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GEOGRAPHIC COMPARISONS OF

WASHINGTON STATE NON-TRAUMATIC DENTAL COMPLAINT EMERGENCY DEPARTMENT PATIENTS

by

Jacqueline A. Juhl

A thesis

submitted in partial fulfillment

of the requirements for the degree of

Master of Science in Dental Hygiene

Idaho State University

August 8, 2014

Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Jacqueline A. Juhl find it satisfactory and recommend that it be accepted.

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November 8, 2013

Jacqueline Juhl
Stop 8048
Pocatello, ID 83209

RE: Your application dated 11/7/2013 regarding study number 4005: Comparison of Rural and Urban Emergency Department Non-Traumatic Dental Complaint Pits and Treatment Variables

Dear Ms. Juhl:

I agree that this study qualifies as exempt from review under the following guideline: 4. Analysis of existing data sets. This letter is your approval, please, keep this document in a safe place.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You are granted permission to conduct your study effective immediately. The study is not subject to renewal.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Patricia Hunter (208-282-2179; fax 208-282-4529; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

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Finally, I also dedicate this thesis, in a special way, to the people of my home Washington State county in which the RTU site is located, and to underserved peoples everywhere with fervent hope for equity, social justice, dignity, and compassion in achieving oral healthcare access.

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Abstract

Objective: Compare rural-to-urban commuting [RTU] and urban [URB] Non-Traumatic-Dental-Complaint [NTDC] Emergency Department [ED] patient demographic profiles, institutional administrative experiences, and clinical experiences in Washington State.

Methods: Electronically extracted data from 1183 de-identified patient records were analyzed using a one-way *t*-test, Mann-Whitney test, Pearson Chi-square analysis, and Fisher's Exact test with a 0.05 alpha level.

Results: Usable records provided by the RTU site numbered 197 and by the URB site were 1183. The demographic profiles indicated that more males visited the ED at both geographic sites. Between sites a significant difference was found between the ages, sex, and ICD-9 code utilization by licensed providers of NTDC ED patients. Clinical NTDC patient experiences varied by diagnosis, treating provider, and admissions.

Conclusions: Differences existed between RTU and URB institutions in several aspects of NTDC ED patient experiences including ICD-9 codes usage which might adversely affect patient outcomes and healthcare policies.

Keywords, emergency department, , rural-to-urban commuting, non-traumatic dental complaint, urban, uninsured

Chapter 1 Introduction

Introduction

Geographic residency is an important consideration in understanding the growing use of emergency departments (EDs) for Non-Traumatic Dental Complaint [or Condition] (NTDC) (Heaton, Smith, & Raybould, 2004; Patel, Miner, & Miner, 2012; Pew Center for the States, 2011, 2012; Shortridge & Moore, 2009; 2010 United States Department of Health and Human Services [USDHHS], 2000; United States Senate Committee on Health, Education, Labor & Pensions Subcommittee on Primary Health and Aging, 2012). Additionally, treatment received by NTDC patients in EDs in different geographic setting might be affected by prevalent economic trends, political events, and resulting policy changes (Guay, 2004; Heaton, Smith, & Raybould, 2004; Pew Center for the States, 2011, 2012, Shortridge & Moore, 2009, 2010). The critical state of oral healthcare in the United States (U.S.) has been exacerbated by the recent protracted fiscal crisis (Pew Center on the States, 2012; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). The Washington State budget has been particularly affected by this economic downturn, forcing budget cuts which resulted in the loss of dental benefits to more than 466,000 adults in fiscal year 2010-2011 (Washington State Health Care Authority, 2011).

As fiscal resources in public and private sectors have become increasingly strained, access to preventive and routine dental care have been concomitantly denied to many of the most vulnerable in our society (Garcia, Cadoret, & Henshaw, 2008; Gibbs, Nsiah-Jefferson, McHugh, Trivedi, & Prothrow-Stith, 2006; Pew Center on the States, 2011, 2012; Shelley, Russell, Parikh, & Fahs, 2011; Smedley, 2003; USDHHS, 2000). More than 100 million Americans cannot access dental care and suffer the dire health consequences; some, even death (American Dental Association [ADA], 2007; Shortridge & Moore, 2010). Furthermore, in excess of 47 million people live in geographic areas where access to oral healthcare is difficult or unavailable (Pew Center for the

States, 2012; United States Senate Committee on Health, Education, Labor & Pensions Subcommittee on Primary Health and Aging, 2012). Numerous investigators have established that, without other perceived recourse, patients with severe dental pain not caused by trauma, NTDC patients, seek care in EDs for pain relief (Anderson, Cherala, Traore, & Martin, 2010; Anderson & Thomas, 2003; Casamassimo, Thikkurissy, Burton, Edelstein, & Maironi, 2009; Centers for Disease Control and Prevention [CDC], 2011; Cohen, Bonito, Akin, Manski, Macek, Edwards, & Cornelius, 2008; Cohen, Bonito, Eicheldinger, Maski, Macek, Edwards, & Khanna, 2011; Cohen, Magder, Manski, Mullins, 2003; Cohen, Manski, Magder, & Mullins, 2002; Davis, Deinard, & Maïga, 2010; Dolan, Atchison, & Nuynh, 2005; Hong, Ahmed, McCunniff, Liu, Cai, & Hoff, 2011; Lewis, Lynch, & Johnston, 2003; McLean, A. 2006; Nagarkar, Kumar, & Moss, 2012; Nalliah, Allareddy, Elangovan, Karimbux, Lee, Gahendrareddy, & Allareddy, 2011; Okunseri, Okunseri, Chilmaza, Huranani, Xiang, & Szabo, 2013; Okunseri, Okunseri, Thorpe, Xiang, & Szabo, 2012; Okunseri, Pajewski, Jackson, & Sazabo, 2011; Pajewski & Okunseri, 2012; U.S. General Accounting Office [USGAO], 2000, 2010; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012; Wall, Vujicic, & Nasseh, 2012).

Nationally, the cost of ED visits for NTDC is a financial burden to local, state, and federal budgets and many question the efficacy and appropriateness of ED treatment for NTDC patients by non-dental professions (Anderson et al., 2010; Cassamassimo, et al., 2009; CDC, 2011; Cohen, Bonito, Akin, Manski, et al., 2008, Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011, Cohen, Magder, et al., 2003; Cohen, Manksi, et al., 2002; Davis et al., 2010; Dolan et al., 2005; Guay, 2004, 2006; Hong et al., 2011; IOM, 2011a; Lewis et al., 2003; McLean, 2006; Nagarkar et al., 2012; Nalliah et al., 2011; Okunseri, Okunseri, Thorpe, et al., 2012; Okunseri, Pajewski, et al., 2011; Pajewski et al., 2012; Wall et al., 2012; USGAO, 2000, 2010; USDHHS, 2000; U. S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). The consequences of seeking treatment for relief of NDTC in EDs are staggering, pervasive, and, either

directly or indirectly, impact every person in the U.S. More than 830,000 ED visits occurred across the U.S. for preventable dental conditions in 2009, a 16% increase since 2006 (U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). Costs of NTDC ED treatment are staggering, both in terms of financial costs and individual suffering. Costs for NTDC ED treatments have been reported as $170 million for only eight reporting states. (Nalliah et al., 2011; Vargas & Arevalo, 2009). In 2006, the cost of loss of productivity, missed education, social implications of dental pain and tooth loss, quality of life issues, and increased risk of systemic co-morbidities and death was estimated at $164 million (Pew Center for the States, 2012). In 2010, in Florida alone, there were 115,000 ED visits for dental pain costing over $88 million. Of these, over 40,000 of these patients were Medicaid recipients (Pew Center for the States, 2012). In 2006, in Maine, dental abscesses accounted for 3,400 ED visits (Pew Center for the States, 2012). In Washington State, 23,000 NTDC ED visits occurred at 53 surveyed hospitals during eighteen months between 2008 and 2009 (Pew Center for the States, 2012). A Washington State Hospital Association (WSHA) survey of 53 Washington State Hospitals reported that more than 23,000 ED visits for NTDC occurred in an 18 month period between 2008-2009 at a cost of $36.3 million (WSHA, 2011).

