Singhal et al., 2015; Trikhacheva et al., 2015; Cohen, Magder, Manski, & Mullins, 2003).

Health status and comorbidities. ED visits for dental conditions have been increasing at a higher rate than physical conditions (Lee, Lewis, Saltzman, & Starks, 2012). They compared the incidence of dental visits with asthma visits per 1000 from 2001 to 2008 and found visits for back pain increased only 0.3%, visits for asthma were unchanged, and visits for dental conditions increased 59%.

Studies have shown that patients with chronic medical conditions including HIV, pregnancy, sickle cell anemia, diabetes, cardiovascular disease, Down's syndrome, mental illness, and substance abuse are a higher risk of having untreated periodontal conditions that progress to the point of visiting the ED, specifically as frequent visitors (Dietrich, Sharma, Walter, Weston, & Beck, 2013; Grubbs, Plantinga, Tuot, & Powe, 2012; Kamer et al., 2016; Laurence et al., 2006; Nalliah, Da Silva, & Allareddy, 2013; Preshaw et al., 2012; Zahnd et al., 2012). For many of these conditions there is a chronic underlying inflammation or bacterial infection that can colonize in the oral cavity (Scannapieco & Shay, 2014). When coupled with

untreated tooth decay, an individual who is not being followed by a dental health professional is left to seek out pain relief in the ED.

Access to oral health, preventive care, and dentists. The passage of the Patient Protection and Affordable Care Act or ACA in 2010 expanded health care coverage to millions of Americans who were without health insurance coverage. The act required preventive dental coverage for children and not for adults (Fingar et al., 2015, 2015; The Kaiser Family Foundation, 2017; The Pew Center on the States, 2012; Yarbrough, Vujicic, & Nasseh, 2016). Where Medicaid does reimburse dentists for preventive care services, there has been minimal participation by the dental community due to the low fee-for-service reimbursement compared to commercial dental insurance or self-pay patients (Colla, Stachowski, Kundu, Kennedy, & Vujicic, 2016; Nasseh, Vujicic, & Yarbrough, 2014a; Paradise, 2016). Between 2008 and 2009, Medicaid only reimbursed dentists about 50% of what private insurance companies reimbursed for preventive services (Decker & Lipton, 2015).

Adult Medicaid beneficiaries have access to dentists for preventive dental care in twenty-eight states. Much of the research has found evidence that supports an association between people not having preventive dental care coverage through Medicaid and dental care visits to the ED (Nasseh, Vujicic, & Yarbrough, 2014b; Neely, Jones, Rich, Santana Gutierrez, & Mehra, 2014; Yarbrough et al., 2014). However, current research has challenged the association between access to dentists and visits to the ED among Medicaid beneficiaries. Fingar et al. (2015) conducted research that looked at the supply of dentists and the provision of dental coverage in states where Medicaid reimbursed for preventive oral health services. They found no evidence to

support an increase in Medicaid coverage nor did they find an increase in available dentists caused fewer dental related ED visits.

Insurance status. The uninsured and low-income individuals are the highest utilizers of the ED for dental related diagnoses, with data showing that more than 40% of people were self-pay and more than 30% were Medicaid (Allareddy, Rampa, Lee, Allareddy, and Nalliah, (2014). The association between insurance status and overall ED visits has been researched; however, there is limited research into the association between dental insurance and ED visits because the question related to having dental insurance is not one that is asked at the point of hospital triage (Bayat, Vehkalahti, Zafarmand, & Tala, 2008; Lowe, 2012; Tang et al., 2010; Xin, Kilgore, Sen, & Blackburn, 2015). As of 2013, 99% of dental insurance was sold as a separate policy from the medical coverage offered by employers in the United States (Harris, 2014). Dental coverage can be costly whether it is a plan offered through an employer or a private policy, and in 2010, the average cost of a dental plan was $561 (Decker & Lipton, 2015), something that is cost prohibitive to many individuals. For those who do have dental insurance or Medicaid coverage, the ability to pay the out of pocket amount for dental care is a significant barrier to utilizing dental care in the community (Schrimshaw, Siegel, Wolfson, Mitchell, & Kunzel, 2011).

Barriers. The literature identified several barriers to achieving oral health equal to physical health. These include but are not limited to the following: availability of dentists in the immediate environment; cultural beliefs and attitudes toward oral health; fear and anxiety of dentists; poor oral health literacy; family income; inability to attend work or child-care needs in order to go and see a dentist; dental insurance; an inability to afford out of pocket expenses associated with a visit to the dentist; living in a state where preventive oral health care is not

provided as a covered benefit for Medicaid beneficiaries; and living where there is a shortage of oral health providers who accept Medicaid reimbursement rates (Burton L. Edelstein, 2002; Center for Health Care Strategies, Inc., 2016; Mejia et al., 2008; Paradise, 2016; Vanderbilt et al., 2013). While there was a paucity of research exploring cultural beliefs and attitudes towards dentistry, Butani, Weintraub, and Barker, (2008) found differences by race in seeking care. Their research demonstrated that race or ethnicity is tied to oral health. Blacks tend to seek care when there is a problem and not preventively, and view home remedies to calm dental pain are preferred options to treatment. Chinese people were found to engage in preventive dental care for both adults and children, in tandem with using herbs, teas, and acupuncture. They also found that oral health literacy played a key role in the delay of seeking dental care among Hispanics/Latinos. They were not knowledgeable about the role of fluoride and the prevention of tooth decay as well as a lack of knowledge about the connection between sweets and tooth decay. Puerto Ricans were found to believe that milk causes oral infections in infants and tooth brushing was for fresh breath rather than to help prevent tooth decay.

Fear and anxiety of the dentist has been identified as one of the strongest deterrents to adults seeking preventive dental care, contributing to a cycle of avoidant behavior that results in more complex dental interventions or tooth loss once the individual seeks care (Armfield, Stewart, & Spencer, 2007). Research looking at racial/ethnic disparities has shown that Blacks are least likely to seek dental care, report more tooth pain and tooth decay, are three times more likely to have lost at least one tooth, and have the highest prevalence of periodontal disease compared to Whites (Gilbert et al., 2002; Kelesidis, 2014; Schrimshaw et al., 2011; Siegel et al., 2012). As with other ethnic and racial groups, fear related to dental care is prevalent among

Blacks; however, research into this specific population's fear of dental care is more sparse because the majority of research has been conducted with white people who were being treated for anxiety disorders (Gilbert et al., 2002; Siegel et al., 2012). Six types of dental fear were identified among Blacks in a Harlem study, including several that were consistent with fears found in other studies of the general population (fear of drills, fear of a tooth extraction, fear of pain), and three that were found to be unique to Black adults (Siegel et al., 2012). Siegel et al. (2012) found that their specific fears were related to the use of unsanitary instruments, fear of catching a disease like HIV/AIDS, and fear of developing cancer from the use of X-rays. These fears were associated with environmental influences and poor oral health literacy.

A Review of States that Add Fluoride to Community Water Systems, the Justification for Doing, and the Controversy Against Water Fluoridation

Fluoride exists naturally in minerals and small amounts in water sources. The addition of fluoride to public water systems (community water fluoridation) has been heralded as one of the greatest public health accomplishments of the 20th Century (Centers for Disease Control (CDC), 2016). Implemented in some areas more than 70 years ago, the goal of adding fluoride to public water supplies has been to control chronic dental caries. Surveillance data has shown that adding fluoride to community water systems has reduced dental caries by more than 25%.

As of 2014, 74.4% of communities in the United States were adding fluoride to public water systems, falling short of the CDCs *Healthy People 2020* goal of 79.6% of all community water systems being fluoridated ("Data & Statistics, Community Water Fluoridation, Division of Oral Health, CDC," 2016). Table 3 shows the twenty states and the District of Columbia that have met or exceeded the 79.6% goal, with the District of Columbia achieving 100% and

Kentucky achieving 99.0%. In 2015, the CDC lowered their recommended ratio from 0.7 milligrams per 1.2 liters of water to 0.7 milligrams per 1 liter of water to offset the fluoride people receive from using toothpaste with fluoride and to prevent fluorosis, a condition known to change the appearance of the dental enamel (U.S. Department of Health & Human Services, 2015).

Table 3

Top Twenty States Ranked by Percent of Fluoridation

State	Persons receiving fluoridated water	Persons served by CWS	Percent	Rank
District of Columbia	595,000	595,000	100.00	
Kentucky	4,388,383	4,393,871	99.90	1
Minnesota	4,165,301	4,215,391	98.80	2
Illinois	12,687,788	12,880,580	98.50	3
North Dakota	616,946	637,796	96.70	4
Maryland	5,021,283	5,206,520	96.40	5
Georgia	9,717,858	10,097,343	96.20	6
Virginia	6,166,729	6,429,902	95.90	7
Indiana	4,388,330	4,582,546	94.70	8
South Carolina	3,468,425	3,706,859	93.60	9
South Dakota	646,671	690,759	93.60	10
Iowa	2,575,373	2,778,151	92.70	11
Ohio	9,790,109	10,557,092	92.70	12
Michigan	7,519,064	8,201,134	91.70	13
West Virginia	1,367,215	1,509,995	90.50	14
Connecticut	2,409,333	2,690,930	89.50	15
Wisconsin	3,579,100	4,025,387	88.90	16
Tennessee	5,103,368	5,789,624	88.10	17
North Carolina	6,067,182	6,907,674	87.80	18
Delaware	712,420	818,110	87.10	19
Rhode Island	842,987	997,824	84.50	20

Full adoption of fluoride has been met with controversy due to claims that fluoride can cause dental fluorosis and various physical maladies including risk for diabetes in children, hypothyroidism, bone density, diabetes, and cognitive disorders (Fluegge, 2016; D. W. Lewis & Banting, 1994; McDonagh et al., 2000; Peckham & Awofeso, 2014). Klivitsky et al. (2015) conducted a research study in Israel to see if there was an association between hospitalizations for tooth decay and fluoridated water. Their study looked at 1,413 hospitalizations due to dental conditions from 2005 to 2011 across 38 municipalities. They found that municipalities with higher fluoridation in their drinking water had fewer hospitalizations, and people with lower

socioeconomic status had more hospitalizations for dental conditions. These findings are consistent with an earlier study conducted by Cho, Lee, Paik, and Bae (2014), as they conducted a comparative study of populations in Korea, one with fluoridated water and one without. They found that the population with exposure to fluoridated water had fewer incidences of tooth decay and contributed to a higher socioeconomic status.

Summary

In summary, the literature did support a reduction in tooth decay and dental caries when fluoride was added to community water systems in conjunction with preventive dental cleanings and fluoridated toothpaste. The literature also supported the need to regulate the quantity of this mineral in our daily consumption. The literature review did not produce replicable studies that found associations between fluoride and adverse health outcomes.

The information gathered during the literature review supported that EDs are not the appropriate setting to treat NTDCs. Public health programs must target oral health prevention initiatives aimed at preventing adult Medicaid beneficiaries from going to the ED for dental care consistent with programs for physical health (Wall & Nasseh, 2013). Oral health interventions that address barriers to adults seeking dental care in the community are needed to change individual decisions of where and when to seek care. These include expanding preventive oral health services to all adult Medicaid beneficiaries across all states, reducing out of pocket costs to those who do seek care from a dentist, and increasing oral health literacy across the population. The economic savings of diverting costs of care in the ED to funding care by dentists is significant, with savings estimated at 79% or more than $1.7 billion annually (Wall, Nasseh & Vujicic, 2014). In addition to cost savings and lowering the burden on the ED physicians for

treating non-urgent conditions, the individual can have the opportunity to build an ongoing relationship with an oral healthcare professional and bridge the gaps in the oral and physical health continuum.

Chapter 3: Research Method

Introduction

Chapter 3 provides details of the research study, a description of the research approach including the study design, secondary data source, data collection, instrumentation, sample, target population, data analysis, and a discussion of ethical considerations. The overview includes the rationale for selecting a retrospective quantitative research design, the reasoning for selecting an established national database as the source of data to answer the research questions, and the characteristics of the sample from the secondary dataset.

Variables

The dependent variable in this quantitative study was the ED visits for NTDCs and the diagnosis codes assigned to these visits that met the definition of nontraumatic and dental. Dental conditions are identified by the ICD9 codes 520.0 to 526.9, 528.0 to 528.9, 784.92, V52.3, V53.4, V58.5, and V72.2. The dependent variable was constructed to identify whether a patient had presented at an ED for a dental emergency. This variable was constructed from information contained in the variables DIAG1, DIAG2, and DIAG3 in the dataset. The codes from these variables used to construct the dependent variable included IDC 521-521.9, 522-522.9, 523-523.9, 524-524.9, 525-525.9, 526-526.9, 528-528.9, and 78492. The codes excluded from the study were 520-520.9 as these were relevant to childhood tooth development. A total of 440 individual patient records had this diagnosis either on the DIAG1, DIAG2, or DIAG3 variable. Final coding of the dependent variable was 1=yes, the ED visit was for one of the aforementioned codes, and 0=no, the ED visit was not for one of the aforementioned codes.

The independent variables in this study were the geographic locations as identified by the

state of residence information contained in the 2012 NHAMCS survey data; insurance coverage as defined by having Medicaid; the presence of preventive oral health coverage for adults; fluoridation levels in the community water systems; and the age, gender, and race/ethnicity of the patient.

Nature of the Study

This research was a retrospective, nonexperimental, quantitative, correlational research design that investigated associations between geographic location and ED visits for NTDCs. A correlational approach was selected because it examines associations that may exist between independent variables and the dependent variable. It was an ideal choice for working with survey data, as relationships can be evaluated while causal inference is not made (Frankfort-Nachmias & Nachmias, 2008). This research serves as an early foundation for more detailed, in-person qualitative research whereby patients in the ED can be surveyed as to why they choose to go to the ED, if they have a dentist in the community, their fears around dentistry, and so forth.

A qualitative design was not chosen for this research because it focuses on understanding why individuals make choices and what motivates them as an individual (Crosby, DiClemente, & Salazar, 2006). A qualitative approach would not be the ideal choice for this research as the goal was to identify associations between visits to the ED and public health policies that do or do not cover preventive dental care for adult Medicaid beneficiaries. A quantitative research design was selected because it looks at a cross-section of ED visits across a range of geographic locations, and it was ideal for secondary data. I used a descriptive statistical analysis to examine correlations between states with and without preventive oral health coverage and ED visit use for NTDCs. I explored associations between a state's percent of community water systems that were

fluoridated greater than or equal to the CDC's (2016) recommendation that 79.6% of a state's community water systems receive fluoride additives to prevent tooth decay and the state's ED use for NTDCs.

Secondary data analysis was selected because historically it has been a cornerstone of social science research since Durkheim analyzed government data to understand suicide rates across countries (Frankfort-Nachmias & Nachmias, 2008). Secondary data is collected across the United States, and social scientists access this information from a variety of resources. The advantages in selecting a reliable secondary dataset include (a) a systematic method to the data collection, (b) it is an established reliable instrument, (c) opportunities for replication, (d) data available over multiple periods of time using a consistent survey instrument, (e) nonidentified patient information minimizing ethical concerns, (f) larger sample size over multiple geographic areas, and (g) and a low cost to access the data, as it is often free or inexpensive.

Two secondary datasets were considered for this research: the NHAMCS produced by the CDC and the Nationwide ED Sample (NEDS) generated by the Healthcare Cost and Utilization Project. NHAMCS data are available for free download in several statistical software packages. NEDS data are available for download; however, it is costly, requiring payment for each participating state's data. Reasons for selecting the NHAMCS survey data included (a) consistent with the published research used in Chapter 2, (b) the data are available at no cost, (c) the data are available for every year since 1992, (d) the survey instrument is sound with more than 500 published research documents using it as their data source, and (e) it is the nation's leading study of ambulatory medical care occurring in hospital-based ED and outpatient departments.

Lewis, Lynch, and Johnston (2003) used the 1997 to 2000 NHAMCS dataset to identify national incidence rates for NTDC visits to the ED as well as Medicaid and the uninsured as being the most frequent visitors for this condition. Lewis, McKinney, Lee, Melbye, and Rue (2015) used the NHAMCS 2009 to 2010 dataset to rank the frequency of NTDCs with visits for other subjective conditions like back pain and conducted a multivariate analysis to compare patient demographics, source of payment for the visit (Medicaid or uninsured), and geographic locations using metropolitan statistical area (MSA). Lewis et al. showed a 6.1% increase in visits to the ED for tooth pain, as adults ranging from age 20- to 44-years-old were the most frequent visitor to the ED for NTDCs. Tooth pain was ranked as the fifth most common reason for visiting the ED, and the uninsured and Medicaid adult beneficiaries were the most common patient.

Okunseri, Okunseri, Thorpe, Xiang, and Szabo (2012) analyzed the 1997 to 2007 NHAMCS datasets to identify characteristics of patients who visited the ED for NTDCs. Okunseri et al. (2013) used the same datasets to identify days and times of the week with the highest frequency of visits. Wall, Nasseh, and Vujicic (2014) analyzed the NHAMCS 2009 to 2010 data to identify that 54.8% of visits for dental-related conditions were semiurgent and 23.9% were nonurgent.

The NEDS database was not chosen for this research because of the high cost to purchase the database, which proved to be a constraint. NEDS offers researchers a national dataset with more than 100 variables encompassing procedure-based and comorbid data, as well as disposition and outcome (ie., if the patient was discharged or admitted). Allareddy et al. (2014) used the NEDS database from 2008 through 2010 to study the severity of dental conditions,

comorbidities of patients presenting to the ED for dental pain, charges associated with dental conditions, and mortality rates associated with urgent dental conditions. Wall and Vujicic (2015) used the 2012 NEDS database to update their ongoing research into NTDCs and ED use, and their findings were consistent with prior research.

Methodology

This section includes the data source, population, sampling, and sampling procedure as documented by the NHAMCS. No participants were recruited for this study, and no interventions were performed as a secondary dataset was used. This was not a pilot study. However, the findings may serve as the basis for future studies that can include interviews of ED patients along with use data.

Data Source

ED visit data were sourced by the 2012 results from the NHAMCS. The year 2012 was the only version of the survey with data that identified five states apart from the regional data that it normally captures. Available for public use and download since 1992, this annual survey has collected use data on ambulatory care services in both hospital-based ED and outpatient departments. NHAMCS is a national survey of randomly selected, noninstitutional ED and outpatient hospital visits that use a four-stage probability design. The survey includes data from patient records taken from nonfederal, general, and short-stay hospitals in the United States. The CDC's National Center for Health Statistics oversee the annual survey and provides the data online for public use. Although the survey includes hospital ambulatory care department visits, I focused solely on hospital ED visits as taken from the 29,453 patient records.

The NHAMCS 2012 ED patient record is comprised of 67 elements taken from hospital-based medical records of actual patient visits to the ED. Data includes the patient's gender, race and ethnicity, age, and income level, as well as the type of insurance, hospital type, and geographic location. Although eligibility for Medicaid coverage varies by state, for this study, comparisons between adults with and without Medical coverage as their identified source of insurance and/or payment source was reviewed. State-level community water fluoridation statistical information was taken from the Community Water Fluoridation, Fluoridation Statistics web page within the Oral Health division of the CDC (Division of Oral Health, National Center for Chronic Disease Prevention and Health Promotion, 2016).

Population and Sample

Target population. The target populace for this study was all 29,453-hospital ED patient records collected in the 2012 NHAMCS ED survey. The survey included demographic information regarding patient age, sex, race, marital status, patient residence status, insurance status, diagnoses, and the state location of the hospital (for the top five most populous states only). The survey results provided by the NHAMCS are weighted to represent a national sample. The weighted visits from the 2012 survey equated to 130,869,572 ED visits. Consistent with prior research using this survey data dating back to 1992, I produced partial results that can be generalizable across the United States.

Sample unit. Sampling allows researchers to make empirical generalizations while working with smaller quantities of data or limited information (Frankfort-Nachmias & Nachmias, 2008). The sample unit for this research was the actual record of the patient visit to the ED as documented by the field agent and hospital staff using the NHAMCS ED patient

record sample card (see Appendix D). NHAMCS researchers generated this probability sample from patient records based on visits to the EDs in the hospitals participating in the NHAMCS survey. I used this sample. There were 29,453 patient records for the 2012 survey. I used all of the data from the survey and did not engage in a sampling procedure. The sample was restricted to patients between the ages of 19 to 64, which narrowed the dataset from 29,453 to 18,112 patient records.

The survey is a nationally recognized dataset using a complex, multistage probability sample of patient visits to the ED across all 50 United States and the District of Columbia. The probability sample allows the researcher to make accurate estimates of their research findings (Frankfort-Nachmias & Nachmias, 2008, p. 167). Hospital participation in the sample is voluntary. To be included in the selection sample, hospitals must meet four basic criteria: (a) be a nonfederal general hospital and support shot stays (less than 30 days), (b) have a 24-hour ED, (c) be geographically located in the United States including the District of Columbia, and (d) have an outpatient department whose staff must include physicians or a hospital-based ambulatory surgical center.

It is important to have an adequate sample size in scientific research so that the research can be considered rigorous and the findings can pertain to the general populace (Crosby et al., 2006). An a priori power analysis was computed using the G*Power program (Faul et al., 2009) for a multiple linear regression to determine the minimum sample size needed to conduct the investigation. The program suggested a sample size of $N = 107$. The number of independent variables was set at eight. Power was set at .95. Significance was set at $p < .05$. Cohen's f^2 was set at 0.15 for a small to moderate effect.

Procedure for accessing data. The 2012 NHAMCS survey public data file is available on the Internet for download and was downloaded per the specifications on the website and provided by the CDC. There was no request process required to download this public dataset. There are 586 items in the survey file. The analysis of the data was performed using version 24.0 of the IBM Statistical Package for the Social Sciences (SPSS). Descriptive statistics was used for determining frequencies, means, and standard deviations, as appropriate. All patient records meeting the criteria for ED visits were used.

The file documentation provides instructions for downloading the file and the file layout and obtaining variance estimates by using SPSS Complex Samples module in version 24.0. The file layout of the survey data was ITEM NO., FIELD LENGTH, FIELD LOCATION, [ITEM NAME], DESCRITION, AND CODES.

Instrumentation

The NHAMCS dataset has high credibility and is a scientifically sound survey instrument. It was selected because it is produced annually; offers a free public use download; has been used in more than 500 research articles including the *Annals of Emergency Medicine;* and is approved by the American College of Emergency Physicians, the Emergency Nurses Association, the Society for Emergency Academic Medicine, and the American College of Osteopathic Emergency Physicians. It is a nationwide probability sample study that requires adjustments as well as the application of a sampling weight factor. This encounter-based survey has several strengths including its size, multiple variables, and a thorough methodology.

The 2012 NHAMCS survey instrument used for this study was the ED patient record sample card. The NHAMCS survey period was December 26, 2011 through December 28, 2012.

Hospitals are formally instated into the survey by outreach from field representatives of the U.S. Census Bureau. These field representatives visit the hospitals and either hospital staff or the field representative takes the patient medical record and completes the NHAMCS patient record form. The 2012 NHAMCS survey was the first field surveillance to be conducted electronically since the inception of the survey; however, only 3% of sample hospitals embraced the electronic format compared to 97% who preferred the field agent completing the documentation in paper format (CDC, n.d.).

The 2012 NHAMCS survey's multistage probability sample design includes (a) geographically selected primary sampling units (PSUs), (b) hospitals within these PSUs, (c) clinics within the hospital outpatient departments, and (d) the record of the patient visits within the emergency service areas (ESAs). I used all data from this year and did not engage in a sampling procedure. In total, 640 hospitals were identified for the 2012 survey, and 535 had ED visits eligible for the survey. Among the eligible hospitals, 408 completed the survey. The survey documentation does not specify why more than 80 hospitals did not complete the survey other than a reference to a hospital being closed or an unknown reason. Of the 544 eligible emergency service areas, 454 completed the survey. In 2012, the survey expanded its reach to ensure inclusion of the top five states with the highest concentrations of people: Texas, Florida, New York, California, and Illinois. Exclusion criteria from the survey included hospitals with a length of stay greater than 30 days, federal hospitals, and military and Veterans Administration facilities. Patient visits that result in an inpatient admission were excluded from the sample.

The 2012 NHAMCS survey consisted of 29,453 patient record forms that were randomly selected from the hospital's medical records of patient visits across the 4-week reporting period.

The survey defines a visit as occurring when a patient and a medical professional (physician or staff member supervised by a physician) experience a personal interaction. Response rates in the survey have both weighted and unweighted values to represent a national probability sample. The sample unweighted response rate for the hospitals was 76.3%, and for the ESAs, the unweighted response rate was 83.5%. Among the five most populous states that were included in 2012, the weighted response rates were between 54.6% to 71.9%.

The de-identified data collected in the 2012 NHAMCS included age; gender; hospital; geographic location; income level; race; type of insurance; reason for the hospital visit; whether the visit is the result of a trauma or injury; initial vital signs; whether this is a repeat visit, primary, secondary and tertiary diagnoses; medications and immunization history; types of tests and therapies provided during the visit; type of providers seen during the patient visit; status related to whether the patient was alive or deceased; and disposition, namely, if the patient was admitted, referred, transferred to another facility, or if the patient left on their own..

Research Questions and Hypotheses

Research questions for this study were:

RQ1: Does Medicaid adult preventive dental coverage, along with other patient characteristics, reduce ED visits for NTDCs?

$H_0$1. There is a relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower non-traumatic dental condition ED rates.

H_a1. There is no relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower non-traumatic dental condition

ED rates.

RQ2: Does community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, play a role in reducing ED visits for NTDCs?

$H_0$2. There is a relationship between community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

H_a2. There is no relationship between community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

Definition of Terms and Variables

The NHAMCS 2012 Micro-Data File Documentation provides a definition of the terms and variables contained in the survey. These variables are the ones surveyed in the primary data collection process executed by the field representatives. These are the only variables that can be analyzed in the data analysis using descriptive statistics. Additional information regarding the levels of preventive care provided by each state and the level of community water fluoridation will be gathered from non-NHAMCS sources. Below is a list of the NHAMCS variables and terms.

Dependent variable. The dependent variable was constructed to identify whether or not a respondent had presented at an emergency room for a dental emergency. This variable was constructed from information contained in the variables DIAG1, DIAG2, and DIAG3. The codes from these variables used to construct the dependent variable included IDC 521-521.9, 522-522.9, 523-523.9, 524-524.9, 525-525.9, 526-526.9, 528-528.9, and 78492. A total of 440

individuals had this diagnosis either on the DIAG1, DIAG2, or DIAG3 variable. Final coding of the dependent variable was 1=yes, the emergency room visit was for one of the aforementioned codes, and 0=no, the emergency room visit was not for one of the aforementioned codes.

Independent variables. *Age* in the NHAMCS 2012 survey was left to range from age 19 to age 64. *Gender* was categorized as female or male. *Race* was categorized as non-Hispanic White, non-Hispanic Black or African American, Hispanic, or non-Hispanic other. *Geographic location* was captured by articulating the state of residence of a respondent. The states identified in the dataset were California, Florida, Illinois, New York, Texas, and all other states. *Insurance coverage* was captured under "expected primary source of payment for this visit." This variable was dichotomized into either Medicaid or CHIP and other. Adult preventative dental care present in a state was constructed from scratch. This variable identified one state as having adult preventative dental care (New York, coded as 1) versus the other 49 states (coded as 0). *Fluoride levels* was constructed from scratch. This variable identified the fluoride levels for the state of California (63.7), Illinois (98.5), New York (71.8), Texas (79.6), Florida (78.0), or the rest of the nation (74.6).

Reliability of estimates. The sample consists of approximately 500 hospitals with emergency and outpatient departments. The survey reliability of estimates is based on two criteria being met. First, each estimate must have at least 30 sample records, and if the sample has fewer than 30 cases it is determined to be unreliable. The second criteria sets the relative standard error at less than 30%. When both criteria are met, the sample is reliable. If only one criterion is met, it is determined to be unreliable. For this study, all Patient Record form data will be included to optimize reliability. If the reliability criteria are not met, increasing the sample

size may be required or combining multiple years of data may be necessary.

Estimation procedures**.** The NHAMCS survey uses a complex multistage estimation process designed to produce unbiased estimates, and the details are provided in the 189-page NHAMCS Micro-Data File Documentation. Three components of the estimation procedure are 1) inflation by reciprocals of selection probabilities; 2) adjustment for nonresponses; and 3) ratio adjustments, (National Center for Health Statistics, Centers for Disease Control and Prevention, 2015, para 1.).

Inflation by reciprocals of selection probabilities. This survey is a complex multistage design and there are four probabilities, one for each sampling stage: a) the selection of the PSU; b) selection of the hospital; c) selection of the emergency service area or outpatient clinic within the hospital; and d) selection of the visit. To gather the overall probability of selection the survey takes the product of the four probabilities at each stage. The calculation of the probability of visit selection, the sample size of the ESA is divided by the number of actual visits. The calculation of the inflation weight is the inverse of the overall selection probability.

Adjustment for nonresponse. The adjustment for nonresponse is necessary because inducted hospitals into the sample may not respond or not fully respond to the survey and an appropriate weight must be applied. The NHAMCS survey estimation procedure adjusts for two nonresponse types. One type is when a hospital refuses to respond to the survey request and fails to provide the requested information. The weights were determined by taking the nonrespondent hospital and comparing it to similar responsive hospitals based on size and region. The second nonresponse occurs when a hospital provides incomplete Patient Record form information for its sample. The calculation performed applies a weight to the response by taking the number of

weeks the hospital did provide data during the survey period.

Ratio adjustments. NHAMCS provides a population ratio adjustment by the regions of the hospitals in the sample as identified by hospital ownership and the region they are in. In the South and West regions, further adjustments were made that identified the hospital with the ownership. The adjustment "consists of a factor in which the numerator is the sum of annual visits to the hospital EDs within each stratum, and an estimated number of ED visits within each stratum is the denominator" (National Center for Health Statistics, Centers for Disease Control and Prevention, 2015).

Population weighting factor. A weighting factor is used in the survey to give the data a weight that can be used to estimate national trends from the sample collected. The aggregation of the "patient visit weights" from the 29,453 sample records for 2012, results in 130,869,572 estimated visits made by all the patients who sought medical care in EDs in the United States during the survey reporting period.

Data Collection

Hospitals are systematically and randomly assigned a 4-week reporting period from which designated staff complete the data collection process. Survey content includes patient demographics, source pf payment, diagnoses, medications, reason for the visit, injury status, procedures performed in the ED, geographic location, and types of providers seen during the visit. The U.S. Census Bureau provides the field agents collect the data for the NHAMCS survey. These field agents are responsible for the outreach to induct the hospital and designated staff into the survey and provide training to the hospital staff on how to complete the data collection survey, the Patient Record form.

The 2012 survey was the first to be conducted using an electronic process versus an onsite paper-based survey. The survey sets a goal of 100 Patient Record forms per identified hospital ED during the 4-week reporting period. The survey reports keying and coding error rates between 0-1% and nonresponse rates at 5% or less.

Data Analysis

Descriptive statistics were used to describe the ED visits captured in the Patient Record Form. All patient records and all variables captured in the data collection process were used in this study. A binary logistic regression analysis was used as it works well with the statistical software used in this study, supports the research questions, and by using categorical and dichotomous variables, provided predictions based on the relationships found in the analysis. The analysis regressed a dichotomous binary dependent variable onto the several independent predictor variables to answer the research questions.

Ethical Procedures

A legal requirement of the National Center for Health Statistics (NCHS) is the assurance of confidentiality of all the responses collected by the Census Bureau staff. They do not include any data that can identify a hospital, establishment nor a patient in the survey. The 2012 NHAMCS survey data collection method was the first-year data was transmitted electronically, increasing confidentiality, minimizing data entry errors and optimizing confidentiality and privacy as the only data viewed is the data needed for the Patient Record Forms, and these do not include names or addresses of the patient.

Confidentiality and privacy. The confidentiality of the NHAMCS data is protected by Title 42, United States Code, Section 242K. This code allows the collection of data for the

purposes of health and statistical research. Any information that could identify an individual patient or is not released to anyone – "including the President, Congress, or any court, without the consent of the provider." The Census Bureau staff responsible for the collection of the survey data sign an affidavit making them "subject to the Privacy Act, the Public Health Service Act, and other laws that require the data be protected." Since the survey's inception in 1992, both the NCHS and Census Bureau have maintained an impeccable record in ensuring the privacy of the survey participants (facilities and patient records).

Privacy is protected under the Privacy Rule of the Health Insurance Portability and Accountability Act of 1996 (HIPAA). An important requirement of all health care providers (physicians and facilities) participating in the NHAMCS electronic survey is compliance with the Privacy Rule as of April 14, 2003. The criteria require participants to make disclosures of protected health information without requesting patient authorization if the disclosure is for public health purposes or for research that has been approved by an Institutional Review Board with a waiver of patient authorization.

Conclusion

Chapter 3 provided details for the quantitative research design for this study using a national secondary dataset. The research questions are designed to investigate potential associations between preventive dental care for adults and ED use for NTDCs, as well as potential associations between community water fluoridation and adult ED use for NTDCs. Oral health must be seen on a continuum of health throughout the life cycle if we are to see overall sustained health improvements in our nation's population because to provide coverage for preventive physical health and not oral health is ignoring the holistic approach to health

consistent with our mission to serve the public's health. As Medicaid moves forward providing expanded coverage to uninsured adults across the United States, it is imperative that public health departments seek policy reform and find ways to fund preventive dental services for adults consistent with preventive dental coverage provided to children.