It is established that most dental pain is preventable by routine, regularly timed care that includes early detection and treatment of infections and pathologies of oral structures (Casamassimo, et al., 2009; Cohen, Bonito, Akin, Manski, et al., 2008, Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011; Harris, García-Godoy, & Nathe, 2009, Guay, 2004, 2006; Lashley, 2008)). Dental pain which is severe enough to cause an individual to seek care in an emergency setting is considered behavior that results from of a complex set of circumstances and perceptions (Dolan, Atchison, & Huynh, 2005; Nagarkar, Kumar, & Moss, 2012; Wall, Vujicic, & Nasseh, 2012). According to the Institute of Medicine (IOM, 2011), the reasons why individuals seek NTDC pain relief in EDs might include a lack of regular access to oral care; a lack of appropriate quality measures to evaluate oral care including outcomes; a lack or limited dental insurance coverage or dental care

providers; inadequate consideration of the importance of oral health as a component of total health by primary care providers; and inadequate oral health literacy.

Edelstein and others suggested that underlying the reasons individuals seek NTDC pain relief in EDs might be the lack of access to oral healthcare in rural and urban populations (Edelstein, 2010; Guay, 2006; Lewis, Lynch, & Johnston, 2003; Oral Health America, 2003). Davidson and Andersen (1997) described the influence of ethnicity on oral healthcare-seeking behaviors, while others have reported the significance of health literacy on health outcomes in ED patients (Cohen, Bonito, Eicheldinger, Manski, Edwards, et al., 2011; Olives, Patel, Patel, Hottinger, & Moner, 2011). Other researchers have posited that attitudes and beliefs about oral healthcare align most accurately with oral disease and oral healthcare utilization (Riley, Gilbert, & Heft, 2006).

The lack of dental providers and their maldistribution are critical elements of the access to oral healthcare dilemma (Cassamassimo, et al., 2009; Chattopadhyay, 2008; Heaton, Smith, & Raybould, 2004; Oral Health America, 2003; Pew Center for the States, 2011, 2012; Shortridge, 2009, 2010; USDHHS, 2000; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). To date, approximately 15% of the U.S. population, some 46,738,788 adults and children, live in geographic areas declared Dental Health Professional Shortage Areas (DPHSAs) by the USDHHS (2000). Residency in a DHPSA presents unique challenges to achieving and maintaining optimal oral health (Orlans & Grumbach, 2002). The USDHHS designates a county's DPHSA status by calculating the ratio of its population to the number of dentists, along with consideration of other population-specific factors. Each DPHSA is given a score from zero to 26 indicating need (Orlans & Grumbach, 2002). In Washington State, *all* of its 39 counties are designated DSHPAs, with 32 counties having scores of 10 or higher. The highest scores are found in geographically isolated counties which contain large impoverished or Native American populations (USDHHS, n.d.c). Guay (2004, 2006) and others (Chattopadhyay, 2008; Wall, et al., 2012; Wallace & MacEntee, 2012) posited that provider distribution could be affected by population concentration. This investigation defined

population concentration by Rural/Urban Commuting Areas (RUCA) classifications, noting that several classifications might exist within a single county (Hart, Larson, & Lishner, 2005). RUCA classifications are a system of thirty-three codes used to describe U. S. geographic population concentrations (See Figure 2, page 76). Geographic residency in a DPHSA considered to be rural-to-urban or urban might affect an individual's oral health status due to several factors:

- Availability of oral healthcare providers or those willing to accept various remuneration options. (Casamassimo, et al., 2009; Davis, Deinard, & Maïga, 2010; Edelstein, 2010, Orlans & Grumbach, 2002; Pew Center on the States, 2011, 2012; Shortridge & Moore, 2009, 2010; USGAO, 2000, 2010; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012)
- Availability of local oral health "safety nets" or alternative oral health resources or facilities (Casamassimo, et al.,2009; Chattopadhyay, 2008; Edelstein, 2010, Pew Center on the States, 2012; Shortridge & Moore, 2009, 2010; USGAO, 2000, 2010; U.S. Government Accountability Office [U.S.GAO], 2011; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012).
- Availability of adequately fluoridated water supply and sealant programs (Colangelo, 2009; Pew Center on the States, 2011; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012; Vargas & Arevalo, 2009).
- Transportation issues (Cassamassimo, et al., 2009; Shortridge & Moore, 2009; 2010).
- Work loss and child care issues (Casamassimo, et al., 2009; Shortridge & Moore, 2009, 2010).
- Economic status (Casamassimo, et al.,2009; Chattopadhyay, 2008; Orlans & Grumbach, 2002; Pew Center on the States, 2012; Shortridge & Moore, 2009, 2010; USGAO, 2000, 2010; U.S. Senate

Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012).

- Lack of desire for routine and preventive oral care (Chattopadhyay, 2008; Guay, 2004, 2006).
- Language literacy (Cohen, Bonito, Eicheldinger, Manski, & Edwards, 2011; Garcia, Cadoret, & Henshaw, 2008; Wilson, Chen, Grumbach, Wang, & Fernandez, 2005).
- Healthcare system literacy (Garcia, et al., 2008; Olives, et al., 2011; Wilson, et al., 2005).

Notably, the landmark report *Oral Health in America: A Report of the Surgeon General* underscored the need for development of national oral healthcare policies and establishment of a viable national oral health safety-net to remedy existing inequities (USDHHS, 2000).

Historically, responsibility for national oral healthcare policy has been overseen by legislators advised by the medical profession, while it has been delivered primarily by the dental profession, a philosophy whose efficacy and appropriateness is now being questioned (Association of American Medical Colleges, 2008; Cohen, Bonito, Akin, Manski, et al., 2008; Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011; Cohen, Magder, et al., 2003; Cohen, Manski, et al, 2002; Ferullo, Silk, & Savageau, 2011; IOM, 2011; Lewis et al., 2003; Okunseri, Okunseri, Thorpe, et al., 2012; Okunseri, Pajewski, et al., 2011). This strategy has greatly influenced dental insurance plan design and, thus, access to oral healthcare (Guay, 2004, 2006). Since the 1930s, when the dental education pioneer, Dr. William Gies, called for better cooperation between dental and medical sciences and advancement of oral health research, dentistry and medicine have evolved as very separate disciplines (Gutmann, 2009). While dentists and dental hygienists are required to complete extensive coursework--an average of 250 course credits for dentists (University of Washington School of Dentistry, n.d.) and 120 course credits for dental hygienists (ADHA, 2013)--in human anatomy and physiology, pharmacology, emergency medical treatment, pediatrics, treatment of persons with mental and physical disabilities, and gerontology, as well as cultural competency, physicians receive an average of only five hours of oral health

education (ADA, 2013; Association of American Medical Colleges, 2008; Ferullo et al., 2011). Therefore, NTDC patients presenting to EDs are most often treated by healthcare providers who are not trained in dental medicine and procedures, might not be prepared to deal with cultural and English language literacy issues, and are unable to provide optimal treatment outcomes (Cohen, Bonito, Akin, Manski, et al., 2008; Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011; Cohen, Magder, et al., 2003; Cohen, Manski, et al, 2002; Ferullo et al, 2011; Lewis et al., 2003; Okunseri, Okunseri, Chilmaza, et al., 2013; Okunseri, Okunseri, Thorpe, et al., 2012; Okunseri, Pajewski, et al., 2011; Pajewski, 2012; Trivedy, Date, Rocc, Al-Rawl, Jaiganish, Harris, & Anderson, 2011).

Notably, while the federal government, medical and dental scientists and researchers, and philanthropic organizations strive to provide opportunities and strategies for optimal systemic and oral health for all of the U.S. populous, progress in oral healthcare access remains insufficient. Real progress, which positively impacts oral healthcare outcomes, requires rigorous scrutiny into underlying nidi including further clarification of patient characteristics, influences of geographic residence, availability of oral healthcare providers, fiscal resources, and facilities for care (USDHHS, n.d.a; DeVoe, et al., 2003; Heaton, et al., 2004; Pew Center for the States, 2011, 2012, Shortridge & Moore, 2009, 2010; USDHHS, 2000; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012).

Statement of the Problem

The objective of this study was to provide deeper insight into the experiences of NTDC populations by considering the effects of geography on the population demographics, institutional administrative experiences, and clinical experiences of rural-to-urban-commuting (RTU) and urban (URB) NTDC patients in Washington State. The cost of treatment for NTDC patients to EDs nationally had been reported as skyrocketing and ineffective as established above. Local, state, and federal agencies struggle to find cost-effective options while providing quality of care for NTDC treatment. Solutions might vary depending on geographic residency and

availability of fiscal and treatment resources, and varying solutions affect healthcare outcomes. The 1996 Emergency Medical Treatment and Labor Act (EMTALA) specified what treatments were to be provided by emergency departments; it did not specify who should provide those treatments (American Academy of Emergency Medicine, 2013). ED utilization by NTDC patients in Washington State has not been thoroughly assessed because Washington State lacks funding for such research (Reed, 2013). The lack of detailed ED NTDC data in Washington State, a state replete with healthcare and economic paradoxes, demands alternative research methodologies to capture needed data on which evidence-based oral healthcare policy might be formulated. Further study is needed to provide evidence for improved oral health outcomes, innovative solutions to resource disparities, and improved evidence-based policy to address the voids of quantitative variances of NTDC patient ED treatment in Washington State.