Chapter 4: Results

Introduction

Adults seeking oral pain relief in the ED for preventable, NTDCs is well researched (Okunseri et al., 2012; Otto, 2014b; Wall & Nasseh, 2013). Unlike prior studies that included all ED visits for NTDCs in the dataset, I examined a subset of the 2012 NHAMCS survey. I focused on predictor variables related to patients aged 18 to 64 years of age across the top five most populous states (California, Illinois, Florida, New York, and Texas) as identified in the 2012 NHAMCS survey. In Research Question 1, I sought to compare states that did provide preventive oral health coverage for adults with states that did not and the respective volume of ED visits for NTDCs in each of the top five states. As discussed in Chapter 2, a *Healthy People 2020* oral health goal is to have 79.6% of public water systems in the United States fluoridated ("Data & Statistics, Community Water Fluoridation, Division of Oral Health, CDC," 2016). In Research Question 2, I investigated any association between the volume of ED visits for NTDCs in states that met or exceeded the CDCs recommended community water system fluoridation level with states that did not meet the recommended level.

In this chapter, I summarize the outcome of the binary logistic regression analysis performed on the 2012 NHAMCS survey data. It includes a review of the research questions, hypotheses, and predictor variables used in the analysis. The chapter ends with a summary and segues into Chapter 5's discussion and recommendations.

The research questions and hypotheses for this study were as follows:

RQ1: Does Medicaid adult preventive dental coverage, along with other patient characteristics, reduce ED visits for NTDCs?

$H_0$1: There is a relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower non-traumatic dental condition ED rates.

H_a1: There is no relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower non-traumatic dental condition ED rates.

RQ2: Does community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, play a role in reducing ED visits for NTDCs?

$H_0$2: There is a relationship between community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

H_a2: There is no relationship between community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

Data Collection

This was a retrospective, nonexperimental, quantitative, correlational study that used a secondary dataset. As described in Chapter 3, the 2012 NHAMCS national survey collected ED visit data from hospitals across the United States during 4-week periods occurring between December 26, 2011 and December 28, 2012. The 2012 NHAMCS survey identified the top five most populous states as Texas, Florida, New York, California, and Illinois. These five states were identified in the survey apart from the remaining states to eliminate double counting of the survey results. The remaining states and the District of Columbia were included in the region they belong.

Preparation of the Data

The 2012 survey data were downloaded as an SPSS file from the NHAMCS website. The dataset was examined for missing data, the variable count was compared to the meta-data documentation, and confirmation was made of the total number of records. Records for patients 0 to 18 years of age and 65 years and greater were removed from the dataset before the analyses to be consistent with the focus of the research questions on adults who were Medicaid eligible. The data required several dummy variables to be created before estimation of the binary logistic regression models. Specifically, the variable that measured a patient's race/ethnicity was broken into three separate dummy variables: Non-Hispanic White (coded as 1) versus other (coded as 0); Non-Hispanic Black (coded as 1) versus other (coded as 0); Hispanic (coded as 1) versus other (coded as 0). Given the nominal-level nature of the variable, this coding was necessary so that the variables could be entered into the regression equation (Allison, 1999; Ritchey, 2008). The variable that measured the state a patient visited an ED in was also broken into five separate dummy variables: California (coded as 1) as opposed to other (coded as 0); Illinois (coded as 1) as opposed to other (coded as 0); New York (coded as 1) as opposed to other (coded as 0); Texas (coded as 1) as opposed to other (coded as 0); and Florida (coded as 1) as opposed to other (coded as 0). Given the nominal-level nature of the variable, this coding was necessary so that the variables could be entered into the regression equation (Allison, 1999; Ritchey, 2008).

A new variable was constructed to track the states community water fluoridation levels (percent of community water systems in the state with fluoride added). This variable identified the percent of statewide community water systems fluoridation levels for the state of California (63.7), Illinois (98.5), New York (71.8), Texas (79.6), Florida (78.0), or the rest of the nation

(74.6), (CDC, 2016). A second new variable was constructed to identify states that did or did not provide Medicaid eligible adult preventative dental care. This variable identified one state as having Medicaid eligible adult preventative dental care (New York was coded as 1) versus the other 49 states (coded as 0; Medicaid and CHIP Payment and Access Commission, 2015).

The dependent variable was constructed to identify whether a patient record was coded as presenting to the ED for a NTDC. This variable was constructed from information contained in the variables DIAG1, DIAG2, and DIAG3 within the original dataset. The codes from these variables used to construct the dependent variable included ICD9 521-521.9, 522-522.9, 523-523.9, 524-524.9, 525-525.9, 526-526.9, 528-528.9, and 78492. A total of 440 individuals had a dental-related ICD9 diagnosis either on the DIAG1, DIAG2, or DIAG3 variable. This information was collapsed into a dichotomous variable that identified whether the ED visit was for one of the above-mentioned codes (coded as 1) or whether the ED visit was not for one of the above-mentioned codes (coded as 0).

The original intention was to use the five dummy variables that tracked which state a patient record was from within the binary logistic regression equations that were estimated. However, this was not possible due to extreme multicollinearity among these variables and other constructed variables in the dataset. Multicollinearity results when two or more independent variables are vastly correlated concurrently in a regression model (Allison, 1999; Vatcheva, Lee, McCormick, & Rahbar, 2016). Issues with multicollinearity are detected by running a multiple linear regression and examining the variance inflation factors (VIFs). A VIF of 10 or greater indicates multicollinearity (Allison, 1999). The VIFs for the five dummy variables that tracked

the state where the ED patient record occurred were well over 30. As a result, these variables were deleted from all regression analyses.

Survey Sample

There were 640 hospitals identified for participation in the 2012 NHAMCS survey, and 408 ED hospitals completed the survey. Hospitals were identified to participate through a randomized selection process and were identified as being ED only, outpatient facility only, or both. Of the 640 hospitals, 85 were found to be ineligible due to hospitals having closed or for other reasons unknown to me and not listed in the survey documentation. Of the remaining hospitals, 535 hospitals were determined to be eligible for the survey and 408 ED hospitals chose to participate. The unweighted ED hospital sampling response rate was 76.3%, and the weighted response rate was 75.3%. The survey resulted in N = 29,453 randomly selected ED patient records. The research questions focused on adult patient visits to the ED for NTDCs. Exclusions to the patient records for this study were any patient records for the 0 to 18 years of age and 65 years of age and older consistent with the focus of this research on adults. The resulting sample after the exclusions was N=18,112 patient records. No discrepancies from the data collection plan described in Chapter 3 were identified.

The demographic information taken from the survey's patient records for this study was the patient's age, sex, ethnicity, and race. Medicaid and CHIP insurance status, hospital geographic location, and ICD 9 diagnoses were also used. The top five most populous states represent 52.4% of patient records in the dataset. The mean age of the patients presenting to the ED for dental pain was 39 years of age.

The 2012 NHAMCS survey collected 29,453 patient records representing ED visits from 408 hospitals with emergency and outpatient departments across the top five states and the four regions. The survey's metadata file provided the weighted results representing a national sample at 130,869,572 ED visits. The survey achieved the national sample estimate by assigning an inflation factor to each patient record. The patient visit weights were aggregated resulting in the 29,453 sample records totaling to the 130,869,572 estimated ED visits across the United States. An assumption of this study was that results from the subset of the top five most populous states was considered representative of national estimates, consistent with prior research that used these data.

A binary logistic regression technique was selected to test if the independent variables influenced the binary dependent variable of whether a patient had an ED visit (Crosby et al., 2006). The statistical covariates in this study included age, fluoride, sex, and Medicaid or CHIPS as the source of payment. Race was a nominal multicategory variable and was, therefore, transformed into a series of dichotomous variable (i.e., dummy variables) for purposes of the regression model.

The most suitable descriptive statistics to report are categorical variables, percentages, and frequencies (Ritchey, 2008). These were each calculated in the sample and are presented in Table 4. A total of 440 (2.4%) patient records were identified with an ICD9 diagnosis of a NTDC. Slightly more than half of the patient records in the sample (56.4%) were female. More than half of the patient records in the sample (57.6%) were non-Hispanic White. The top five most populous states of California, Florida, Illinois, New York, and Texas represented 52.4% of ED patient records. Nearly 1 in every 4 patients (27.1%) identified as having Medicaid or CHIP

as their insurance. Less than 1 in every 2 patients (12.3%) had adult preventative dental care as a benefit option.

Results

Table 4

Percentages and Frequencies of the Study Variables

	Frequency	Percent
Gender		
Male	7904	43.6
Female	10208	56.4
Race/Ethnicity		
Non-Hispanic White	10436	57.6
Non-Hispanic Black	4137	22.8
Hispanic	2944	16.3
Non-Hispanic Other	595	3.3
State of Residence		
California	2073	11.4
Florida	1492	8.2
Illinois	2488	13.7
New York	2227	12.3
Texas	1234	6.8
Other	8598	47.6
Expected Source of Payment		
Medicaid or CHIP	4907	27.1
Other	13205	72.9
Adult Preventative Dental Care		
Yes	2227	12.3
No	13205	87.7
Emergency Department Visit for Dental Emergency		
Yes	440	2.4
No	17672	97.6
N	18112	100.00

The data presented in Table 5 represents the means and standard deviations that were calculated for all continuous variables for the sample. Ritchey (2008) noted that for continuous variables, means and standard deviations are the most suitable descriptive statistics to report. The

average age of patients was just under 39-years-old. The average community water system fluoride levels for all respondents was 76.91. The average community water fluoridation levels were assessed because fluoridation has been a public health prevention method for several decades. The national average per the CDC (2016) is 79.6% of community water systems being fluoridated in order to provide optimized preventive oral health.

Table 5

Means and Standard Deviations, Scale Variables

Variable	M	SD
Age of Respondent	38.93	13.06
Fluoride Levels	76.91	9.51

Note: n=18112.

In the two research questions, I studied associations between adult visits to the ED for NTDCs, adult preventive dental care in the state for Medicaid eligible adults, community water fluoridation levels, and demographic characteristics of the patients.

RQ1: Does Medicaid adult preventive dental coverage, along with other patient characteristics, reduce ED visits for NTDCs?

$H_0$1: There is a relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower nontraumatic dental condition ED rates.

H_a1: There is no relationship between Medicaid adult preventive dental coverage, along with other patient characteristics, and lower non-traumatic dental condition ED rates.

RQ2: Does community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, play a role in reducing ED visits for NTDCs?

$H_0$2: There is a relationship between community water fluoridation, along with Medicaid

adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

H_a2: There is no relationship between community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, and lower ED visits for NTDCs.

Tables 6 and Table 7 present the results of the binary logistic regression of ED visits for a NTDC onto the various predictors. As Ritchey (2008) noted, binary logistic regression is best suited when the dependent variable is dichotomous in nature and the independent variables are a mix of both continuous and categorical variables. These criteria are satisfied under the current circumstances.

Table 6

Binary Logistic Regression Results Model 1

	Model 1			
Variable	*B*	*SE(B)*	*exp(B)*	*p*
Constant	-3.734	0.407	0.024	0.000
Age of Respondent	-0.026	0.004	0.975	0.000
Gender of Respondent	0.215	0.098	1.240	0.029
Dichotomized Race of Respondent (1=White)	0.719	0.361	2.052	0.047
Dichotomized Race of Respondent (1=Black)	0.609	0.370	1.838	0.100
Dichotomized Race of Respondent (1=Hispanic)	0.164	0.385	1.179	0.669
Expected Source of Payment (1=Medicaid)	0.303	0.105	1.354	0.004
Adult Preventative Dental Care (1=Yes)	-0.073	0.150	0.930	0.629
Df	7			
Nagelkerke R^2	0.019			
Omnibus X^2	70.216			0.000

Two models were estimated. The first model was used to answer Research Question 1, while the second model was used to answer Research Question 2. The first parameter of interest in Model 1is the chi-square goodness of fit omnibus test of model coefficients. The omnibus test

of model coefficients in Model 1 was statistically significant ($X^2 = 70.216$ $df = 7$, $p < 0.001$). As such, decomposition of effects within the regression model can proceed. The Nagelkerke R^2 in Model 1 suggested that 2.0% of the variation in the dependent variable is due to the seven independent variables in the model. This suggests relatively poor model fit (Agresti, 2002).

Among the seven independent variables in Model 1, four emerged as significant predictors of whether someone visited an ED for a NTDC. A negative and statistically significant relationship ($p < 0.001$) emerged between a patient's age and visiting an ED for a NTDC. Each 1-year increase in age showed a lower odd of an ED visit for a NTDC by 2.56%. The formula to derive this effect was $(e^{-0.026} – 1)(100) = -2.56\%$. A positive and statistically significant relationship ($p = 0.029$) was found between a patient's gender and visiting an ED for a NTDC. Being male increased the proportional odds of visiting an ED for a NTDC by 23.98%. The formula to derive this effect was $(e^{0.215} – 1)(100) = 23.98\%$. A positive and statistically significant relationship ($p = 0.047$) was found between being White and visiting an ED for a NTDC. Being White increased the proportional odds of visiting and ED for a NTDC by 105.23%. The formula to derive this effect was $(e^{0.719} – 1)(100) = 105.23\%$. A positive and statistically significant relationship ($p = 0.004$) existed between the expected source of payment and visiting an ED for a NTDC. This means that paying with either Medicaid or CHIP increased the proportional odds of visiting an ED for a NTDC by 35.39%. The formula to derive this effect was $(e^{0.303} – 1)(100) = 35.39\%$.

The first parameter of interest in Model 2 was the chi-square goodness of fit omnibus test of model coefficients. The omnibus test of model coefficients in Model 2 was statistically significant ($X^2 = 73.850$ $df = 8$, $p < 0.001$), and therefore decomposition of effects within the

regression model could proceed. The Nagelkerke R^2 in Model 2 suggested that 2.0% of the variation in the dependent variable was due to the eight independent variables in the model. This suggested a relatively poor model fit (Agresti, 2002).

Table 7

Binary Logistic Regression Results Model 2

	Model 2			
Variable	*B*	*SE(B)*	*exp(B)*	*p*
Constant	-4.447	0.550	0.012	0.000
Age	-0.026	0.004	0.975	0.000
Gender	0.215	0.098	1.240	0.029
Dichotomized Race (1=White)	0.679	0.362	1.972	0.061
Dichotomized Race (1=Black)	0.562	0.371	1.753	0.130
Dichotomized Race (1=Hispanic)	0.137	0.385	1.147	0.722
Expected Source of Payment (1=Medicaid)	0.292	0.105	1.340	0.006
Adult Preventative Dental Care (1=Yes)	-0.009	0.154	0.991	0.951
Fluoride Levels	0.010	0.005	1.010	0.053
Df	8			
Nagelkerke R^2	0.020			
Omnibus X^2	73.850			0.000

Model 2 had eight independent variables. Three emerged as significant predictors of whether someone visited an ED for a NTDC. A negative and statistically significant relationship ($p < 0.001$) was found between a patient's age and visiting an ED for a NTDC. This means that each one-year increase in age lowered the proportional odds of visiting an ED for a NTDC by 2.56%. The formula to derive this effect is $(e^{-0.026} – 1)(100) = -2.56\%$. A positive and statistically significant relationship ($p = 0.029$) exists between a respondent's gender and visiting an ED for a NTDC. Being male increased the proportional odds of visiting an ED for a NTDC by 23.98%. The formula to derive this effect is $(e^{0.215} – 1)(100) = 23.98\%$. A positive and statistically

significant relationship ($p = 0.006$) exists between the expected source of payment and visiting an ED for a NTDC. Patients paying with Medicaid or CHIP increased the proportional odds of visiting an ED for a NTDC by 33.91%. The formula to derive this effect is $(e^{0.292} – 1)(100) = 33.91\%$.

There were no additional statistical tests of hypotheses that emerged from the analysis due to the impact of multicollinearity. This research set out to explore NTDCs and ED visits for the top five most populous states. This detailed level of analysis was hindered due to the observed impact of significant multicollinearity across the variables that existed in the data set as well as the variables that were composed to support the research questions. The VIFs were greater than 30, a solid indicator that more detailed state-level analysis would not yield statistically sound results.

Summary

Of the seven independent variables used in regression model one, four emerged in support of the alternative hypothesis which hypothesized that there is no relationship between Medicaid adult preventive dental coverage and a lower volume of ED visits for NTDCs. The patient characteristics found to be statistically significant were a patient's age, gender, and Medicaid as the expected source of payment. Of the eight independent variables used in regression model two, three emerged in support of the alternative hypothesis which hypothesized that there is no relationship between community water fluoridation, Medicaid adult preventive dental coverage, patient demographics, and lower ED visits for NTDCs. While patient characteristics including a patient's age, gender, and Medicaid as a source of payment were

found to be statistically significant, there was no support for a relationship between community water fluoridation levels and fewer ED visits for NTDCs.

The research supports prior research findings that visits to hospital emergency departments for non-emergent conditions is both a healthcare and health policy concern (Bamezai et al., 2005; Kellermann & Weinick, 2012; Uscher-Pines, Pines, Kellermann, Gillen, & Mehrotra, 2013). Medicaid beneficiaries seeking care in the ED rather than visiting community dental clinics or community-based dentists has been a growing problem facing emergency departments as the ED does not retain dentists on staff, providing minimal interventions often limited to pain relief medications and/or a referral to a clinic or dentist (Singhal et al., 2016).

The findings from this research support the literature cited in chapter two. Predictors of visiting the ED for NTDCs include Medicaid as a payment source, gender and age. Two states offered preventive dental care to Medicaid adult beneficiaries; however, while it is not possible to confirm that this benefit is a predictor of fewer visits to the ED for NTDCs, it is something future research should examine at the individual state levels. No relationship was found between community water fluoridation and fewer or more ED NTDC visits. Specific research at the individual state level to further explore this potential relationship is advised.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this retrospective, quantitative study was to investigate NTDCs visits to the ED by Medicaid-eligible adults using a national secondary dataset. In the first research question, I sought to identify associations between these ED visits across the top five most populous states as compared to other states that provided preventive oral health care for adult Medicaid enrollees. In the second research question, I sought to compare the ED visits for NTDCs in these states and the aggregate state community water fluoridation levels when hypothesizing that fluoridation may also be a predictor of ED use for NTDCs. While the topic of ED visits for NTDCs has been researched, the contribution to the literature made by conducting this study was to address a the associations between ED visits for NTDCs, state-sponsored adult preventive dental care coverage, and state-specific community water fluoridation (a major public health initiative for more than 70 years) levels consistent with the CDC's recommended water fluoridation levels. Each research question was investigated to serve as a foundation for future research that could impact public health policies, interventions, and health outcomes.

The 2012 NHAMCS was selected as the data source because it separated the top five most populous states (California, Florida, Illinois, New York, and Texas) from the four U.S. Census Bureau regions (Northeast, Midwest, South, and West). These five states represented 52.4% of the ED visits and allowed for a limited state-level view of the data for comparison purposes. Although prior researchers analyzed all ED records for NTDCs regardless of age, I focused on patient records for ages 19 to 64 (patient records for the 0 to 18 years of age and the

over 65 years of age were excluded in support of the research questions that looked at adult ED visits for NTDCs).

Summary of Findings and Interpretation

The key independent variables in this study were geographic location, Medicaid insurance coverage, age, gender, and race/ethnicity. Two additional independent variables not included in the secondary dataset were constructed to assess whether states that provided adult preventative dental care and state community water fluoridation influenced ED visits for NTDCs. The dependent variable was the actual patient record of an ED visit for an ICD9 diagnosis consistent with a NTDC. Binary regression models were constructed to assess the potential associations between the independent variables and the dependent variable. A key result from this study was that the findings associated with the independent variables of age, gender, race/ethnicity, and Medicaid aligned with prior research (Han, Nguyen, Drope, & Jemal, 2015; Lee et al., 2012; McGinn-Shapiro, 2008) as cited in Chapter 2. This was an important result because I focused only on those individuals over 19 and under 65-year-old adults, a fact which excluded more than 11,000 patient records from the dataset.

In Research Question 1, I asked if Medicaid adult preventive dental coverage, along with other patient characteristics, reduce ED visits for NTDCs? Patient characteristics as described above and adult preventive dental coverage did emerge as predictors of ED visits for NTDCs. A negative and statistically significant relationship existed between adults having preventive care and visiting the ED for a dental emergency. Although only New York offered comprehensive adult preventive dental coverage, their preventative dental coverage translated into 1 in 4 patient records occurring where preventive adult dental coverage was available. Further research is

needed because being an adult on Medicaid and being eligible to receive preventive dental care posed a higher prediction of going to the ED for a preventable dental condition. The provision of preventive care is intended to reduce emergency care; however, in this study, it did not. It is imperative that public health professionals and policy leaders understand this relationship to evaluate how preventive health programs can yield the intended outcomes. The ability to explore this phenomenon further is critical to understanding why Medicaid eligible beneficiaries who have preventive care dental coverage continue to go to the ED for NTDCs.

In Research Question 2, I asked if community water fluoridation, along with Medicaid adult preventive dental coverage and patient demographics, play a role in reducing ED visits for NTDCs? I sought to identify if fluoride added to community water systems (aggregated at the state level) in the top five most populous states was a predictor variable for ED visits for NTDCs. Three patient demographic independent variables emerged in support of the hypothesis: age, gender, and Medicaid. I found that the overall state level of community water fluoridation was not found to be a predictor of ED visits for NTDCs. Also, when adding the variable that measured water fluoridation to the regression model, the previously statistically significant relationship between adult preventative dental care and ED visits for NTDCs became statistically nonsignificant.

Support of the alternative hypothesis for Research Question 2 is important because public health has promoted the importance of adding fluoride to the public water systems for more than 70 years as a means to promote dental health and reduce the incidence of dental caries. Exploring the combination of fluoridated water and preventive dental coverage is an important research focus because evidence to support these two preventive measures could result in either health

promotion of the benefits of water fluoridation, or more robust promotion of fluoridating community water systems. Associations between fluoridated water, adult preventive care for Medicaid enrollees, and lower ED visits for NTDCs was not supported by this research. As such, research at the individual state or county levels to further explore this potential relationship is recommended.

In looking at the influence of patient demographics as predictors of ED visits for NTDCs, there was a negative and statistically significant relationship between a patient's age and visiting an ED for a NTDC. Although the average age of the patient records was 39, it was found that each year increase in age lowered the proportional odds of visiting the ED for a NTDC by 2.56%. Young adults sought out emergency care for their preventable dental condition more frequently. Patients are not connected to either a primary care physician in their community nor a dentist, that they may perceive that the ED is the place to get quick and expedient care, that they could be seeking opioid pain relief, or that they did not know where else to go for care. Although it is not possible to know why young adults go to the ED for their dental needs based on this study nor this dataset, the finding raises awareness for public health educators to target health promotions towards this demographic. An example of future research could include a qualitative study on patients in the ED to inquire if they have a dentist or if they have seen a dentist in the prior 12 months. Oral health education at the time of the interview could assist in redirecting the patient into the community for oral health care.

Another demographic predictor of going to the ED for NTDCs was gender. I found a positive and statistically significant relationship between a patient's gender and visiting the ED for a NTDC. Being male raised the odds of an ED visit for a dental emergency by 24.61%. I

found that adult males are more likely to delay seeking health care resources until a health event or health emergency occurs. Public health outreach and health promotion interventions towards this demographic are needed for several reasons as care is the traditional mechanism to identify additional health care resources including oral health and serve as a point in ensuring a holistic approach to health improvement. Second, if an individual has a primary care physician, there is a higher likelihood that said individual would also engage with an oral health professional. Conversely, if the adult is not engaged with a primary care provider or dentist, the likelihood of seeking care in the ED may be higher than someone who is engaged and has a relationship with a health care professional. The NHAMCS dataset does not include questions surrounding whether the patient has a primary care provider nor a dentist. Adding these questions to the survey would help to close gaps in the data and help advance public health policies geared towards health promotion.

Andersen's Behavioral Model of Health Services Utilization

This study hypothesized that adults experiencing NTDCs must make a choice around pain remediation to 1) ignore the pain, 2) seek home remedies, or 3) seek pain remediation by a healthcare provider (i.e., a hospital). The theoretical framework used for this study to investigate these points was Andersen's behavioral model of health services utilization. This approach divides the predictive factors into three key concepts. Each provides insights into how a person makes choices on what health care services to utilize, when to use them, and addressed oral health outcomes. These conceptions are divided into three essential components: predisposing, enabling, and need.

This research demonstrated partial support of the model for predisposing, enabling, and need. Predisposing factors that emerged from this study were consistent with the independent variables or patient characteristics (i.e., age, gender, race, and insurance status). The results of this study showed that Medicaid as a payment source represented 27.1% (or one in every four) patient visits to the ED for a NTDC. Medicaid was also an enabling resource because state sponsored health coverage afforded the individual to go to the ED. As discussed in chapter two, not all states offer dental coverage for Medicaid adults. Of the 46 states that do offer some element of coverage from preventive care to ED only, only New York emerged as the state with preventive dental coverage among the top five most populous states in this study (representing 52.4% of the sample). The remaining states of California, Florida, Illinois, and Texas provided limited or emergency care only.

The most significant factor in both the model and in the research findings was need. Manifested by the actual ED visit, the individual acted upon the perceived need for pain relief and sought emergency care in a healthcare setting. The adults who made a choice to go to the ED for healthcare services to relieve them of their dental pain did so in a manner that was consistent with Andersen's perception of need driven by symptom acuity. That is, a decision to take action that has to occur was based on the individual's perception of the severity of his or her symptoms. Of the 18,112 ED records used in this study, 440 adults, or 2.4% of the sample, were driven by their need for pain relief to go to the ED for their NTDC. This is considered significant given that prior studies had 1.6% or all ED visits due to NTDCs. Consistent with Uscher-Pines et al. (2013) in their systematic literature review of understanding the decision-making process of

going to the ED, the findings of this study support the individual's need to decide from the point of pain acuity to take action and went to the ED.

There were several areas where the theoretical model did not fit the research questions. First, the dataset did not indicate whether the patient sought remediation in their community. This was an important component of the predisposition and the enabling aspects of the model; however, they are void from the patient record survey that comprises the dataset. Second, it is unknown if the individual attempted homegrown remedies, as this would support the predictive aspect of the model. However, this is not a question in the patient record survey and not something that could be investigated. Third, if the individual had a primary care provider or a dentist, this would provide additional insights into the predisposing and enabling components of the model, as well as whether there were failed attempts to be treated in a lower cost setting. Lastly, the length of time the individual experienced pain before going to the ED would be an important metric to assess enabling and predictive components of the model. In the absence of these and perhaps other components, the complete application of the model to the hypotheses could not be fully adjudicated.

Limitations

Three strengths of this study were identified. First, the research questions were composed without having looked at the dataset, yet the results supported prior research that highlighted specific patient demographics. This offered the opportunity to both compare and replicate findings. Second, the large sample size afforded the extraction of 440 patient records for NTDCs, above the *a priori* power analysis determination that the minimum sample size needed for this investigation was $N = 107$. While the limitations of the dataset did not afford an investigation of

every state, the top five most populous states did represent 52.4% of all ED visits, a considerable and representative size.

Even though there were strengths associated with the study, there were also limitations. The most significant limitation for this research was the survey itself. First, the survey did not lend itself to a state-by-state analysis due to the limitation of multicollinearity. Despite the top five states representing more than 50% of ED visits in the survey, the extreme multicollinearity resulted in a VIF of more than 30. This prevented the state level regression analysis of the independent variables. Recommendations for future research would be to only use this specific survey for national or regional analyses.

To improve alignment with Andersen's theoretical model, additional questions added to the survey would have been helpful. Specifically, questions related to whether the patient had seen a dentist in the prior 12 months, if they had an oral health routine, if they brushed their teeth with a fluoridated toothpaste, did they drink their local water, did they attempt to alleviate their pain by seeing a primary care provider or dentist in their respective community prior to coming to the ED. Each of these would help to close the gap in applying this theoretical framework to a national dataset. The lack of information surrounding the patient's choices and actions inhibited a full and robust application of the theoretical framework.

Access to dentists in the individual states was not explored due to the limitations of the survey questions and the absence of metropolitan service area (MSA) level data to match to dentist registries. This posed a limitation by not knowing if the individual avoided or delayed care that may have been available. While access was a limitation in other studies (Cohen et al., 2002; Coughlin, Long, & Shen, 2005; Fingar et al., 2015) engaging in a dialogue with a patient

to understand why they chose to go to the ED and if they had access to community-based dental care will assist future oral health utilization research.

While the dataset used in this study included the top five most populous states, the impact of the multicollinearity in the regression models prevented the ability to analyze the data by individual state and extract commonalities that could support more global public dental health policies. Future research should expand upon this research and conduct a cross-sectional analysis of ED use for NTDCs comparing states who offer preventive dental coverage to Medicaid adult enrollees with states that do not offer this coverage due to New York having results that showed Medicaid and preventive coverage as a predictor of higher ED utilization for NTDCs. Additional studies could focus on the financial aspects of the ED visits and use the data as leverage for policy reform. An additional study could take ED utilization data and compare hospitals by zip code to compare to community water fluoridation levels and assess potential benefits from this decades-old public health initiative.

Generalizability of the findings is another limitation. While the size of the dataset made it generalizable across the United States, the impact of the multicollinearity in the regression modeling and the other limitations cited above prevent robust generalizability of results. Additional research to allow for greater generalizability of the data findings is therefore recommended.

Implications

This study contributes to the scientific body of knowledge by replicating prior research that found that gender, age, race, and insurance status were predictors of ED visits for NTDCs. The result that supports this study as a foundation for future research is that states with adult

preventive coverage for adult dental care served as a predictor for high ED utilization for NTDCs. The policy implications of this finding could impact public health funding for Medicaid adult enrollees, especially if the results are replicated and expanded in other research.

The Surgeon General's call to action was done to both influence policy makers to accept that preventive oral healthcare is as important as medical care and as a way to add to the science and evidence base to improve oral health (Satcha, 2000) for all individuals. Keeping in mind the Surgeon General's call, I focused on the potential associations between preventive dental coverage for adult Medicaid enrollees and their ED visits for NTDCs. The potential for positive social change lies in moving the needle on the health care continuum by providing preventive dental coverage to all adults in the United States, particularly those who are disadvantaged and receiving government support. It is imperative that state level analyses in states with and without adult preventive dental care be conducted to ensure that this benefit does not erode the importance of oral health in the United States.

Satcha (2000) referred to the mouth as the gateway to infections and diseases, and called upon policy makers, public health officials, and health care practitioners to make every effort to reduce the impact of untreated oral disease while positioning oral health on par with physical health (Satcha, 2000). While foreign research has found that adults exposed to community water fluoridation have fewer dental caries (Peres, Peres, Barbato, & Höfelmann, 2016), communities in the United States continue to debate the health improvement value of water fluoridation. Public health can contribute to positive social change by conducting research focused on the best approach to preventing dental caries that begin in early childhood and continue into adulthood. Water fluoridation has been a public health initiative for the prevention of dental caries for more

than 70 years. While this study did not find any association between a state's percent of fluoridation in their public water systems and ED visits for NTDCs, research at individual state levels exploring this potential relationship is recommended.

Conclusion

The two research questions studied associations between adult visits to the ED for NTDCs, adult preventive dental care in the state for Medicaid eligible adults, community water fluoridation levels, and predictive demographic characteristics of the patients. Only 21 states (or 42 percent) of state public health departments provided limited or no dental benefits, and more than 40% of NTDCs that present to the ED result from preventable yet untreated dental caries (Douglass & Douglass, 2003), equating to one visit every 15 seconds for a preventable yet untreated dental condition.

My study addressed a research gap that examined associations among states with and without adult Medicaid enrollees receiving preventive oral health care coverage, ED visits for NTDCs, and the state's community water fluoridation levels. NTDCs presenting to the ED is a public health policy issue because it illuminates a continued gap in our healthcare continuum. My results suggest that untreated dental caries into adulthood can lead to oral pain and discomfort, resulting in adults seeking pain relief in the ED. It is important for public health policy makers and health educators to explore options to close the gaps in care between physical and oral health. Oral health coverage should be on par with physical health if we are to provide a holistic approach to total health.

In summary, my research contributes to the Surgeon General's call to action for equality in oral and physical health coverage. Until adult oral health is viewed as a vital component of the

total continuum of health, total population health cannot be achieved. The role of public health is to be the health advocate across the spectrum of our nation's population. The gateway to reform policy concerning the provision of scientific evidence is to recognize that adult oral health prevention is not only a health need but also an economic demand. Fiscal responsibility can be achieved through prevention, and it is incumbent upon public health practitioners to provide this evidence.

It has been 17 years since the Surgeon General called upon health professionals to be inclusive of oral and physical health. Contributing to this challenge has been a lack of cohesive understanding of what defines oral health. The future of oral health care research in the United States should focus on providing the necessary evidence for governing bodies to allocate funding for oral health prevention and not remediation. Increasing alignment with oral health preventive care coverage for adults with physical preventive care supports the vision of total health.