Purpose of the Study

The objective of this investigation was to describe the demographic profiles, institutional administrative experiences, and clinical experiences of NTDC patients presenting to EDs located in RTU and URB communities in Washington State over a 12-month time-frame. Another purpose was to compare the demographic profiles, administrative experiences, and clinical experiences of NTDC patients presenting to EDs located in RTU and URB communities to determine differences related to these variables.

Professional Significance

The significance of this study was relevant to numerous professional interests as identified in declarative documents and research agendas of the: American Dental Hygienists Association (ADHA), American Dental Association (ADA), National Institute of Dental and Craniofacial Research (NIDCR), and USDHHS. This research aligned with Section A which supports studies that "are concerned with health maintenance and disease prevention; public policy ... and legislation; and development, validation and testing of instruments, strategies

and mechanisms that demonstrate effectiveness (ADHA, 2007, p. 1). Part six of this section is particularly relevant to this research in that it specifically addresses investigation of "... how environmental factors ...[such as geographic residence] influence oral health behaviors" (ADHA, 2007, p. 1). Parts one and nine of Section B of this document are relevant to this comparative geographic study, as this research investigated variables of ED healthcare quality, diagnosis accuracy, patient safety, and outcomes affecting NTDC diagnosis (ADHA, 2007, p. 1). This research also investigated factors such as Dental Healthcare Provider Shortage Area (DHPSA) scores and geographic residency that might "... predict supply, demand and need for dental hygiene services" (ADHA, 2007, p. 2).

Germane to the ADA Research Agenda (ADA, 2009), this investigation addressed Goal 1, Objective 1-2 by enhancing "... understanding of factors related to access to- and utilization of- dental services... with emphasis on the development and evaluation of innovative methods to: address oral health disparities and improve access to oral health care in the United States" (p.1).

This research also aligned with the vision expressed in the ADA's *State and Community Models for Improving Access to Dental Care for the Underserved--A White Paper* (2004) by citing evidence relevant to the degree to which oral health disparities among underserved populations, including children, exists in the sample population, and concurring with that document's position on the achievement of relevant *Healthy People 2010* oral healthcare goals such as barriers to care and possible improvements to Safety Net Delivery Systems, dental utilization, and outcomes.

Because this study attempted to capture co-morbidity and hospital admissions data of NTDC patients presenting to EDs in two different types of geographic settings, it aligned with the NIH and the NIDCR "trans-NIH initiatives 'Roadmap'" in that this study attempted to gather evidence that might provide links to "...the question of whether oral infections cause or contribute to the development of ...systemic problems" (Tabak, 2004, pp. 196-197).

This study was relevant to three specific documents produced by the USDHHS: *Healthy People 2020* (USDHHS, 2012a), *Oral Health in America: A Report of the Surgeon General* (USDHHS, 2000), and *A National Call to Action to Promote Oral Health* (USDHHS, 2003). In *Healthy People 2020* (USDHHS, 2012a), the oral health goals OH 14, referring to increasing the proportion of adults who receive preventive interventions in dental offices, and OH16, referring to increasing the number of states and the District of Columbia that have oral and craniofacial health surveillance systems, might provide evidence of the need for improvements to preventive interventions and oral and craniofacial surveillance systems in Washington State. This study addressed two major findings of *Oral Health in America: A Report of the Surgeon General*, (USDHHS, 2000) by providing information about how "oral diseases and disorders in and of themselves affect health and well-being..." of citizens of Washington State (*Major Findings*, para. 1) and about the "...profound and consequential oral health disparities within the (Washington State) population" (*Major Findings*, para. 4). In its preface, *A National Call to Action to Promote Oral Health* (USDHHS, 2003) noted that the Surgeon General concluded that "...no one should suffer from oral diseases or conditions that can be effectively prevented and treated" (para. 2) and notes that more information through scientific research is needed to address and end oral health disparities. This study attempted to provide scientific evidence about patients who utilize EDs for non-traumatic dental complaints (NTDC). It is the aspiration of the investigators that evidence from this study be utilized for oral healthcare policy improvements in Washington State. Such evidence might prove consistent with the research objectives of *Healthy People 2020* because this document aimed to provide evidence toward achieving established child and adult oral disease reduction goals. The *Healthy People 2020* national healthcare initiative acknowledges that the severity of oral health disparities positively correlates with rurality of residency, a hypothesis tested in this research, while it also cited rural shortages of dental health providers as a factor in rural oral health disparities, an additional hypothesis investigated in this study.

While *Oral Health in America: A Report of the Surgeon General* described the state of oral health in the U.S. at the beginning of the new millennium, it also described the need for community-based improvements to the oral health safety-net. This study tested the hypothesis of ED utilization, the core of many community oral health safety-nets, for variations based on geographic residency. Consistent with the purpose of this research, the Surgeon General concluded that more information is needed to improve oral health and eliminate health disparities. The professional significance of *A National Call to Action to Promote Oral Health* is that, while recognizing progress made in the state of U.S. oral health according to the 2000 Surgeon General's report, it underscored the need for more progress to be made in understanding and solving disparities in oral healthcare access, including oral health disparities affecting those of the marginalized, the poor, the vulnerable, and the geographically isolated (USDHHS, 2003, p. 9), the focus of this research. It also addressed the oral healthcare challenges of citizens residing in DHPSAs who might receive care from providers not adequately trained to provide needed services.

Research Questions

This retrospective descriptive comparative investigation answer**ed** the following research questions:

1. What are the demographic profiles of rural-to-urban commuting and urban NTDC patients presenting to EDs over a consecutive twelve-month period?
2. What are the institutional administrative experiences of rural-to-urban commuting and urban NTDC patients presenting to EDs over a consecutive twelve-month period?
3. What are clinical experiences of rural-to-urban commuting and urban NTDC patients presenting to EDs over a consecutive twelve-month period?

This research tested the following null hypotheses:

1. There are no statistically significant differences in the demographic profiles of RTU and URB NTDC patients presenting to EDs over a consecutive twelve-month period.

2. There are no statistically significant differences in the institutional administrative experiences of RTU and URB NTDC patients presenting to EDs over a consecutive twelve-month period.
3. There are no statistically significant differences in clinical experiences of RTU and URB NTDC patients presenting to EDs over a consecutive twelve-month period.

Conceptual Definitions

Conceptual definitions were ordered by hypothesis as follows:

Demographic Profiles.

For this study, the demographic profile included patient age, race, ethnicity, and gender as defined below.

Age. Expressed as a discretized range of five years of ≤10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, and >70 at time of ED NTDC visit, based on date of admission and patient's date of birth rounded to the last complete year. If the date of birth was unknown, it was recorded as "00." Acceptable range of age is from the same date of the ED NTDC visit to 120 years. Age exceeding 120 years was recorded as 120 years of age.

Race. A group of people sharing the same culture, history, language, etc., and sharing variable but distinct physical characteristics was expressed as patient self-reported and defined[1] as:

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[1] Racial and ethnicity classifications modified from California Office of Statewide Health Planning & Development (2011).

Asian/Pacific Islander: A person having origins in or who identifies with any of the original oriental peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands. This race designation includes Hawaii, Laos, Vietnam, Cambodia, Hong Kong, Taiwan, China, India, Japan, Korea, the Philippine Islands, and Samoa. Coded for this study as "01."

Black: A person having origins in or who identifies with any of the black racial groups of Africa. Coded for this study as "02."

Native American/Eskimo/Aleut: A person having origins in or who identifies with any of the original peoples of North America, and who maintains cultural identification through tribal affiliation or community recognition. Coded for this study as "03."

White: A person having origins in or who identifies with any of the original Caucasian peoples of Europe, North Africa, or the Middle East. Coded for this study as "04".

Other: Any possible options not covered in the above categories. This designation might include patients who cite more than one race. Coded for this study as "05."

Missing data in the race file was recorded as "00."

Ethnicity. Expressed as patient self-reported and defined[1] as:

Hispanic: A person who identifies with or is of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin. Hispanic origin or descent is not to be confused with race. A person of Hispanic origin may be of any race. Coded for this study as "01."