References

Agresti, A. (2002). *Categorical data analysis* (2nd ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Allareddy, V., Rampa, S., Lee, M. K., Allareddy, V., & Nalliah, R. P. (2014). Hospital-based emergency department visits involving dental conditions: Profile and predictors of poor outcomes and resource utilization. *The Journal of the American Dental Association*, *145*(4), 331–337. https://doi.org/10.14219/jada.2014.7

Allison, P. D. (1999). *Multiple regression: A primer*. Thousand Oaks, CA: Sage Publications, Inc.

American Dental Association. (2015). Costly toothaches: ED visits for dental care have doubled since 2000. Retrieved September 7, 2015, from https://www.advisory.com/daily-briefing/2015/07/06/costly-toothaches

Andersen, R. M., & Davidson, P. L. (1997). Ethnicity, aging, and oral health outcomes: A conceptual framework. *Advances in Dental Research*, *11*(2), 203–209. doi:10.1177/08959374970110020201

Anderson, L., Cherala, S., Traore, E., & Martin, N. R. (2010a). Utilization of hospital emergency departments for non-traumatic dental care in New Hampshire, 2001–2008. *Journal of Community Health*, *36*(4), 513–516. https://doi.org/10.1007/s10900-010-9335-5

Anderson, L., Cherala, S., Traore, E., & Martin, N. R. (2010b). Utilization of hospital emergency departments for non-traumatic dental care in New Hampshire, 2001–2008. *Journal of Community Health*, *36*(4), 513–516. https://doi.org/10.1007/s10900-010-9335-5

Armfield, J. M., Stewart, J. F., & Spencer, A. J. (2007). The vicious cycle of dental fear: Exploring the interplay between oral health, service utilization and dental fear. *BMC Oral Health*, *7*, 1. https://doi.org/10.1186/1472-6831-7-1

Baker, S. R. (2009). Applying Andersen's behavioural model to oral health: What are the contextual factors shaping perceived oral health outcomes? *Community Dentistry and Oral Epidemiology*, *37*(6), 485–494. https://doi.org/10.1111/j.1600-0528.2009.00495.x

Balakrishnan, M., Simmonds, R. S., & Tagg, J. R. (2000). Dental caries is a preventable infectious disease. *Australian Dental Journal*, *45*(4), 235–245. https://doi.org/10.1111/j.1834-7819.2000.tb00257.x

Bamezai, A., Melnick, G., & Nawathe, A. (2005). The cost of an emergency department visit and its relationship to emergency department volume. *Annals of Emergency Medicine*, *45*(5), 483–490. https://doi.org/10.1016/j.annemergmed.2004.08.029

Bascones-Martínez, A., Arias-Herrera, S., Criado-Cámara, E., Bascones-Ilundáin, J., & Bascones-Ilundáin, C. (2013). Periodontal disease and diabetes. In S. I. A. Bs. MSc (Ed.), *Diabetes* (pp. 76–87). https://doi.org/10.1007/978-1-4614-5441-0_9

Bascones-Martínez, A., Muñoz-Corcuera, M., & Bascones-Ilundain, J. (2015). Diabetes and periodontitis: A bidirectional relationship. *Medicina Clínica (English Edition)*, *145*(1), 31–35. https://doi.org/10.1016/j.medcle.2015.12.048

Bayat, F., Vehkalahti, M. M., Zafarmand, A. H., & Tala, H. (2008). Impact of insurance scheme on adults' dental check-ups in a developing oral health care system. *European Journal of Dentistry*, *2*, 3–10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2633147/

Benjamin, R. M. (2010). Oral health: The silent epidemic. *Public Health Reports*, *125*(2), 158–159. doi:10.1177/003335491012500202

Butani, Y., Weintraub, J. A., & Barker, J. C. (2008). Oral health-related cultural beliefs for four racial/ethnic groups: Assessment of the literature. *BMC Oral Health*, *8*, 26. https://doi.org/10.1186/1472-6831-8-26

Caufield, P. W., Li, Y., & Dasanayake, A. (2005). Dental caries: An infectious and transmissible disease [Abstract]. *Compendium of Continuing Education in Dentistry (Jamesburg, N.J. : 1995)*, *26*(5 Suppl 1), 10–16. Retrieved from http://europepmc.org/abstract/med/17036539

Center for Health Care Strategies, Inc. (2015). Medicaid adult dental benefits: An overview. Retrieved from http://www.chcs.org/media/Adult-Oral-Health-Fact-Sheet_101915.pdf

Center for Health Care Strategies, Inc. (2016). Medicaid adult dental benefits: An overview. Retrieved April 2, 2016, from http://www.chcs.org/media/Adult-Oral-Health-Fact-Sheet_020816.pdf

Centers for Disease Control. (2015). Dental caries and tooth loss in adults in the United States, 2011-2012 Retrieved December 30, 2015, from https://www.cdc.gov/nchs/products/databriefs/db197.htm

Centers for Disease Control. (2016). CDC - 2012 water fluoridation statistics - statistics - community water fluoridation - oral health. Retrieved December 30, 2015, from http://www.cdc.gov/fluoridation/statistics/2012stats.htm

Chattopadhyay, A. (2008). Oral health disparities in the United States. *Dental Clinics of North America*, *52*(2), 297–318. https://doi.org/10.1016/j.cden.2007.11.001

Cho, H.-J., Lee, H.-S., Paik, D.-I., & Bae, K.-H. (2014). Association of dental caries with socioeconomic status in relation to different water fluoridation levels. *Community Dentistry and Oral Epidemiology*, *42*(6), 536–542. https://doi.org/10.1111/cdoe.12110

Chung, C. H., Bagheri, A., & D'Souza, G. (2014). Epidemiology of oral human papillomavirus infection. *Oral Oncology*, *50*(5), 364–369. https://doi.org/10.1016/j.oraloncology.2013.09.003

Cohen, L. A., Magder, L. S., Manski, R. J., & Mullins, C. D. (2003). Hospital admissions associated with nontraumatic dental emergencies in a medicaid population. *The American Journal of Emergency Medicine*, *21*(7), 540–544. https://doi.org/10.1016/j.ajem.2003.08.013

Colla, C. H., Stachowski, C., Kundu, S., Kennedy, G., & Vujicic, M. (2016). Dental Care Within Accountable Care Organizations: Challenges and Opportunities. Retrieved March 19, 2016, from http://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_0316_2.pdf?la=en

Coughlin, T. A., Long, S. K., & Shen, Y.-C. (2005). Assessing Access To Care Under Medicaid: Evidence For The Nation And Thirteen States. *Health Affairs*, *24*(4), 1073–1083. https://doi.org/10.1377/hlthaff.24.4.1073

Crosby, R., A., DiClemente, R., J., & Salazar, L., F. (2006). *Research methods in health promotion*. San Francisco, CA: Jossey-Bass.

da Silva, A. N. da, Mendonça, M. H. M. de, & Vettore, M. V. (2008). A salutogenic approach to oral health promotion. *Cadernos De Saúde Pública*, *24 Suppl 4*, s521-530. Retrieved December 15, 2016, from http://www.scielo.br/pdf/csp/v24s4/05.pdf

Data & Statistics, Community Water Fluoridation, Division of Oral Health, CDC. (2016). Retrieved December 10, 2016, from http://www.cdc.gov/fluoridation/statistics/

Decker, S. L., & Lipton, B. J. (2015). Do Medicaid benefit expansions have teeth? The effect of Medicaid adult dental coverage on the use of dental services and oral health. *Journal of Health Economics*, *44*, 212–225. https://doi.org/10.1016/j.jhealeco.2015.08.009

Dietrich, T., Sharma, P., Walter, C., Weston, P., & Beck, J. (2013). The epidemiological evidence behind the association between periodontitis and incident atherosclerotic cardiovascular disease. *Journal of Clinical Periodontology*, *40*, S70–S84. https://doi.org/10.1111/jcpe.12062

Division of Oral Health, National Center for Chronic Disease Prevention and Health Promotion. (2016). CDC - 2012 Water Fluoridation Statistics - Statistics - Community Water Fluoridation - Oral Health. Retrieved December 15, 2016, from http://www.cdc.gov/fluoridation/statistics/2014stats.htm

Dolan, T. A., Atchison, K., & Huynh, T. N. (2005). Access to dental care among older adults in the United States. *Journal of Dental Education*, *69*(9), 961–974. Retrieved April 6, 2016 from http://www.jdentaled.org/content/69/9/961.short

Douglass, A. B., & Douglass, J. M. (2003). Common Dental Emergencies. *American Family Physician*, *67*(3), 511–517. Retrieved May 8, 2016 from http://www.aafp.org/afp/2003/0201/p511.html

Dowling Evans, D., & Gisnes, C. (2013). Managing Dental Pain in the Emergency Department: Dental Disparities With Practice Implications. *Advanced Emergency Nursing Journal*, *35*(2), 95–102. https://doi.org/10.1097/TME.0b013e31828f701e

Dye, B. A., Tan, S., Smith, V., Lewis, B. G., Barker, L. K., Thornton-Evans, G., … Li, C.-H. (2007). Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital and Health Statistics. Series 11, Data from the National Health Survey*, (248), 1–92. Retrieved March 26, 2016 from https://www.cdc.gov/nchs/data/series/sr_11/sr11_248.pdf

Dye, B., Thornton-Evans, G., Li, X., & Iafolla, T. (2015). Dental caries and tooth loss in adults in the United States, 2011-2012. *NCHS Data Brief*, (197), 197. Retrieved May 8, 2016 from https://www.cdc.gov/nchs/data/databriefs/db197.pdf

Edelstein, B. L. (2006). The Dental Caries Pandemic and Disparities Problem. *BMC Oral Health*, *6*(Suppl 1), S2. https://doi.org/10.1186/1472-6831-6-S1-S2

Edelstein, Burton L. (2002). Disparities in oral health and access to care: findings of national surveys [Abstract]. *Ambulatory Pediatrics: The Official Journal of the Ambulatory Pediatric Association*, *2*(2 Suppl), 141–147. Retrieved May 8, 2016 from https://www.ncbi.nlm.nih.gov/pubmed/11950385

Eke, P. I., Dye, B. A., Wei, L., Thornton-Evans, G. O., & Genco, R. J. (2012). Prevalence of Periodontitis in Adults in the United States: 2009 and 2010. *Journal of Dental Research*, *91*(10), 914–920. https://doi.org/10.1177/0022034512457373

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Figueiredo, R. L. F., Singhal, S., Dempster, L., Hwang, S. W., & Quinonez, C. (2015). The accuracy of International Classification of Diseases coding for dental problems not associated with trauma in a hospital emergency department. *Journal of Public Health Dentistry*. https://doi.org/10.1111/jphd.12115

Fingar, K. R., Smith, M. W., Davies, S., McDonald, K. M., Stocks, C., & Raven, M. C. (2015). Medicaid Dental Coverage Alone May Not Lower Rates Of Dental Emergency Department Visits. *Health Affairs (Project Hope)*, *34*(8), 1349–1357. https://doi.org/10.1377/hlthaff.2015.0223

Fluegge, K. (2016). Community water fluoridation predicts increase in age-adjusted incidence and prevalence of diabetes in 22 states from 2005 and 2010. *Journal of Water and Health*, *14*(5), 864–877. https://doi.org/10.2166/wh.2016.012

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth Publishers.

Gambhir, R. S. (2015). Primary Care in Dentistry - An Untapped Potential. *Journal of Family Medicine and Primary Care*, *4*(1), 13–18. https://doi.org/10.4103/2249-4863.152239

Gilbert, G. H., Shah, G. R., Shelton, B. J., Heft, M. W., Bradford, E. H., & Chavers, L. S. (2002). Racial Differences in Predictors of Dental Care Use. *Health Services Research*, *37*(6), 1487–1507. https://doi.org/10.1111/1475-6773.01217

Goddard, M., & Smith, P. (2001). Equity of access to health care services: theory and evidence from the UK. *Social Science & Medicine (1982)*, *53*(9), 1149–1162. Retrieved May 8, 2016 from https://www.york.ac.uk/che/pdf/op32.pdf

Griffin, S. O., Jones, J. A., Brunson, D., Griffin, P. M., & Bailey, W. D. (2012). Burden of Oral Disease Among Older Adults and Implications for Public Health Priorities. *American Journal of Public Health, 102*(3), 411–418. https://doi.org/10.2105/AJPH.2011.300362

Grubbs, V., Plantinga, L. C., Tuot, D. S., & Powe, N. R. (2012). Chronic kidney disease and use of dental services in a united states public healthcare system: a retrospective cohort study. *BMC Nephrology*, *13*, 16. https://doi.org/10.1186/1471-2369-13-16

Gurenlian J.R. (2009). Inflammation: the relationship between oral health and systemic disease. *Dental Assistant*, *78*(2), 8–44.

Han, X., Nguyen, B. T., Drope, J., & Jemal, A. (2015). Health-Related Outcomes among the Poor: Medicaid Expansion vs. Non-Expansion States. *PLoS ONE*, *10*(12), 1–11. https://doi.org/10.1371/journal.pone.0144429

Harris, J. C. (2014). The Affordable Care Act and its ramifications on the dental profession. *Dental Abstracts*, *59*(1), 4–5. https://doi.org/10.1016/j.denabs.2013.10.003

Hinton, E., & Paradise, J. (2016). *Access to Dental Care in Medicaid: Spotlight on Nonelderly Adults* (pp. 1–11). Kaiser Family Foundation. Retrieved from http://kff.org/medicaid/issue-brief/access-to-dental-care-in-medicaid-spotlight-on-nonelderly-adults/

Hollister, M. C., & Weintraub, J. A. (1993). The association of oral status with systemic health, quality of life, and economic productivity. *Journal of Dental Education*, *57*(12), 901–912.

Hollister, M. Catherine, & Anema, M. G. (2004). Health behavior models and oral health: a review [Abstract]. *Journal of Dental Hygiene: JDH*, *78*(3), 6. Retrieved March 26, 2017 from http://www.jdentaled.org/content/57/12/901

Honigman, L., Wiler, J., Rooks, S., & Ginde, A. (2013). National Study of Non-urgent Emergency Department Visits and Associated Resource Utilization. *Western Journal of Emergency Medicine*, *14*(6), 609–616. https://doi.org/10.5811/westjem.2013.5.16112

Irani, F. C., Wassall, R. R., & Preshaw, P. M. (2015). Impact of periodontal status on oral health-related quality of life in patients with and without type 2 diabetes. *Journal of Dentistry*, *43*(5), 506–511. https://doi.org/10.1016/j.jdent.2015.03.001

Jacobson, J. J., Epstein, J. B., Eichmiller, F. C., Gibson, T. B., Carls, G. S., Vogtmann, E., … Murphy, B. (2012). The cost burden of oral, oral pharyngeal, and salivary gland cancers in three groups: commercial insurance, medicare, and medicaid. *Head & Neck Oncology*, *4*, 15. https://doi.org/10.1186/1758-3284-4-15

Kakudate, N., Morita, M., Sugai, M., & Kawanami, M. (2009). Systematic cognitive behavioral approach for oral hygiene instruction: A short-term study. *Patient Education and Counseling*, *74*(2), 191–196. https://doi.org/10.1016/j.pec.2008.08.014

Kamer, A. R., Fortea, J. O., Videla, S., Mayoral, A., Janal, M., Carmona-Iragui, M., … de Leon, M. J. (2016). Periodontal disease's contribution to Alzheimer's disease progression in Down syndrome. *Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring*, *2*, 49–57. https://doi.org/10.1016/j.dadm.2016.01.001

Kapellas, K., Jamieson, L. M., Do, L. G., Bartold, P. M., Wang, H., Maple-Brown, L. J., … Skilton, M. R. (2014). Associations between periodontal disease and cardiovascular

surrogate measures among Indigenous Australians. *International Journal of Cardiology*, *173*(2), 190–196. https://doi.org/10.1016/j.ijcard.2014.02.015

Kaylor, M. B., Polivka, B. J., Chaudry, R., Salsberry, P., & Wee, A. G. (2011). Dental Insurance and Dental Service Use by U.S. Women of Childbearing Age. *Public Health Nursing*, *28*(3), 213–222. https://doi.org/10.1111/j.1525-1446.2010.00914.x

Kelesidis, N. (2014). A Racial Comparison of Sociocultural Factors and Oral Health Perceptions. *American Dental Hygienists Association*, *88*(3), 173–182. Retrieved November 2, 2016 from http://jdh.adha.org/content/88/3/173.full.pdf

Kellermann, A. L., & Weinick, R. M. (2012). Emergency Departments, Medicaid Costs, and Access to Primary Care — Understanding the Link. *New England Journal of Medicine*, *366*(23), 2141–2143. https://doi.org/10.1056/NEJMp1203247