Non-Hispanic: A person who identifies with a culture or origin other than Hispanic. This category excludes patients who cannot or will not declare their ethnicity. Coded for this study as "02."

Unknown: Includes patients who cannot or will not declare their ethnicity or if the data is missing. Coded for this study as "00."

Gender. Expressed as patient self-reported and defined as female or male. Patient disclosure of specific alternative genderual identities will not be required. Female for this study will be coded as "01." Male for this study will be coded as "02." Alternative genderual identities will be coded as "03.".Missing data will be coded as "00."

Administrative Experiences.

Administrative experiences were comprised of the day of the week on which the NTDC patient presented to the ED, rate of return, and a dichotomous hospital admission status (admitted, not admitted) as a result of presenting to the ED.

Day of the week. Day of the week was associated with de-identified patient number used to identify patterns of ED utilization, particularly in cases of returning patients. Sunday was coded as "01," Monday as "02," Tuesday as "03," Wednesday as "04," Thursday as "05," Friday as "06," and Saturday as "07."

Rate of return of patient. By using de-identified patient identification number, rates of frequency indicating patient return visits to EDs for NTDC were calculated as an actual count of return visits per patient to provide raw data for population averages for both the RTU and URB populations.

Hospital admission. Dichotomous "yes" or "no" responses were used to identify conditions and associated co-morbidities requiring further care in a hospital setting. These data also provided important information about NTDC ED costs by comparing non-admission and admission average costs associated with identified co-morbidities from current literature (Cohen, Magder, et al., 2003; Washington State Hospital Association, 2011).

Clinical Experience.

Clinical experience was comprised of the ICD-9 codes used for diagnosing the NTDC patient presenting to the ED; type of medical provider treating the NTDC patient; co-morbidities of the NTDC patient identified by providers during the ED visit; the treatment and diagnostics provided the NTDC patient during ED visit; and

prescriptions provided the NTDC patient during the ED visit. See Table 1, Common Dental ICD-9 Codes and Descriptions, and Table 2, Co-morbidity ICD-9 Codes and Descriptions.

ICD-9 Codes. ICD-9 Codes are numeric codes based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) developed by the World Health Organization. The International Classification of Diseases (ICD-9) is the authorized mechanism of designating codes to diagnoses and procedures used in hospitals in the U.S.

Table 1

Common Dental ICD-9 Codes and Descriptions

Variable Title	ICD-9 Code	Description
ICD 520	520-521.9	Diseases of hard tissues of the teeth
ICD 522	522-522.9	Diseases of the pulp and hard tissues
ICD 532	523-523.9	Gingival and periodontal diseases
ICD 524	524.60	Temporomandibular joint disorder, unspecified
ICD 525	525.3-528.9	Retained dental root and other unspecified disorders of the teeth and supporting structures
ICD 682	682	Cellulitis and abscess of unspecified sites
ICD 784.2	784.2 & 784.92	Swelling, mass, or lump in head and neck, and jaw pain
ICD 873.63	873.63	Internal structure of mouth, without mention of complication, broken tooth

Provider. A licensed or certified medical personnel title performing treatment coded as: "MD" for physician; "DO" for osteopathic doctor; "PA" for physician assistant; "CNP" for certified nurse practitioner;

"ARPN" for advanced registered nurse practitioner; "RN" for registered nurse; "EMT" for emergency medical technician; and "MT" for medical technician.

Co-morbidity. "Simultaneous presence of two (or more) chronic diseases or conditions in a patient" (Stevenson & Lindberg, 2010, p. 352). For the purpose of this study, Table 2 highlights the ICD-9 codes that were used for comorbidity (CMS.gov., n.d.).

Table 2

Co-morbidity ICD-9 Codes and Descriptions

Variable Title	ICD-9 Code	Description
CoInf	001 - 139	Infectious diseases
CoMMalig	140 - 239	Malignancies
CoMDM	240 - 279	Diabetes mellitus and other metabolic and immunity disorders
CoMent	290 - 388.7	Mental illnesses
CoMCV	390 - 459	Hypertension and cardio-vascular diseases
CoPulm	460 - 519	Pulmonary diseases
CoPrg	630 - 679	Pregnancy

Treatment. "...Care given to a patient for an illness or injury" (Stevenson & Lindberg, 2010, p. 1844). This was coded for this investigation as "00" for data missing, "01" for no treatment given, "02" for treatment given, including diagnostics.

Prescription. "An instruction written by a medical provider that authorizes a patient to be provided a medicine or treatment" (Stevenson & Lindberg, 2010, p. 1381). These were coded as: 1= yes, 2= no, 0= missing.

Emergency department (ED).

The Emergency Department relates to the physical space within a hospital that is staffed and equipped to provide a variety of expedited emergency care, especially for patients experiencing, or who perceive themselves to be experiencing, traumatic injury, rapid onset, or acute illness, and to prioritize patients' severity of need using a triage system.

Rural-to-Urban Commuting (RTU) and Urban (URB).

For this investigation, the terms "RTU commuting" (RTU) and "urban" (URB) used in this investigation were based on the seminal Rural-Urban Commuting Area (RUCA) codes developed by the U.S. Department of Agriculture and the University of Washington's Washington, Wyoming, Alaska, Montana, Idaho (WWAMI) Rural Health Research Center, which are found *within* legislated geographic county boundaries. The RUCA system classifies settlement areas in the United States by qualifying the degree to which locations from core commercial areas to remote sylvan regions are urbanized. Through a system of thirty-three codes, the RUCA utilizes census tract and postal code data rather than legislated geographic county boundaries to more accurately depict population settlement variations (Morrill, Cromartie, & Hart, 1999; WWAMI RUCA, nda, ndb, ndc, ndd). Based on RUCA criteria, this investigation defined "rural", "RTU commuting", and "urban" terms as:

Rural. A complex concept of a geographic region or legally defined bounded area representing unique environmental ethos, and economies traditionally relying on natural resources. For this study, it referred to legislated geographically bounded counties with populations less than 10,000 residents, some small communities, and some isolated rural areas.

RTU commuting area. For this study, RTU commuting area" referred to legislated geographically bounded counties with populations of 10,001 to 120,000 residents, various sized communities, and significant populations of residents that commute to urban areas. Such areas also possess unique environmental ethos containing some characteristics found in both rural and urban areas, and have economies traditionally relying on natural resources, tourism, and light industry

Urban. For this study, "urban" referred to legislated geographically bounded counties or areas which might also be aggregates of geographically defined counties with populations of to 120,001 to 2,000,000 residents, various sized cities, towns, and communities. Such areas also possess unique environmental ethos, dense populations, and economies traditionally relying on multiple industrial, societal, and cultural resources.

Other Conceptual Definitions.

Other conceptual definitions relevant to this investigation were as follows:

Access to oral health care. "The extent to which an individual who needs care and services is able to receive them. Access is more than having insurance coverage or the ability to pay for services. It is also determined by the availability of services, acceptability of services, cultural appropriateness, location, hours of operation, transportation needs, and cost" (Metro Crisis Services, 2010, "Glossary," para. 2).

De-Identified-Patient Identifier. Expressed as an alphanumeric or bar code patient identifier which was modified in a way which is unknown to the researcher and used solely to associate ED patients or returning ED patients with variables such as gender, age, ICD-9 diagnosis, etc. being investigated for the purpose of this research.

DHPSA. Dental Health Professional(s) Shortage Area. A Dental Health Professional(s) Shortage Area is defined as:

An area is so designated if the following three criteria are met: 1) The area is a rational area for the delivery of dental services, 2) One of the following conditions prevails in the area: (a) the area has a population to full-

time-equivalent dentist ratio of at least 5,000:1, or (b) the area has a population to full-time-equivalent dentist ratio of less than 5,000:1 but greater than 4,000:1 and has unusually high needs for dental services or insufficient capacity of existing dental providers, 3) Dental professionals in contiguous areas are over-utilized, excessively distant, or inaccessible to the population of the area under consideration (USDHHS, "Glossary and acronyms," n.d. b., para. 19).

Environmental ethos. For this study, this concept referred to the specific political, racial, socio-economic, historic, and philosophic tenor of a community or geographic region which might influence implementation and design of local healthcare delivery initiatives.

Non-Traumatic Dental Complaint (NTDC). Non-traumatic dental complaint (or condition) is a disease or condition of oral structures not caused by sudden injury but rather as a result of untreated infections or pathologies of the periodontium, dentition, skeletal, or soft oral tissues, or oral neoplasms. When these conditions become acute or intolerable, persons experiencing such conditions might seek emergent relief as defined in the literature review chapter of this investigation.