Klivitsky, A., Tasher, D., Stein, M., Gavron, E., & Somekh, E. (2015). Hospitalizations for dental infections. *The Journal of the American Dental Association*, *146*(3), 179–183. https://doi.org/10.1016/j.adaj.2014.12.011

Krall, E. A., Garcia, R. I., & Dawson-Hughes, B. (1996). Increased risk of tooth loss is related to bone loss at the whole body, hip, and spine. *Calcified Tissue International*, *59*(6), 433–437. https://doi.org/10.1007/BF00369206

Kutsch, V.K., & Young, D.A. (2011). New directions in the etiology of dental caries disease. *Journal of the California Dental Association*, *39*(10), 716–721. Retrieved December 31, 2016 from https://pdfs.semanticscholar.org/40c1/ffab3145f44fe321fffa6e91985ec379438a.pdf

Laurence, B., George, D., Woods, D., Shosanya, A., Katz, R. V., Lanzkron, S., … Powe, N. (2006). The association between sickle cell disease and dental caries in African Americans. *Special Care in Dentistry*, *26*(3), 95–100. https://doi.org/10.1111/j.1754-4505.2006.tb01430.x

Lee, H. H., Lewis, C. W., Saltzman, B., & Starks, H. (2012). Visiting the Emergency Department for Dental Problems: Trends in Utilization, 2001 to 2008. *American Journal of Public Health*, *102*(11), e77–e83. https://doi.org/10.2105/AJPH.2012.300965

Lewis, C., Lynch, H., & Johnston, B. (2003). Dental complaints in emergency departments: A national perspective. *Annals of Emergency Medicine*, *42*(1), 93–99. https://doi.org/10.1067/mem.2003.234

Lewis, C. W., McKinney, C. M., Lee, H. H., Melbye, M. L., & Rue, T. C. (2015). Visits to US emergency departments by 20- to 29-year-olds with toothache during 2001-2010. *The Journal of the American Dental Association*, *146*(5), 295–302.e2. https://doi.org/10.1016/j.adaj.2015.01.013

Lewis, D. W., & Banting, D. W. (1994). Water fluoridation: current effectiveness and dental fluorosis [Abstract]. *Community Dentistry and Oral Epidemiology*, *22*(3), 153–158. Retrieved December 31, 2015 from https://www.ncbi.nlm.nih.gov/pubmed/8070242

Lloyd, K., DeLia, D., & Cantor, J. C. (2014, March). Use of Emergency Departments for Non-Traumatic Oral Care in New Jersey,". Retrieved April 2, 2016, from http://www.cshp.rutgers.edu/Downloads/10360.pdf

Locker, D., Maggirias, J., & Quiñonez, C. (2011). Income, dental insurance coverage, and financial barriers to dental care among Canadian adults. *Journal of Public Health Dentistry*, *71*(4), 327–334. https://doi.org/10.1111/j.1752-7325.2011.00277.x

Löe, H. (1993). Periodontal Disease: The sixth complication of diabetes mellitus. *Diabetes Care*, *16*(1), 329–334. https://doi.org/10.2337/diacare.16.1.329

Lowe, R. A. (2012). Health Insurance Status Change and Emergency Department Use Among US Adults. *Archives of Internal Medicine*, *172*(8), 642. https://doi.org/10.1001/archinternmed.2012.34

Macinko, J., Starfield, B., & Shi, L. (2003). The Contribution of Primary Care Systems to Health Outcomes within Organization for Economic Cooperation and Development (OECD) Countries, 1970–1998. *Health Services Research*, *38*(3), 831–865. https://doi.org/10.1111/1475-6773.00149

Manz, M., C. (2016). Methods in assessing non-traumatic dental care in emergency departments. *Association of State and Territorial Dental Directors.* Retrieved March 21, 2016 from http://studylib.net/doc/6831862/methods-in-assessing-non-traumatic-dental-care-in-emergency

Marcenes, W., Kassebaum, N. J., Bernabé, E., Flaxman, A., Naghavi, M., Lopez, A., & Murray, C. J. L. (2013). Global Burden of Oral Conditions in 1990-2010 A Systematic Analysis. *Journal of Dental Research*, *92*(7), 592–597. https://doi.org/10.1177/0022034513490168

McDonagh, M. S., Whiting, P. F., Wilson, P. M., Sutton, A. J., Chestnutt, I., Cooper, J., … Kleijnen, J. (2000). Systematic review of water fluoridation. *BMJ : British Medical*

Journal, *321*(7265), 855–859. Retrieved December 31, 2015 from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC27492/

McGinn-Shapiro, M. (2008). Medicaid coverage of adult dental services. *State Health Policy Monitor*, *2*(2), 1–6. Retrieved December 22, 2016 from http://www.usalliancefororalhealth.org/sites/default/files/reports/Adult%20Dental%20Monitor.pdf

Medicaid and CHIP Payment and Access Commission. (2015). *Medicaid Coverage of Dental Benefits for Adults* (pp. 1–31). MACPAC. Retrieved from https://www.macpac.gov/wp-content/uploads/2015/06/Medicaid-Coverage-of-Dental-Benefits-for-Adults.pdf

Mejia, G., C., Kaufman, J., S., Corbie-Smith, G., Rozier, R. G., Caplan, D. J., & Suchindran, C., M. (2008). A Conceptual Framework for Hispanic Oral Health Care. *Journal of Public Health Dentistry*, *68*(1), 1–6. https://doi.org/10.1111/j.1752-7325.2007.00073.x

NADP. (2016). Who has dental benefits? Retrieved March 28, 2017, from http://www.nadp.org/Dental_Benefits_Basics/Dental_BB_1.aspx

Nakao, S., Scott, J., Masterson, E., & Chi, D. (2015). Non-traumatic Dental Condition-Related Emergency Department Visits and Associated Costs for Children and Adults with Autism Spectrum Disorders. *Journal of Autism & Developmental Disorders*, *45*(5), 1396–1407. https://doi.org/10.1007/s10803-014-2298-0

Nalliah, R. P., Allareddy, V., Elangovan, S., Karimbux, N., & Allareddy, V. (2010). Hospital Based Emergency Department Visits Attributed To Dental Caries in the United States in 2006. *Journal of Evidence-Based Dental Practice*, *10*(4), 212–222. https://doi.org/10.1016/j.jebdp.2010.09.013

Nalliah, R. P., Da Silva, J. D., & Allareddy, V. (2013). The characteristics of hospital emergency department visits made by people with mental health conditions who had dental problems [Abstract]. *Journal of the American Dental Association (1939), 144*(6), 617–624. Retrieved December 22, 2016 from https://www.ncbi.nlm.nih.gov/pubmed/23729459

Nasseh, K., Vujicic, M., & Yarbrough, C. (2014a). A Ten-Year, State-by-State, Analysis of Medicaid Fee-for-Service Reimbursement Rates for Dental Care Services. *American Dental Association*, 1–16. Retrieved September 18, 2016 from http://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_1014_3.ashx

Nasseh, K., Vujicic, M., & Yarbrough, C. (2014b). A Ten-Year, State-by-State, Analysis of Medicaid Fee-for-Service Reimbursement Rates for Dental Care Services. Retrieved March 19, 2016, from http://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_1014_3.pdf?la=en

National Center for Health Statistics, Centers for Disease Control and Prevention. (n.d.). *2012 NHAMCS Micro-data File Documentation* (pp. 1–189). National Center for Health Statistics, Centers for Disease Control and Prevention. Retrieved from ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHAMCS/doc12_ed.pdf

National Center for Health Statistics, Centers for Disease Control and Prevention. (2015). NAMCS/NHAMCS - Estimation Procedures. Retrieved January 9, 2017, from https://www.cdc.gov/nchs/ahcd/ahcd_estimation_procedures.htm

National Center for Health Statistics, Centers for Disease Control and Prevention (CDC). (2015). NAMCS/NHAMCS - Scope and Sample Design. Retrieved December 15, 2016, from https://www.cdc.gov/nchs/ahcd/ahcd_scope.htm

National Institute of Dental and Craniofacial Research. (n.d.). Chapter 3: Diseases and Disorders. Retrieved May 8, 2016, from http://www.nidcr.nih.gov/DataStatistics/SurgeonGeneral/sgr/chap3.htm#dental_caries

National Network for Oral Health Access. (2012, February). Medicaid Adult Dental Benefits: The Costs of Emergency Only. Retrieved April 2, 2016, from http://www.nnoha.org/nnoha-content/uploads/2013/07/Medicaid-Adult-Dental-Benefits-The-Costs-of-Emergency-Only.pdf

Neely, M., Jones, J. A., Rich, S., Santana Gutierrez, L., & Mehra, P. (2014). Effects of Cuts in Medicaid on Dental-Related Visits and Costs at a Safety-Net Hospital. *American Journal of Public Health*, *104*(6), e13–e16. https://doi.org/10.2105/AJPH.2014.301903

Newton, J. T., & Bower, E. J. (2005). The social determinants of oral health: new approaches to conceptualizing and researching complex causal networks. *Community Dentistry and Oral Epidemiology*, *33*(1), 25–34. https://doi.org/10.1111/j.1600-0528.2004.00190.x

Nguyen, C. M., Kim, J. W. M., Quan, V. H., Nguyen, B. H., & Tran, S. D. (2015). Periodontal associations in cardiovascular diseases: The latest evidence and understanding. *Journal of Oral Biology and Craniofacial Research*, *5*(3), 203–206. https://doi.org/10.1016/j.jobcr.2015.06.008

Office of Disease Prevention and Health Promotion. (2016). Oral Health: In Healthy People 2020. Retrieved March 16, 2016, from https://www.healthypeople.gov/2020/topics-objectives/topic/oral-health

Okunseri, C. (2015). There are More Than 1.3 Million Emergency Department Visits and Charges of $1 Billion Annually due to Nontraumatic Dental Conditions in the United States. *Journal of Evidence Based Dental Practice*, *15*(1), 33–34. https://doi.org/10.1016/j.jebdp.2014.12.002

Okunseri, C., Okunseri, E., Thorpe, J. M., Xiang, Q., & Szabo, A. (2012). Patient characteristics and trends in nontraumatic dental condition visits to emergency departments in the United States. *Clinical, Cosmetic and Investigational Dentistry*, *4*, 1–7. https://doi.org/10.2147/CCIDEN.S28168

Okunseri, E., Fischer, M., Sadeghi, S., Xiang, Q., & Szabo, A. (2013). Nontraumatic dental condition-related visits to emergency departments on weekdays, weekends and night hours: findings from the National Hospital Ambulatory Medical Care Survey. *Clinical, Cosmetic and Investigational Dentistry*, 69. https://doi.org/10.2147/CCIDE.S49191

Otto, M. (2014a, April 8). Lack of access to dental care leads to expensive emergency room care. Retrieved April 2, 2016, from http://healthjournalism.org/blog/2014/04/lack-of-access-to-dental-care-leads-to-expensive-emergency-room-care/

Otto, M. (2014b, April 8). Lack of access to dental care leads to expensive emergency room care. Retrieved November 21, 2016, from http://healthjournalism.org/blog/2014/04/lack-of-access-to-dental-care-leads-to-expensive-emergency-room-care/

Paradise, J. (2016, August 17). Improving access to oral health care for adults in Medicaid: Key themes from a policy roundtable. Retrieved September 14, 2016, from http://kff.org/medicaid/report/improving-access-to-oral-health-care-for-adults-in-medicaid-key-themes-from-a-policy-roundtable/

Patel, R., Miner, J. R., & Miner, S. L. (2012). The need for dental care among adults presenting to an urban ED. *The American Journal of Emergency Medicine*, *30*(1), 18–25. https://doi.org/10.1016/j.ajem.2010.09.011

Patrick, D. L., Lee, R. S., Nucci, M., Grembowski, D., Jolles, C. Z., & Milgrom, P. (2006). Reducing oral health disparities: A focus on social and cultural determinants. *BMC Oral Health*, *6*(Suppl 1), S4. https://doi.org/10.1186/1472-6831-6-S1-S4

Peckham, S., & Awofeso, N. (2014). Water fluoridation: a critical review of the physiological effects of ingested fluoride as a public health intervention. *TheScientificWorldJournal*, *2014*, 293019. https://doi.org/10.1155/2014/293019

Pennycook, A., Makower, R., Brewer, A., Moulton, C., & Crawford, R. (1993). The management of dental problems presenting to an accident and emergency department. *Journal Of The Royal Society Of Medicine*, *86*(12), 702–703.

Peres, M. A., Peres, K. G., Barbato, P. R., & Höfelmann, D. A. (2016). Access to fluoridated water and adult dental caries: A natural experiment. *Journal of Dental Research*. https://doi.org/10.1177/0022034516643064

Petersen, P. E., Bourgeois, D., Ogawa, H., Estupinan-Day, S., & Ndiaye, C. (2005). The global burden of oral diseases and risks to oral health. *Bulletin of the World Health Organization*, *83*(9), 661–669. https://doi.org/10.1590/S0042-96862005000900011

Pew Center on the States. (2013, February 28). A Costly Dental Destination: Hospital Care Means States Pay Dearly. Retrieved April 2, 2016, from http://www.pewtrusts.org/~/media/assets/2012/01/16/a-costly-dental-destination.pdf

Pihlstrom, B. L., Michalowicz, B. S., & Johnson, N. W. (2005). Periodontal diseases. *The Lancet*, *366*(9499), 1809–1820. https://doi.org/10.1016/S0140-6736(05)67728-8

Polsky, D., Richards, M., Basseyn, S., Wissoker, D., Kenney, G. M., Zuckerman, S., & Rhodes, K. V. (2015). Appointment Availability after Increases in Medicaid Payments for Primary Care. *New England Journal of Medicine*, *372*(6), 537–545. https://doi.org/10.1056/NEJMsa1413299

Preshaw, P. M., Alba, A. L., Herrera, D., Jepsen, S., Konstantinidis, A., Makrilakis, K., & Taylor, R. (2012). Periodontitis and diabetes: a two-way relationship. *Diabetologia*, *55*(1), 21–31. https://doi.org/10.1007/s00125-011-2342-y

Quiñonez, C., Gibson, D., Jokovic, A., & Locker, D. (2009). Emergency department visits for dental care of nontraumatic origin. *Community Dentistry and Oral Epidemiology*, *37*(4), 366–371. https://doi.org/10.1111/j.1600-0528.2009.00476.x

Quiñonez, C., Ieraci, L., & Guttmann, A. (2011). Potentially preventable hospital use for dental conditions: implications for expanding dental coverage for low income populations. *Journal of Health Care for the Poor and Underserved*, *22*(3), 1048–1058. https://doi.org/10.1353/hpu.2011.0097

Ritchey, F. J. (2008). *The statistical imagination* (2nd edition). Boston, MA: McGraw-Hill.