Summary of Chapter 1

The purpose of this study was to gain knowledge about the status of ED utilization by NTDC patients in RTU and URB settings in Washington State. As current economic trends appear to influence access to routine and consistent preventive oral healthcare, recent evidence indicates that utilization of EDs for the treatment of NTDCs has increased (Garcia et al., 2008; Gibbs et al., 2006; Heaton et al., 2004; Pew Center for the States, 2011, 2012,; Shelley et al., 2011; Shortridge & Moore 2009, 2010; Smedley, 2003; USDHHS, 2000; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). Many have cited the limited efficacy and expense of this strategy, also questioning the appropriateness and cost efficacy of treating NDTC patients in EDs (Heaton et al., 2004; Pew Center for the States, 2011, 2012;

Shortridge & Moore, 2009, 2010; USDHHS, 2000; USGAO, 2000, 2010; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). NTDC patient utilization of EDs is a complex problem that defies a simple solution. The next chapter will examine in detail different elements of this issue in the context of what is currently known about rural and urban ED utilization by NTDC patients.

Chapter 2 Review of the Literature

Chapter Two explored current literature to gain an understanding of precipitating factors of NTDC patient utilization. It also explored variances in rural-to-urban commuting (RTU) and urban (URB) populations in Washington State which might affect ED utilization by NTDC patients. ED utilization by NTDC patients has been questioned in the literature because it has been established that this phenomenon is expensive and does not result in optimal patient outcomes. Current literature does not, however, discern whether or not, among NTDC populations seeking ED care, there are significant differences in RTU and URB demographics, presenting diagnoses, co-morbidities, treatment providers, days of the week care is sought, rates of return-visit frequency, or rates of hospital admission. Furthermore, due to economic constraints, Washington State currently lacks sufficient funds to collect these data, nor are these data currently collected by any other known sources (Reed, 2013). Current literature does not identify the existence of significant differences within RTU and URB NTDC patient populations themselves. Exploration of these sub-categorized populations and related variables might provide further insight to improving health outcomes of NTDC patients, rural or urban, in Washington State.

For this research, a MeSH search was conducted using the following terms: access to care, advanced dental therapist, dental, dental conditions, dental disease, dental hygienist, dental utilization, dental workforce, dentist, emergency department, emergency service, oral healthcare history, oral healthcare utilization, RUCA, rural, urban, teledentistry, and telemedicine. Literature was accessed using the CINAHL, Cochrane Library, CDC, EBSCOhost, MD Consult, MedlinePlus, PubMed, ProQuest, and Web of Science databases.

Growing ED utilization for non-urgent care and shrinking budgets and reimbursing sources for EDs have precipitated increased interest into causal factors of the phenomenon of increasing NTDC ED usage. Though representing only a small percentage of total ED costs, ED use by NTDC patients also is regarded as an inappropriate and ineffective treatment option (American Hospital Association; 2004; CDC, 2011; Cohen, Bonito, Eicheldinger, et al., 20011; Pew Center on the States, 2011, 2012; Washington State Medical

Association, 2011; USGAO , 2000; 2010; USDHHS, 2000; 2010a). Current literature was reviewed as evidence of an historic context of oral healthcare delivery, access to oral healthcare, the magnitude of ED usage by NTDC patients, geographic impact on access to oral healthcare delivery, and possible future oral health outcomes.

Historic Perspective of United States Oral Healthcare Delivery

Historically, the U.S. oral healthcare delivery system is based on the Private Practice Model and has been a "fee-for-service" system with treatment provided by private dental practitioners (Ahmed, McCunniff, Liu, Cai, & Hoff, 2011; Anderson, 2007; Guay, 2006; Hong, 2011; IOM, 2011a, 2012; Uswak & Keller-Kurysh, 2012; Wallace & MacEntee, 2012; Wendling, 2010). Of the 181,725 licensed dentists in the U.S. in 2007, 166,837, a significant 92%, were engaged in private practice settings (Wendling, 2010). The economic principles in such a system promote entrepreneurial competition among dentists. While private practice encourages patient freedom of dental provider selection, it fails to ensure that those without fiscal resources or dental insurance have access to care. In this dominant U.S. system of oral healthcare delivery, dentists must counterpoise fiscal solvency with meeting the unfulfilled oral health needs of local constituents (Wendling, 2010). To maintain fiscal solvency, the average private dentist must maintain a ratio of about one dentist per 2,000 persons (Nash, 2011; Wendling, 2010). This ratio will vary based on dental practice geographic location and area economic stability and affluence (IOM, 2011a, 2011b). Eight percent of all U.S. counties have no practicing dentists, while large metropolitan areas experience the greatest concentration of dentists (Nash, 2011). For many younger dentists, fiscal solvency is affected by large personal education debt and the cost of establishing their own facility, which must be reflected in the fees for their services. Such fees are beyond the financial means of many vulnerable populations and subsequently limit access to care (DeVoe et al., 2003; Guay, 2004, 2006; IOM, 2011a, 2011b; Uswak et al., 2012, Weber, Showstack, Hunt, Colby, & Callaham, 2005; Wendling, 2010). Anderson (2007) noted that such a care delivery system potentially over-treats some of

the population while under-treating others, and fails to improve overall oral health outcomes. Among other factors, concentration of competing private practice dentists results in geographic maldistribution and is one of the rationales for the development of the Dental Health Professional Shortage Area Program (DHPSAP) by the USDHHS (Center for Rural Pennsylvania, 2004).

Geographic maldistribution of dentists is the primary rationale for the development of the DHPSAP. DHPSAs are a subset of HPSA designations by the USDHHS Health Resources and Services Administration, which administers federal funding of state-administered medical and dental programs. DHPSA designation can occur in densely or sparsely populated areas (IOM, 2011b, USDHHS, 2012b). Only dentists holding Doctors of Dental Surgery or Doctors of Dental Medicine degrees who practice general or pediatric dentistry and not a dental specialty are included when designating an area a DHPSA (USDHHS, 2012b). DHPSA and HPSA designations are used to qualify areas, population groups, and institutions for benefits and incentives such as:

- Centers for Medicare and Medicaid Services (CMS) Provider Incentive Payments
- National Health Service Corps Programs
- Certified Rural Health Clinic Program
- Federally Qualified Health Center Program
- Federally Qualified Health Center Look-A-Like Program.
- Oral Health Training Programs (including "Training in General, Pediatric, Public Health Dentistry and Dental Hygiene; State Oral Health Workforce Improvement programs; and Alternative Dental Healthcare Provider Demonstration Project Program" (USDHHS, 2012b, p. 6).

These programs are intended to ameliorate healthcare maldistributions and enhance recruitment and retention.

Bauman (1996) reported that more than 150 million people in the U.S. lack any dental insurance. Current data indicate some progress in that, fifteen years since that report, approximately 108 million people currently lack any dental insurance (Health Resources and Services Administration, 2011). The Delta Dental

Plans Association (n.d.) reported that dental care is the most frequently reported individual healthcare service *not* utilized due to cost. Meeting the needs of the poor, uninsured, and the under-insured becomes an issue in a fee-for-service system necessitating that any solution must meet the needs of those that the present system does not serve. Investigation and development of alternative, cost effective, quality oral healthcare delivery models, and equitable financial support systems for such models, has been suggested (Edelstein, 2010; IOM, 2011b; Milgrom & Reidy, 1998; Pew Center for the States, 2012; Shortridge et al., 2009, 2010; U.S.GAO, 2011; USGAO, 2000, 2010; USDHHS, n.d., 2000, 2010a).

Dental benefit plans providing payment or partial payment for oral healthcare services spread throughout the U.S. in the 1960s, coinciding with the federal government's initiation of the Medicaid program which subsidized dental care for children (Bauman, 1996; Guay, 2006). These plans have developed over time as a work-related benefit for employment (Anderson, 2007). Financing oral healthcare through private insurers and federal programs has not directly correlated with increased oral healthcare services utilization or improved access to oral healthcare (Colangelo, 2009; Wendling, 2010). Significantly, however, Guay (2004, 2006) noted that modeling any insurance benefit plan, private, state, or federal, after medical benefits plan designs is intrinsically flawed due to fundamental differences in the nature of medical and dental diseases. The differences in medical and dental diseases and predicted sequelae, in turn, might affect benefit utilization and access to care. Having, not having, and changes in dental insurance benefits has been demonstrated as a factor affecting NTDC patient care-seeking behaviors (Davidson & Andersen, 1997; CDC, 2011; Guay, 2006; IOM, 2011a; Shortridge & Moore., 2009, 2010; Weber et al., 2005; Wendling, 2010).