Satcha, D. (2000). *U.S. Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General.* (pp. 1–332). Rockville, MD: U.S. Department of Health

and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health. Retrieved from https://www.nidcr.nih.gov/DataStatistics/SurgeonGeneral/Documents/hck1ocv.@www.surgeon.fullrpt.pdf

Scannapieco, F. A., & Shay, K. (2014). Oral health disparities in older adults: Oral bacteria, inflammation, and aspiration pneumonia. *Dental Clinics of North America*, *58*(4), 771–782. https://doi.org/10.1016/j.cden.2014.06.005

Schrimshaw, E. W., Siegel, K., Wolfson, N. H., Mitchell, D. A., & Kunzel, C. (2011). Insurance-related barriers to accessing dental care among African American adults with oral health symptoms in Harlem, New York City. *American Journal of Public Health*, *101*(8), 1420–1428. https://doi.org/10.2105/AJPH.2010.300076

Seu, K., Hall, K., K., & Moy, E. (2012, November). Emergency department visits for dental-related conditions, 2009. Retrieved April 2, 2016, from https://www.hcup-us.ahrq.gov/reports/statbriefs/sb143.pdf

Siegel, K., Schrimshaw, E. W., Kunzel, C., Wolfson, N. H., Moon-Howard, J., Moats, H. L., & Mitchell, D. A. (2012). Types of dental fear as barriers to dental care among African American adults with oral health symptoms in Harlem. *Journal of Health Care for the Poor and Underserved*, *23*(3). https://doi.org/10.1353/hpu.2012.0088

Singh, A., Harford, J., Schuch, H. S., Watt, R. G., & Peres, M. A. (2016). Theoretical basis and explanation for the relationship between area-level social inequalities and population oral health outcomes – A scoping review. *SSM - Population Health*, *2*, 451–462. https://doi.org/10.1016/j.ssmph.2016.06.001

Singhal, A., Caplan, D. J., Jones, M. P., Momany, E. T., Kuthy, R. A., Buresh, C. T., … Damiano, P. C. (2015). Eliminating Medicaid adult dental coverage in California led to increased dental emergency visits and associated costs. *Health Affairs (Project Hope)*, *34*(5), 749–756. https://doi.org/10.1377/hlthaff.2014.1358

Singhal, A., Momany, E. T., Jones, M. P., Caplan, D. J., Kuthy, R. A., Buresh, C. T., & Damiano, P. C. (2016). Dental care after an emergency department visit for dental problems among adults enrolled in Medicaid. *The Journal of the American Dental Association*, *147*(2), 111–119. https://doi.org/10.1016/j.adaj.2015.08.012

Starfield, B., Shi, L., & Macinko, J. (2005). Contribution of primary care to health systems and health. *The Milbank Quarterly*, *83*(3), 457–502. https://doi.org/10.1111/j.1468-0009.2005.00409.x

Stein, P. S., Kim, J., Adkins, B., & Stearley, S. (2014). Dental pain in the ED: Costs that hurt patients and EDs [Abstract]. *The Journal of the American College of Dentists*, *81*(3), 46–51. Retrieved August 8, 2015 from https://www.ncbi.nlm.nih.gov/pubmed/25951683

Sun, B. C., Chi, D. L., Schwarz, E., Milgrom, P., Yagapen, A., Malveau, S., … Lowe. (2015). Research and Practice. Emergency department visits for nontraumatic dental problems: A Mixed-methods study. *American Journal of Public Health*, *105*(5), 947–955. https://doi.org/10.2105/AJPH.2014.302398

Tang, N., Stein, J., Hsia, R. Y., Maselli, J. H., & Gonzales, R. (2010). Trends and characteristics of us emergency department visits, 1997-2007. *The Journal of the American Medical Association*, *304*(6), 664–670. https://doi.org/10.1001/jama.2010.1112

The Kaiser Family Foundation. (2017). Medicaid benefits: Dental services. Retrieved February 6, 2016, from http://www.kff.org/medicaid/state-indicator/dental-services/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

The Pew Center on the States. (2012). A Costly dental destination: Hospital care means states pay dearly. Retrieved from http://www.pewtrusts.org/~/media/assets/2012/01/16/a-costly-dental-destination.pdf

Tomar, S. L., Carden, D. L., Dodd, V. J., Catalanotto, F. A., & Herndon, J. B. (2016). Trends in dental-related use of hospital emergency departments in Florida. *Journal of Public Health Dentistry*, *76*(3), 249–257. https://doi.org/10.1111/jphd.12158

Trikhacheva, A., Page, M., Gault, H., Ochieng, R., Barth, B. E., Cannon, C. M., … Engelman, K. K. (2015). Dental-related emergency department visits and community dental care resources for emergency room patients. Retrieved from http://archie.kumc.edu/xmlui/handle/2271/1314

Umeizudike, K. A., Iwuala, S. O., Ozoh, O. B., Ayanbadejo, P. O., & Fasanmade, O. A. (2016). Association between periodontal diseases and systemic illnesses: A survey among internal medicine residents in Nigeria. *The Saudi Dental Journal*, *28*(1), 24–30. https://doi.org/10.1016/j.sdentj.2015.03.005

U.S. Department of Health & Human Services. (2015, September 3). HHS issues final recommendation for community water fluoridation [Text]. Retrieved October 14, 2016, from http://www.hhs.gov/about/news/2015/04/27/hhs-issues-final-recommendation-for-community-water-fluoridation.html

Uscher-Pines, L., Mehrotra, A., & Chari, R. (2013). On call at the mall: a mixed methods study of U.S. medical malls. *BMC Health Services Research*, *13*, 471. https://doi.org/10.1186/1472-6963-13-471

Uscher-Pines, L., Pines, J., Kellermann, A., Gillen, E., & Mehrotra, A. (2013). Deciding to visit the emergency department for non-urgent conditions: A systematic review of the literature. *The American Journal of Managed Care*, *19*(1), 47–59. Retrieved August 29, 2016 from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4156292/

Vanderbilt, A. A., Isringhausen, K. T., VanderWielen, L. M., Wright, M. S., Slashcheva, L. D., & Madden, M. A. (2013). Health disparities among highly vulnerable populations in the United States: a call to action for medical and oral health care. *Medical Education Online*, *18*(0). https://doi.org/10.3402/meo.v18i0.20644

Vargas, C. M., & Arevalo, O. (2009). How dental care can preserve and improve oral health. *Dental Clinics of North America*, *53*(3), 399–420. https://doi.org/10.1016/j.cden.2009.03.011

Vatcheva, K. P., Lee, M., McCormick, J. B., & Rahbar, M. H. (2016). Multicollinearity in Regression Analyses Conducted in Epidemiologic Studies. *Epidemiology (Sunnyvale, Calif.)*, *6*(2). https://doi.org/10.4172/2161-1165.1000227

Vujicic, M., & Nasseh, K. (2014). A Decade in Dental Care Utilization among Adults and Children (2001–2010). *Health Services Research*, *49*(2), 460–480. https://doi.org/10.1111/1475-6773.12130

Wall, T., & Nasseh, K. (2013). Dental-Related Emergency Department Visits on the Increase in the United States. *Health Policy Institute, ADA American Dental Association*, (May,

2013), 1–9. Retrieved December 1, 2017 from http://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_0513_1.pdf

Wall, T., Nasseh, K., & Vujicic, M. (2014). Majority of dental-related emergency department visits lack urgency and can be diverted to dental offices. *Health Policy Institute Research Brief. American Dental Association. August*. Retrieved February 7, 2016 from https://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_0814_1.ashx

Wall, T. P. (2012). *Dental Medicaid-2012* (Dental Health Policy Analysis Series) (pp. 1–24). American Dental Association. Retrieved from http://www.aapd.org/assets/1/7/ADA-2012_Medicaid_Report.pdf

Wall, T. P., Vujicic, M., & Nasseh, K. (2012). Recent trends in the utilization of dental care in the United States. *Journal of Dental Education*, *76*(8), 1020–1027. Retrieved December 31, 2016 from http://www.jdentaled.org/content/76/8/1020.long

Wall, T., & Vujicic, M. (2015, April). Emergency department use for dental conditions continues to increase. American Dental Association. Retrieved from http://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_0415_2.ashx

Wallace, N. T., Carlson, M. J., Mosen, D. M., Snyder, J. J., & Wright, B. J. (2011). The individual and program impacts of eliminating Medicaid dental benefits in the Oregon health plan. *American Journal of Public Health*, *101*(11), 2144–2150. https://doi.org/10.2105/AJPH.2010.300031

Watt, Richard G. (2005). Strategies and approaches in oral disease prevention and health promotion. *Bulletin of the World Health Organization*, *83*(9), 711–718. https://doi.org/10.1590/S0042-96862005000900018

Watt, Richard Geddie. (2002). Emerging theories into the social determinants of health: implications for oral health promotion. *Community Dentistry and Oral Epidemiology*, *30*(4), 241–247. https://doi.org/10.1034/j.1600-0528.2002.300401.x

Xin, H., Kilgore, M. L., Sen, B. (Pia), & Blackburn, J. (2015). Can Nonurgent Emergency Department Care Costs be Reduced? Empirical Evidence from a U.S. Nationally Representative Sample. *Journal of Emergency Medicine (0736-4679)*, *49*(3), 347–354. https://doi.org/10.1016/j.jemermed.2015.01.034

Xu, F., & Lu, B. (2011). Prospective association of periodontal disease with cardiovascular and all-cause mortality: NHANES III follow-up study. *Atherosclerosis*, *218*(2), 536–542. https://doi.org/10.1016/j.atherosclerosis.2011.07.091

Yarbrough, C., Vujicic, M., & Nasseh, K. (2014). More than 8 million adults could gain dental benefits through Medicaid expansion. *Health Policy Institute Research Brief. American Dental Association. August*, (February), 1–14. Retrieved March 23, 2016 from http://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_0214_1.ashx

Yarbrough, C., Vujicic, M., & Nasseh, K. (2016). Estimating the Cost of Introducing a Medicaid Adult Dental Benefit in 22 States. Retrieved March 19, 2016, from http://www.ada.org/~/media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_0316_1.pdf?la=en

Zabos, G. P., Northridge, M. E., Ro, M. J., Trinh, C., Vaughan, R., Howard, J. M., … Cohall, A. T. (2008). Lack of oral health care for adults in Harlem: A hidden crisis. *American Journal of Public Health, 98*(Suppl 1), S102–S105. Retrieved December 22, 2016 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2518597/

Zahnd, G., Vray, D., Sérusclat, A., Alibay, D., Bartold, M., Brown, A., … Skilton, M. R. (2012). Longitudinal Displacement of the Carotid Wall and Cardiovascular Risk Factors: Associations with Aging, Adiposity, Blood Pressure and Periodontal Disease Independent of Cross-Sectional Distensibility and Intima-Media Thickness. *Ultrasound in Medicine & Biology, 38*(10), 1705–1715. https://doi.org/10.1016/j.ultrasmedbio.2012.05.004

Appendix A: States Ranked by Percent of Community Water Fluoridation

State Name	People	Persons served by community fluoridation	Percent	Ranking
District of Columbia	595,000	595,000	100.00	
Kentucky	4,375,026	4,380,415	99.90	1
Minnesota	4,134,663	4,184,753	98.8	2
Illinois	12,682,543	12,875,255	98.50	3
Maryland	5,060,379	5,204,155	97.20	4
North Dakota	612,560	633,645	96.70	5
Georgia	9,551,793	9,919,945	96.30	6
Virginia	6,159,737	6,416,760	96.00	7
Indiana	4,342,273	4,582,496	94.80	8
South Carolina	3,602,956	3,839,526	93.80	9
South Dakota	646,671	690,759	93.60	10
Ohio	9,716,289	10,537,957	92.20	11
Iowa	2,555,593	2,778,894	92.00	12
West Virginia	1,365,697	1,499,749	91.10	13
Connecticut	2,350,532	2,603,377	90.30	14
Michigan	7,218,670	7,999,859	90.20	15
Tennessee	5,229,461	5,826,866	89.70	16
Wisconsin	3,597,525	4,025,756	89.40	17
North Carolina	6,164,847	7,042,655	87.50	18
Delaware	705,824	818,110	86.30	19
Rhode Island	837,549	997,824	83.90	20
Texas	20,002,506	25,113,656	79.60	21
Maine	527,163	664,063	79.40	22
Alabama	3,781,607	4,822,023	78.40	23
Florida	13,371,262	17,149,724	78.00	24
New Mexico	1,210,877	1,571,600	77.00	25
Missouri	3,994,342	5,226,360	76.40	26
United States	210,655,401	282,534,910	74.60	
Nevada	1,870,698	2,544,079	73.50	27
Colorado	3,757,694	5,187,582	72.40	28
New York	12,989,488	18,094,452	71.80	29
Nebraska	1,015,094	1,425,664	71.20	30
Massachusetts	4,681,038	6,646,144	70.40	31
Oklahoma	2,486,718	3,548,057	70.10	32
Arkansas	1,785,679	2,669,485	66.90	33

California	24,215,234	38,041,430	63.70	34
Kansas	1,719,503	2,702,452	63.60	Tied for 35
Washington	3,515,797	5,525,840	63.60	Tied for 35
Mississippi	1,738,478	2,984,926	58.20	37
Arizona	3,199,068	5,536,324	57.80	38
Vermont	252,920	450,483	56.10	39
Pennsylvania	5,885,390	10,780,146	54.60	40
Alaska	361,240	682,528	52.90	41
Utah	1,384,638	2,676,448	51.70	42
New Hampshire	383,333	832,631	46.00	43
Wyoming	195,891	449,223	43.60	44
Louisiana	1,996,568	4,601,893	43.40	45
Idaho	395,863	1,097,332	36.10	46
Montana	252,299	788,805	32.00	47
Oregon	833,557	3,688,540	22.60	48
New Jersey	1,206,270	8,288,715	14.60	49
Hawaii	139,598	1,290,549	10.80	50

Appendix B: NHAMCS 2012 List of Data Items: ED

1. Date of visit Time of visit (1995-present)
2. Patient age
3. Patient sex If female, is patient pregnant? (1997-2000)
4. Patient race (revised 1999)
5. Patient ethnicity
6. Waiting time to see physician (1997-2000, 2003-present)
7. Arrival time (2001-present)
8. Length of visit (2001-present)
9. Mode of arrival (1997-2000, 2003-present)
10. Was patient oriented x 3? (2003-present)
11. Does patient reside in nursing home or other institution? (2001-present)
12. Does patient smoke cigarettes? (1995-96)
13. Expected source(s) of payment (revised in 1995 and 1997)
14. Does patient belong to an HMO? (1997-2000)
15. Patient's expressed reason(s) for visit (up to 3)
16. Is this visit related to alcohol use? (2001-2004)
17. Problem alcohol or drug related? (1992-96)
18. Has patient been seen in this ED within the last 72 hours? (2001-present)
19. Immediacy with which patient should be seen (1997-present)
20. Urgency of visit (1992-96)
21. Presenting level of pain (1997-2000, 2003-present)
22. Episode of care (2001-2004)
23. Major reason for this visit (illness, injury, other) (1992)
24. Is visit work related? (2003-present)
25. Is visit injury related? (1995-present)
26. Cause of injury (up to three) (ICD-9-CM E-codes)
27. Place of occurrence (1993-2000)
28. Is injury work related? (1995-2002)
29. Did a firearm produce the injury? (1995-96)
30. Is injury violence related? (1995-96)
31. If interpersonal violence/assault, person who caused the injury (1995-96)
32. Is injury intentional? (1997-present)
33. Is this visit related to an adverse drug event? (2001-02)
    a. If yes, list up to 2 drugs (2001-02)
34. Cause of injury verbatim text (1997-present)
35. Initial vital signs – temperature (2001-present)
36. Initial vital signs – pulse (2001-present)
37. Initial vital signs – systolic and diastolic blood pressure (2001-present)
38. Physician's diagnoses (up to three) (ICD-9-CM)
39. Is diagnosis probable, questionable, or rule out? (1997-present)
40. Does patient have depression or HIV/AIDS? (1995-96)

41. Medications provided or prescribed (up to five in 1992-94, up to six in 1995-2002, up to 8 in 2003-present)
42. Additional drug characteristics for each medication coded:
    a. Generic name code
    b. Prescription status code
    c. Controlled substance status code
    d. Composition status code
    e. Drug class (based on National Drug Code Directory)
    f. Ingredient codes (up to five)
43. Diagnostic and screening services1 Procedures1
44. Disposition of visit Providers seen
45. Patient visit weight (an inflation factor assigned to the visit)
46. Geographic region
47. Metropolitan statistical area (MSA) or non-MSA location of visit
48. Hospital ownership
49. Hospital code (code assigned to all the records from a particular hospital)
50. Patient code (sequential listing of all records from a hospital) (1993-present)
51. Race recode (1993-present)
52. Age recode (1995-present)
53. Intentionality of injury recode (based on E code) (1997-present)
54. Age in days for patients less than one year (1995-present)
55. Who completed the Patient Record forms? (1999-present)
56. Setting type (2001-present)
57. Masked sample design variables (1993-present)