Most recently, the 2010 Patient Protection and Affordable Healthcare Act (PPACA) enacted sweeping healthcare delivery reform (Sparer, 2011). The bill strives to provide comprehensive healthcare coverage while (a) reducing healthcare costs, (b) expanding Medicaid benefits to all low-income citizens, (c) facilitating state-created low-cost insurance for self-employed and small businesses, and (d) fining specified employers for

failing to offer employees healthcare insurance. The PPACA includes (a) expanded children's dental coverage, (b) scholarship incentives for the dental workforce and support for expanded mid-level oral health provider discussions, and (c) interdisciplinary integration of all healthcare systems to establish healthcare homes for each citizen (Sparer, 2011). Enactment of the PPACA will shift the financial burden of NTDC ED visits from hospitals to insurance companies as more of the populous will at least have some ED treatment coverage (USDHHS, 2012c, 2012d). The PPACA is predicted to actually increase NTDC ED utilization by newly insured populations (U.S.GAO, 2011). Notably, the PPACA falls short of providing routine or preventive adult oral healthcare benefits that might reduce the number of NTDC ED visits (USDHHS, 2012c, 2012d). U.S. House of Representatives and Senate hearings prior to the passage of the PPACA incorporated only negligible consideration of the rural impact of specific provision compliance that this law would cause. No provisions were made to ameliorate or offset the additional fiscal strains to rural facilities caused by PPACA compliance (Semansky, Willging, Ley, & Rylko-Bauer, 2012). Le Juene (2013) noted that, while not providing for adult oral healthcare benefits, the PPACA requires all insurance plans to provide for "preventive and wellness services and chronic disease management" (p. 34). As stated previously, many oral diseases are considered "preventable" with routine and regular care. In light of such recent economic and political events, equitable access to oral healthcare, specifically routine and preventive services for oral diseases, remains a labyrinth of geographic, social, workforce, and care delivery issues, cultural, linguistic, financial, political, and legal factors which merit further investigation (Dolan et al., 2005; Kalish, 2012; Le Juene, 2013; Patrick, Lee, Nucci, Grembowski, Jolles, & Milgrom, 2005).

Disparities in Oral Healthcare Access in the United States

The NIH defined "disparities" as the "differences in the incidence, prevalence, mortality, and burden of diseases and other adverse conditions that exist among specific population groups in the United States" (National Information Center on Health Services Research and Health Care Technology [NICHSR], n.d., para.

1). Others described disparities in access to oral healthcare in the U.S. as complex and dynamic interactions of events, including not only the ability to procure oral healthcare services but also the coordinated and balanced existence of: (1) demand for oral healthcare, (2) an adequate work force capable of delivering that care, and (3) an economic environment supportive of both provider and patient engagement in oral healthcare programs (Dolan et al., 2005; Guay, 2004; Patrick et al., 2005; Robinson, 2009; Wallace & MacEntee, 2012). Oral healthcare disparities exist among minority and marginalized populations, the poor, the very young, very old, women, and those marginalized by race or ethnicity, education, income, disability, genderual orientation, and geographic residence (Atchinson et al., 2003; Bhagavatula, Xaing, Szabo, Eichmiller, Kuty, & Okunseri, 2012; CDC, 2011; Chattopadhyay, 2008; Cintron et al., 2006; Cohen, Bonito, Akin, Manski, et al., 2008; Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011; Cohen, Magder, et al., 2003; Cohen, Manski, et al., 2002; Davis et al., 2010; Dolan, et al., 2005, Edelstein, 2010; Galen & Vlahow, 2005; García et al., 2008; Gibbs, Flaer, Younis, & Al-Hajeri, 2010; Hall et al., 2006; Hart et al., 2005; Heaton et al., 2004; IOM, 2011a, 2011b; Lashley, 2008; Milgrom, 1998; Nsiah-Jefferson, McHugh, Trivedi, & Paltrow-Smith, 2006; Okunseri, Okunseri, Chilmaza, 2013; Okunseri, Okunseri, Thorpe, et al., 2012; Okunseri, Pajewski, 2011; Oral Health America, 2003; Patrick, et al., 2006; Pew Center for the States, 2011, 2012; Rawlison & Crews, 2010; Reschovsky & Staiti, 2005; Reidy, Kiet, Ybarra, & Milgrom, 2007; SangNam, Burdine, Smith, Ory, & Phillips, 2011; Shelley, Russell, Parikh, & Fahs, 2011; Shortridge & Moore, 2009, 2010; Smedley et al., 2010; USDHHS, 2000; 2003, 2010a, 2010b; USGAO, 2000; 2010).

Others have noted that minority and marginalized populations experience the preponderance of oral diseases (Atchinson et al., 2003, Bhagavatula, 2012; CDC, 2011; Cintron et al., 2006; Cohen, Bonito, Akin, Manski, et al., 2008, Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011, Cohen, Magder, et al., 2003; Cohen, Manski, et al., 2002; Davis et al., 2010; Dolan, et al., 2005, Edelstein, 2010; Flaer, Younis, & Al-Hajeri, 2010; Galen & Vlahow, 2005; García et al., 2008; Gibbs et al., 2006; Gibbs.Lashley, 2008; Hall et al., 2005;

Heaton et al., 2004; IOM, 2011a, 2011b; Nsiah-Jefferson, McHugh, Trivedi, & Paltrow-Smith, 2006; Okunseri, Okunseri, Chilmaza, 2013; Okunseri, Okunseri, Thorpe, et al., 2012; Okunseri, Pajewski, 2011; Oral Health America, 2003; Patrick, et al., 2006; Pew Center for the States, 2011, 2012; Rawlison & Crews, 2010; Reidy, et al., 2007; Reschovsky & Staiti, 2005; Sang Nam et al., 2011; Shelley et al., 2011; Shortridge & Moore, 2009, 2010; Smedley et al., 2010; USDHHS, USDHHS 2000, 2003, 2010a, 2010b; USGAO, 2000, 2010; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). Quantifying this population's noted lack of demand for oral healthcare is a function of behavior theory and perceptions based in part on oral health literacy, particularly when seeking ED care, although these findings are not supported by all (Olives et al., 2011; Cohen, Bonito, Eicheldinger, Manski, Edwards, et al., 2011). Disease morbidity and mortality are affected a priori by an individual's healthcare behaviors (Atchinson & Dubin, 2003; Riley, et al., 2006).

Ironically, a lack of access to oral healthcare does not directly translate to an increased demand for oral healthcare (Guay, 2004; Ma, Lindsell, Jauch, & Pancioli, 2004; Milgrom & Reidy, 1998; Reschovsky et al., 2005, Wendling, 2010). Riley et al. (2006) found that positive or negative beliefs about oral health correlated with care-seeking decision behaviors to seek care, or in other cases, to avoid seeking care. The IOM (2011b) stated that the lack of oral health care services utilization by those who have dental healthcare benefits was largely due to a lack of oral health literacy and a lack of awareness of need for oral healthcare services.

Flaer et al. (2010) stated that the benefits of preventive private practice dentistry are not generally provided to society's impecunious, who are then relegated to seek emergent pain-relief care. Further, Flaer posited that the Health Belief Model provided the best theoretical explanation of NTDC patient care-seeking behaviors. Cintron et al. (2006) reported that race and ethnicity contribute to unequal pain relief treatment, including relief of pain caused by cancer, for those seeking treatment in emergency departments and other medical and dental care settings. Care-seeking behavior is common in NTDC patients when pain becomes

intolerable (Anderson et al., 2003; Edelstein, 2010). Emergency dental pain care-seeking behavior in emergency departments for acute dental pain is referred to in current literature as "non-traumatic dental complaint" (NTDC) or "non-traumatic dental condition" (Anderson, Cherala, et al., 2010; Cohen, Bonito, Akin, Manski, et al., 20008; Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011; Cohen, Manski, et al., 2002; Okunseri, Okunseri, Chilmaza, et al., 2013; Okunseri, Okunseri, Thorpe, et al,. 2012; Okunseri, Pajewski, et al., 2011). Flaer et al. (2010) found that lower education levels in poor minority and marginalized populations correlated with decreased belief in oral disease severity and vulnerability, which impeded proactive care-seeking behaviors. Most recently, Halvari, Halvari, Bjørnebekk, and Deci (2012) applied the Self-Determination Theory to explore oral healthcare-seeking behaviors and found that a person's autonomous motivation and integrated external motivation were most significant in determining behaviors supporting optimal oral health while "amotivation" (p. 4) resulted when individuals believed that their care-seeking behavior was ineffective. An illustration of ineffectiveness could be the inability to afford preventive or routine oral healthcare or procure a care provider willing to treat them until their condition is emergent.

Several studies have documented the implications of linguistic barriers on healthcare outcomes. The linguistic barrier of limited English proficiency (LEP) is defined by the federal government as the condition of "[i]ndividuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English..." (LEP.gov, n.d., para 3). In 2011, there were more than 25.3 million LEP persons in the U. S. (Britz & Batalova, 2013). Of these, 65% (16.4 million) were Spanish-speaking and 6% (1.6 million) were Chinese-speaking, including Mandarin and Cantonese. Woloshin et al. (1995, in Smedley et al., 2003) reported that linguistic miscommunication between patients and providers resulted in patient non-compliance, limited ability to make informed treatment choices, misdiagnoses, and unnecessary testing, factors contributing to healthcare costs. Patrick et al. (2006) stated that low-income persons, racial minorities, and the disabled have more ED visits than other populations. A priori, some minorities would experience LEP. Nianar and Tinanoff

(1997 in Patrick et al., 2006) reported that Hispanics cited language as a barrier to communication with healthcare providers and that those who primarily spoke English at home were more likely to use dental services.

From their 2005 telephone survey of 1,200 Californians conducted in eleven languages, Wilson, et al. (2005) found that LEP contributed to the risk of adverse medication reactions due to a linguistic inability to understand the medication label, their medical condition, and lack of understanding about how to take the medications. Washington State ranked ninth of the top ten U.S. states with large LEP-persons population and ninth among states whose LEP populations are most rapidly increasing (Migration Policy Institute, National Center on Immigration Integration, 2011) (see Migration Map, Figure 2, p. 119). Smedley et al. (2003) evidenced the probability that a NTDC patient presenting to an ED would be of a minority, increasing a priori the likelihood that the NTDC patient also was experiencing LEP depending upon the geographic location of the ED. One-fifth of Spanish-speaking Hispanics reported delaying healthcare due to linguistic barriers (Robert Wood Johnson Foundation, 2001 in Smedley et al., 2003). Hispanics are the largest minority population residing in Washington State (Britz & Batalova, 2013), and those who speak only Spanish comprise almost 3% of its population (Statistics Brain, 2012). Further, Olives, Patel, Patel, Hottinger, and Miner (2009) found that inadequate health literacy was strongly associated with participants whose primary language was other than English, while Wilson et al. (2005) concluded that LEP might cause compromised healthcare due to the effects of impaired linguistic communication.

Finding appropriate oral healthcare providers when NTDC ED patients do seek oral healthcare is a major barrier facing NTDC patients. Conversely, dentists are frustrated by low public program reimbursement rates and cumbersome administrative burdens (Guay, 2006, Riley, 2005). Wallace (2012) quoted one dentist who declared "*dentistry has to run as a business first and healthcare second...it's not a benevolent healthcare service*" (p.35). The paucity of dentists willing to treat the underserved is a national crisis which is predicted to

worsen in the future (Edelstein, 2010; Patrick et al., 2005; Pew Center for the States, 2011, 2012; Shelley et al., 2011; Shortridge & Moore, 2010; USGAO, 2000; USDHHS, 2000, 2010a, 2010c, 2011, 2012a, 2012b, 2012c, 2012d; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). Others have noted the following reasons for dental provider non-availability: the geographic maldistribution of dentists (Edelstein, 2010; Robinson, 2009), scarcity of dentists willing to treat patients participating in state and federal programs (USGAO, 2000, 2010); fiscally unviable low reimbursement levels to dentists by Medicaid, SCHIPs, and state programs (Guay, 2004, 2006; Wendling, 2010); complex and cumbersome administrative burdens; practice disruption due to patient non-attendance for scheduled appointments (Guay, 2004, 2006; Wendling, 2010); lack of provider comfort treating very young, aged, and special needs populations (Fulda, Johnson, Hahn, & Lyken, 2013); lack of dental provider cultural competence and ethnic diversity; and lack of dentists willing to serve in rural locations or in urban locations considered undesirable (Chattopadhyay, 2008; Cohen, Bonito, Akin, Manski, Macek, et al., 2008; Cohen, Bonito, Eicheldinger, Manski, Macek, et al., 2011; Davis et al., 2010; Dolan et al., 2005; Edelstein, 2010; Hong et al., 2011; Lewis et al., 2003; Nagarkar et al., 2012; Pajewski et al., 2012; Patrick et al., 2005; Riedy et al., 2007; Reschovsky et al, 2005; Shelley, et al., 2011; USGAO, 2000, 2010; Uswak & Keller-Kurysh, 2012). If NTDC patients do successfully find an appropriate ED provider, some evidence indicates that they will not receive equal administrative treatment by other staff in EDs.

Okunseri, Okunseri, Chilmaza, et. al. (2012) analyzed data from the National Hospital Ambulatory Medical Care Survey for 1997 through 2007, excluding 2001 and 2002, and found that elderly, Hispanic, and black NTDC patients experienced longer ED waiting times than younger and white NTDC ED patients. Using multivariate analysis, race and ethnicity were found to be reliable predictors of increased waiting times. This study also noted a trend of increasing waiting times for these populations over time included in the National

Hospital Ambulatory Medical Care Survey (NHAMCS), which also positively correlated with increased ED crowding.

The increased waiting times for these groups might be associated with disproportionate economic challenges to oral healthcare access among minorities resulting from the continuing current fiscal recession in the U.S. Freeman (2011) noted disproportionate unemployment rates experienced by blacks and Hispanics in the United States for the last forty years, a significant contributor to this population's economic challenges.

The unemployment rate of 7.9% does not adequately express the fiscal struggle of 12,088,000 or the U.S. populous (U.S. Department of Labor, 2012). Americans who have lost their jobs have also lost or are at risk of losing private medical and dental insurance benefits (U.S. Department of Labor, 2012). Despite numerous legislative attempts to improve healthcare access, nearly 43 million lack any healthcare insurance, one of several determinants to access to healthcare (Devoe, et al., 2003; Dolan et al., 2005, Fuentes-Afflick, & Hessol, 2009; Lui, 2007; Liu, Probst, Martin, Wang, & Salinas, 2007; Patel, Miner, & Miner, 2012). Furthermore, in today's economic climate, fewer employers offer healthcare insurance benefits (Schiller, Lucas, Ward, & Peregoy, 2010). Schiller, Lucas, Ward, and Peregoy (2010) reported that from 2000 to 2010, employers' healthcare benefits, including dental coverage, have fallen from 69% to 59% leaving many working poor ineligible for assistance programs and paying for dental services out of pocket. Many marginally employed persons find co-payments for routine and consistent preventive dental care beyond reach and are forced to delay treatment of dental symptoms.

Since the 1930s, the U.S. federal government has enacted several laws intended to provide a healthcare "safety net" (Colangelo, 2009; Edelstein, 2010). The federal Medicare program provides physician visits, hospitalization, and prescription drug benefits to persons over 65 years of age. The Medicaid/Children's Health Insurance Program (CHIP), administered by individual states, provides medical and limited oral health benefits for children under age six with family incomes up to 133% of the federal poverty level (FPL), children ages 6-

19 with family incomes up to 100% of the FPL, and pregnant women with family incomes up to 133% of the FPL (USDHHS, 2012b). Strained individual state budgets might limit healthcare benefits that provide limited medical care benefits (State of Washington, 2012).

Efforts have been initiated to assist those in need, especially children, to procure a dental home (American Academy of Pediatric Dentistry [AAPD], 2010; Association of State and Territorial Dental Directors [ASTDD], 2011; Oral Health America, 2003; USDHHS, 2010b; USGAO, 2010). A dental home, which many citizens currently lack (AAPD, 2010; Oral Health America, 2003; USGAO, 2010), establishes a consistent source of routine and preventive care through an ongoing relationship between the patient, parents of young patients, and a dental provider. A dental home is modeled similarly to a "medical home" to provide a "...cost-effective and a better alternative to emergency dental care" and to reduce the risk of preventable dental disease (Kisby, 2011, p. 32). However, establishing a dental home might be more difficult due to variable state-to-state economic climates.

Budget strains have precipitated the enactment of controversial legislation which can challenge securing a dental home. For example, in 2011, Washington State enacted legislation which limits Medicaid patients to only three reimbursed ED visits, requiring EDs to comply with a "Best Practices for Reducing Preventable Emergency Room Visits by Medicaid Clients" policy (Washington State Medical Association, 2012). The policy was developed as a contested compromise between the state and the Washington State chapter of the American College of Emergency Physicians, Seattle Children's Hospital, Washington State Medical Association, and the Washington State Hospital Association (Washington State Medical Association, 2012).