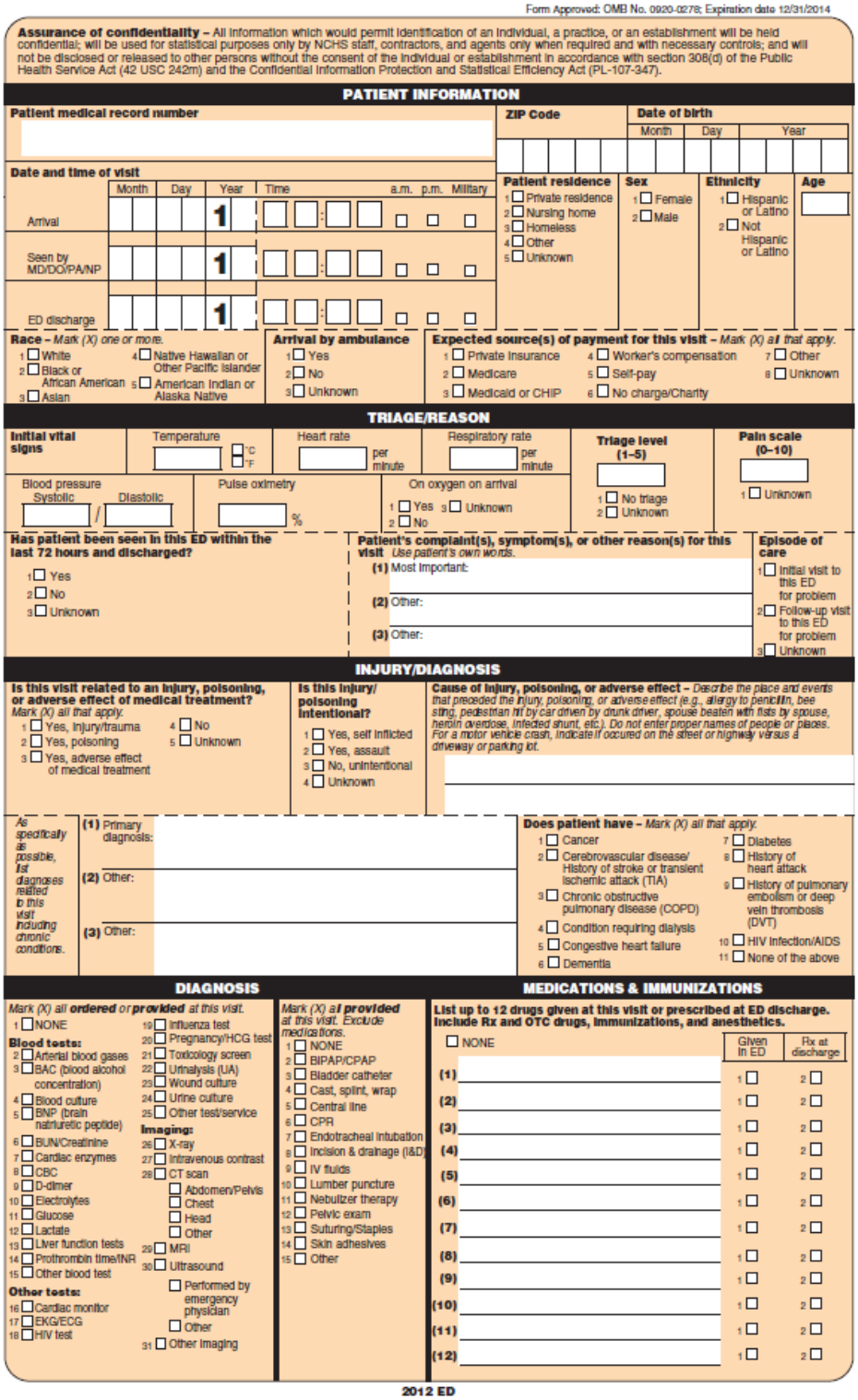
Appendix C: ICD9 Diagnosis Codes for Dental-related Conditions

ICD9 code	Description
520.0 to 520.9	Disorders of tooth development and eruption
	520 Disorders of tooth development and eruption
	520.0 Anodontia
	520.1 Supernumerary teeth
	520.2 Abnormalities of size and form of teeth
	520.3 Mottled teeth convert 520.3
	520.4 Disturbances of tooth formation
	520.5 Hereditary disturbances in tooth structure, not elsewhere classified
	Specific code 520.6 Disturbances in tooth eruption
	520.7 Teething syndrome
	520.8 Other specified disorders of tooth development and eruption
	520.9 Unspecified disorder of tooth development and eruption
521.0-521.9	Diseases of hard tissues of teeth
	521.0 Dental caries
	521.00 Dental caries, unspecified
	521.01 Dental caries limited to enamel
	521.02 Dental caries extending into dentine
	521.03 Dental caries extending into pulp
	521.04 Arrested dental caries
	521.05 Odontoclasia
	521.06 Dental caries pit and fissure
	521.07 Dental caries of smooth surface
	521.08 Dental caries of root surface
	521.09 Other dental caries
	521.1 Excessive dental attrition (approximal wear) (occlusal wear)
	521.10 Excessive attrition, unspecified
	521.11 Excessive attrition, limited to enamel
	521.12 Excessive attrition, extending into dentine
	521.13 Excessive attrition, extending into pulp
	521.14 Excessive attrition, localized
	521.15 Excessive attrition, generalized
	521.2 Abrasion of teeth
	521.20 Abrasion, unspecified
	521.21 Abrasion, limited to enamel
	521.22 Abrasion, extending into dentine
	521.23 Abrasion, extending into pulp
	521.24 Abrasion, localized
	521.25 Abrasion, generalized
	521.3 Erosion of teeth
	521.30 Erosion, unspecified
	521.31 Erosion, limited to enamel

	521.32 Erosion, extending into dentine
	521.33 Erosion, extending into pulp
	521.34 Erosion, localized
	521.35 Erosion, generalized
	521.4 Pathological tooth resorption
	521.40 Pathological resorption, unspecified
	521.41 Pathological resorption, internal
	521.42 Pathological resorption, external
	521.49 Other pathological resorption
	521.5 Hypercementosis
	521.6 Ankylosis of teeth
	521.7 Intrinsic posteruptive color changes
	521.8 Other specified diseases of hard tissues of teeth
	521.81 Cracked tooth
	521.89 Other specific diseases of hard tissues of teeth
	521.9 Unspecified disease of hard tissues of teeth
522.0 to 522.9	Diseases of pulp and periapical tissues
	522.0 Pulpitis convert 522.0 to ICD-10-CM
	522.1 Necrosis of the pulp
	522.2 Pulp degeneration
	522.3 Abnormal hard tissue formation in pulp
	522.4 Acute apical periodontitis of pulpal origin
	522.5 Periapical abscess without sinus
	522.6 Chronic apical periodontitis
	522.7 Periapical abscess with sinus -
	522.8 Radicular cyst
	522.9 Other and unspecified diseases of pulp and periapical tissues
523.0 to 523.9	Gingival and periodontal diseases
	523.0 Acute gingivitis
	523.00 Acute gingivitis, plaque induced
	523.01 Acute gingivitis, non-plaque induced
	523.1 Chronic gingivitis
	523.10 Chronic gingivitis, plaque induced
	523.11 Chronic gingivitis, non-plaque induced
	523.2 Gingival recession
	523.20 Gingival recession, unspecified
	523.21 Gingival recession, minimal
	523.22 Gingival recession, moderate
	523.23 Gingival recession, severe
	523.24 Gingival recession, localized
	523.25 Gingival recession, generalized
	523.3 Aggressive and acute periodontitis
	523.30 Aggressive periodontitis, unspecified
	523.31 Aggressive periodontitis, localized

	523.32 Aggressive periodontitis, generalized
	523.33 Acute periodontitis
	523.4 Chronic periodontitis
	523.40 Chronic periodontitis, unspecified
	523.41 Chronic periodontitis, localized
	523.42 Chronic periodontitis, generalized
	523.5 Periodontosis
	523.6 Accretions on teeth
	523.8 Other specified periodontal diseases
	523.9 Unspecified gingival and periodontal disease
528.0 to 528.9	Diseases of the oral soft tissues excluding lesions specific for gingiva and tongue
	528.0 Stomatitis and mucositis (ulcerative)
	528.00 Stomatitis and mucositis, unspecified
	528.01 Mucositis (ulcerative) due to antineoplastic therapy
	528.02 Mucositis (ulcerative) due to other drugs
	528.09 Other stomatitis and mucositis (ulcerative)
	528.1 Cancrum oris
	528.2 Oral aphthae
	528.3 Cellulitis and abscess of oral soft tissues
	528.4 Cysts of oral soft tissues
	528.5 Diseases of lips
	528.6 Leukoplakia of oral mucosa, including tongue
	528.7 Other disturbances of oral epithelium including tongue
	528.71 Minimal keratinized residual ridge mucosa
	528.72 Excessive keratinized residual ridge mucosa
	528.79 Other disturbances of oral epithelium, including tongue
	528.8 Oral submucosal fibrosis, including of tongue
	528.9 Other and unspecified diseases of the oral soft tissues
784.92	Jaw pain
V52.3	Fitting and adjustment of dental prosthetic device
V53.4	Fitting and adjustment of dental prosthetic device
V58.5	Orthodontics aftercare
V72.2	Dental examination

Appendix D: NHAMCS 2012 ED Patient Record Form



Form Approved: OMB No. 0920-0278; Expiration date 12/31/2014

Assurance of confidentiality – All information which would permit identification of an individual, a practice, or an establishment will be held confidential; will be used for statistical purposes only by NCHS staff, contractors, and agents only when required and with necessary controls; and will not be disclosed or released to other persons without the consent of the individual or establishment in accordance with section 308(d) of the Public Health Service Act (42 USC 242m) and the Confidential Information Protection and Statistical Efficiency Act (PL-107-347).

PATIENT INFORMATION

Patient medical record number

ZIP Code

Date of birth — Month / Day / Year

Date and time of visit — Month / Day / Year / Time / a.m. p.m. Military

- Arrival
- Seen by MD/DO/PA/NP
- ED discharge

Patient residence
1 ☐ Private residence
2 ☐ Nursing home
3 ☐ Homeless
4 ☐ Other
5 ☐ Unknown

Sex
1 ☐ Female
2 ☐ Male

Ethnicity
1 ☐ Hispanic or Latino
2 ☐ Not Hispanic or Latino

Age

Race – *Mark (X) one or more.*
1 ☐ White
2 ☐ Black or African American
3 ☐ Asian
4 ☐ Native Hawaiian or Other Pacific Islander
5 ☐ American Indian or Alaska Native

Arrival by ambulance
1 ☐ Yes
2 ☐ No
3 ☐ Unknown

Expected source(s) of payment for this visit – *Mark (X) all that apply.*
1 ☐ Private Insurance
2 ☐ Medicare
3 ☐ Medicaid or CHIP
4 ☐ Worker's compensation
5 ☐ Self-pay
6 ☐ No charge/Charity
7 ☐ Other
8 ☐ Unknown

TRIAGE/REASON

Initial vital signs

Temperature ☐ °C ☐ °F

Heart rate — per minute

Respiratory rate — per minute

Blood pressure — Systolic / Diastolic

Pulse oximetry — %

On oxygen on arrival
1 ☐ Yes
2 ☐ No
3 ☐ Unknown

Triage level (1–5)
1 ☐ No triage
2 ☐ Unknown

Pain scale (0–10)
1 ☐ Unknown

Has patient been seen in this ED within the last 72 hours and discharged?
1 ☐ Yes
2 ☐ No
3 ☐ Unknown

Patient's complaint(s), symptom(s), or other reason(s) for this visit *Use patient's own words.*
(1) Most important:
(2) Other:
(3) Other:

Episode of care
1 ☐ Initial visit to this ED for problem
2 ☐ Follow-up visit to this ED for problem
3 ☐ Unknown

INJURY/DIAGNOSIS

Is this visit related to an injury, poisoning, or adverse effect of medical treatment? *Mark (X) all that apply.*
1 ☐ Yes, injury/trauma
2 ☐ Yes, poisoning
3 ☐ Yes, adverse effect of medical treatment
4 ☐ No
5 ☐ Unknown

Is this injury/poisoning intentional?
1 ☐ Yes, self inflicted
2 ☐ Yes, assault
3 ☐ No, unintentional
4 ☐ Unknown

Cause of injury, poisoning, or adverse effect – *Describe the place and events that preceded the injury, poisoning, or adverse effect (e.g., allergy to penicillin, bee sting, pedestrian hit by car driven by drunk driver, spouse beaten with fists by spouse, heroin overdose, infected shunt, etc.). Do not enter proper names of people or places. For a motor vehicle crash, indicate if occured on the street or highway versus a driveway or parking lot.*

As specifically as possible, list diagnoses related to this visit including chronic conditions.

(1) Primary diagnosis:
(2) Other:
(3) Other:

Does patient have – *Mark (X) all that apply.*
1 ☐ Cancer
2 ☐ Cerebrovascular disease/ History of stroke or transient ischemic attack (TIA)
3 ☐ Chronic obstructive pulmonary disease (COPD)
4 ☐ Condition requiring dialysis
5 ☐ Congestive heart failure
6 ☐ Dementia
7 ☐ Diabetes
8 ☐ History of heart attack
9 ☐ History of pulmonary embolism or deep vein thrombosis (DVT)
10 ☐ HIV Infection/AIDS
11 ☐ None of the above

DIAGNOSIS

Mark (X) all ***ordered*** *or* ***provided*** *at this visit.*

1 ☐ NONE

Blood tests:
2 ☐ Arterial blood gases
3 ☐ BAC (blood alcohol concentration)
4 ☐ Blood culture
5 ☐ BNP (brain natriuretic peptide)
6 ☐ BUN/Creatinine
7 ☐ Cardiac enzymes
8 ☐ CBC
9 ☐ D-dimer
10 ☐ Electrolytes
11 ☐ Glucose
12 ☐ Lactate
13 ☐ Liver function tests
14 ☐ Prothrombin time/INR
15 ☐ Other blood test

Other tests:
16 ☐ Cardiac monitor
17 ☐ EKG/ECG
18 ☐ HIV test
19 ☐ Influenza test
20 ☐ Pregnancy/HCG test
21 ☐ Toxicology screen
22 ☐ Urinalysis (UA)
23 ☐ Wound culture
24 ☐ Urine culture
25 ☐ Other test/service

Imaging:
26 ☐ X-ray
27 ☐ Intravenous contrast
28 ☐ CT scan
☐ Abdomen/Pelvis
☐ Chest
☐ Head
☐ Other
29 ☐ MRI
30 ☐ Ultrasound
☐ Performed by emergency physician
☐ Other
31 ☐ Other imaging

MEDICATIONS & IMMUNIZATIONS

Mark (X) ***all provided*** *at this visit. Exclude medications.*

1 ☐ NONE
2 ☐ BIPAP/CPAP
3 ☐ Bladder catheter
4 ☐ Cast, splint, wrap
5 ☐ Central line
6 ☐ CPR
7 ☐ Endotracheal intubation
8 ☐ Incision & drainage (I&D)
9 ☐ IV fluids
10 ☐ Lumber puncture
11 ☐ Nebulizer therapy
12 ☐ Pelvic exam
13 ☐ Suturing/Staples
14 ☐ Skin adhesives
15 ☐ Other

List up to 12 drugs given at this visit or prescribed at ED discharge. Include Rx and OTC drugs, immunizations, and anesthetics.

☐ NONE

	Given in ED	Rx at discharge
(1)	1 ☐	2 ☐
(2)	1 ☐	2 ☐
(3)	1 ☐	2 ☐
(4)	1 ☐	2 ☐
(5)	1 ☐	2 ☐
(6)	1 ☐	2 ☐
(7)	1 ☐	2 ☐
(8)	1 ☐	2 ☐
(9)	1 ☐	2 ☐
(10)	1 ☐	2 ☐
(11)	1 ☐	2 ☐
(12)	1 ☐	2 ☐

2012 ED

DISPOSITION

Mark (X) all providers seen at this visit.

1 ☐ ED attending physician
2 ☐ ED resident/intern
3 ☐ Consulting physician
4 ☐ RN/LPN
5 ☐ Nurse practitioner
6 ☐ Physician assistant
7 ☐ EMT
8 ☐ Other mental health provider
9 ☐ Other

Mark (X) all that apply.

1 ☐ No follow-up planned
2 ☐ Return to ED
3 ☐ Return/Refer to physician/clinic for FU
4 ☐ Left before triage
5 ☐ Left after triage
6 ☐ Left AMA
7 ☐ DOA
8 ☐ Died in ED
9 ☐ Return/Transfer to nursing home
10 ☐ Transfer to psychiatric hospital
11 ☐ Transfer to other hospital
12 ☐ Admit to this hospital
13 ☐ Admit to observation unit then hospitalized
14 ☐ Admit to observation unit, then discharged
15 ☐ Other

HOSPITAL

Complete if the patient was admitted to this hospital at this ED visit. – *Mark (X) "Unknown" in each item, if efforts have been exhausted to collect the data.*

Admitted to:

1 ☐ Critical care unit
2 ☐ Stepdown unit
3 ☐ Operating room
4 ☐ Mental health or detox unit
5 ☐ Cardiac catheterization lab
6 ☐ Other bed/unit
7 ☐ Unknown

Date and time bed was requested for hospital admission or transfer

Month | Day | Year 1 | Time : | a.m. ☐ p.m. ☐ Military ☐

1 ☐ Unknown

Date and time patient actually left the ED or observation unit

Month | Day | Year 1 | Time : | a.m. ☐ p.m. ☐ Military ☐

1 ☐ Unknown

Admitting physician

1 ☐ Hospitalist
2 ☐ Not hospitalist
3 ☐ Unknown

Hospital discharge date

Month | Day | Year 1

1 ☐ Unknown

Principal hospital discharge diagnosis

1 ☐ Unknown

Hospital discharge status/disposition

1 ☐ Alive
2 ☐ Dead
3 ☐ Unknown

→

1 ☐ Home/Residence
2 ☐ Return/Transfer to nursing home
3 ☐ Transfer to another facility (not usual place of residence)
4 ☐ Other
5 ☐ Unknown

▶ ***If this information is not available at time of abstraction, then complete the Hospital Admission Log.***

Date and time of observation unit discharge

Month | Day | Year 1 | Time : | a.m. ☐ p.m. ☐ Military ☐

1 ☐ Unknown

NHAMCS-173 (12-23-2011)