The U.S. Patient Protection and Affordable Healthcare Act (PPACA) enacted by the U. S. Congress in 2010 seeks to improve public access to healthcare (Sparer, 2011, USDHHS, 2012a, 2012b). Under this law, the USDHHS has attempted to bridge the healthcare abyss, including the void in oral healthcare benefits, by providing programs which, in addition to medical care benefits, support oral health promotion/disease

prevention, expand and augment the oral health workforce, and attempt to relieve oral health disparities by allowing young adults to remain on their parents' insurance policies up to their twenty-sixth birthday. However, it does not contain provisions for adult oral healthcare. Federal, state, and private oral healthcare benefits for nonelderly adults in need are minimal or non-existent (USDHHS, 2012a, 2012b; Wall et al., 2012). Furthermore, the PPACA brings into question the role of dental care delivery and the role of a constellation of healthcare providers as new benefits are provided. While not delineating specifics, the PPACA does support comprehensive and integrated care delivery (Sparer, 2011).

In 1986, the federal government passed the Emergency Medical Treatment and Active Labor Act, (EMTALA), an "anti-dumping" statute which legislates when and how a patient must be evaluated and offered treatment or transferred from one hospital to another facility when experiencing an unstable medical condition, regardless of ability to pay or insurance coverage (American Medical Association, 2003). Although violation of this law carries heavy fines, it does not address quality or appropriateness of care, especially for NTDC patients (Anderson et al., 2003; Cohen, Bonito, Akin, Manski, Macek, et al., 2008; Cohen, Bonito, Eicheldinger, Maski, Macek, Edwards, et al., 2011; Cohen, Magder, et al., 2003; Cohen, Manski, et al., 2002; Lewis, et al., 2003).

Scope of Emergency Department NTDC Utilization

The use of ED utilization for NTDC could be an indicator of the current oral health care delivery system's functional efficacy in that it indicates who does and who does not have access to usual non-emergent care (Chattopadhyay, 2008). As noted previously, Patrick et al. (2006) stated that low-income, racial minorities, and the disabled have more ED visits than other populations, and other researchers have found that NTDC patients seek ED care when they perceive that their signs and symptoms are: (1) intolerable, (2) disruptive of other aspects of their lives such as the ability to sleep, work, eat or drink, or (3) lacking other recourse including unsuccessful previous attempts to receive non-emergent care (Anderson et al., 2003; Atchinson et al., 2003; Cintron, et al., 2006; Flaer et al., 2010; Marco, Nagel, Kink, & Baehren, 2012; Riley et al., 2006). Reviewing

current ED utilization levels, key findings from the U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging (2012) included:

- About 17 million low-income children received no dental care in 2009.
- One-fourth of adults in the U.S. ages 65 and older have lost all of their teeth.
- Low-income adults are almost twice as likely as higher-income adults to have gone without a dental check-up in the previous year.
- Bad dental health impacts over-all health and increases the risk for diabetes (and) heart disease.
- Almost 60% of children ages five to seventeen have caries, making tooth decay five times more common than asthma among children of this age (p. 1).

These findings correlate with Geographic Intelligent System (GIS) software and other data correlating Black race, Hispanic ethnicity, other racial minority membership, concentrations of age extremes, and poverty status concomitantly occurring with areas of higher ED utilization (Chattopadhyay, 2008; Dolan, et al., 2005; Davidson et al., 1997; Gindi, et al., 2012; IOM, 2011a, 2011b; Okunseri, Okunseri, Thorpe, et al., 2012). These population subgroups are often concentrated in various geographical locations which affect their ability to access oral healthcare services (Chattopadhyay, 2008). Rural to urban geographic residency was considered as an influencing contextual factor of oral health disparities by Ahn, Burdine, Smith, Ory, and Phillips (2011), who found that rural residents had more tooth loss and were less likely to report dental treatments than their urban counterparts. These investigators referred to other studies which reported other contextual issues of utilization of dental care services, geographic distances to these services and distribution of dental providers as a function of geographic residency.

To date, approximately 15% of the U.S. population, some 46,738,788 adults and children, live in geographic areas declared Dental Health Provider Service Area (DHPSA) by the US Department of Health and Human Services (USDHHS, n.d.b). Of the United States population of 314,707,018, more than 47,500,000

received Medicare insurance benefits in 2010 (National Committee to Preserve Social Security and Medicare, 2012; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). For persons of color, the poor, underserved, disenfranchised, elderly, institutionalized, and mentally impaired, healthcare disparities are more severe and benefits are sparse, shrinking, or non-existent (Dolan et al., 2005; Smedley, 2003). In 2009, in excess of 16 million children lacked access to regular and preventive dental care (Pew Center on the States, 2011). Although programs offering dental benefits for children have improved, Edelstein (2010) described a great disparity in the "safety net" of dental facilities, providers, and payment programs for the socially vulnerable low-income population and the capacity for care delivery from private practice dentistry" (p. 1). As an example of the paucity of dental providers willing to accept this population into private practices, Edelstein (2010) noted only a paltry increase in Medicaid dental provider enrollment after several states significantly increased payment and administration reform. The Pew Center on the States (2011, 2012) found that: (1) 14% of U. S. children, one in seven, suffered severe toothache pain; (2) dental pain resulted in missed days of school; (3) 52% of young new military recruits needed urgent dental care before they were ready for service abroad; and (4) severe dental problems continue to adulthood and impair employability.

The Dental Safety Net

While the IOM (2000) noted urgent need to implement five core recommendations to heal untenable geographic differences in state and local healthcare "safety nets," Edelstein (2010) called the "dental safety net" "...a hodgepodge of local, state, and federal programs and policies that seek to address the needs of vulnerable populations" (p. 536). By default, the nation's hospital EDs have become a "safety net" for the uninsured seeking relief from dental pain (Edelstein, 2010). A growing body of evidence has emerged questioning the appropriateness and efficacy of seeking dental care from EDs (Cohen, Bonito, Akin, Manski, et al., 2008; Cohen, Bonito, Eicheldinger, Maski, Macek, Edwards, et al., 2011; Cohen, Magder, et al., 2003; Cohen,

Manski, Magder, et al., 2002; Colangelo, 2009; Edelstein, 2010; Guay, 2004; Lewis, 2003; Nagarkar et al., 2012; Okunseri, Okunseri, Thorpe, et. al., 2012; Okunseri, Pajewski, et al., 2011; Shortridge & Moore, 2009; Vargas & Arevalo, 2009, Wall et al., 2012). A medical, dental, or any healthcare "safety net" is defined as a system which provides care when other resources are lacking. Edelstein's (2010) dental safety net definition encompassed "... facilities, providers, and payment programs that support dental care for underserved populations..." (p. S32). Edelstein listed "...health centers, dental schools, clinics, Medicaid-oriented dental practices, free-care programs, hospital emergency rooms, and others..." (p. S32) as locations for "...dental safety-net care" noting that these institutions vary in "...availability, comprehensiveness, continuity, and quality" (p. S33). The IOM defined the oral healthcare safety net as "...a group of unrelated entities that both individually and collectively have very little capacity" and noted that the entities are only a short-term solution for a limited population segment, and fail as a reliable or consistent resource for those most in need (p. 84). The National Maternal and Child Oral Health Resource Center (NMCOHRC) defined the oral healthcare safety net simply as

> "...where people go: 1) when they don't have a regular dentist, 2) because they know their Medicaid card will be accepted, 3) because they won't be turned away when they are in pain and can't afford care, and 4) because the clinic is close to home and linked to their other health care providers" (NMCOHRC, 2011, para. 4).

However, in isolated rural areas the fourth statement is not always true in that rural patients experience access to fewer providers and often have to travel greater distances to access providers (Hart, et al., 2005; Reschovsky & Staiti, 2005).

Using EDs as the mainstay of dental safety nets raises several concerns. Wall et al. (2012) noted significantly higher Medicaid eligibility for adults than for children in many states and described the dental safety net as "failing" for adults (p. 1026). The cost of using EDs as dental safety-nets is prohibitive (Cohen,

Bonito, Akin, Manski, et al., 2008; Pew Center on the States, 2011, 2012; USGAO, 2000, 2011; USDHHS, 2000; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging 2012). As previously stated, in Washington State alone, ED treatment of NTDC between January, 2008 and June, 2009 totaled $36.3 million (Washington State Hospital Association, 2011).

Asplin (2001) reviewed the 2000 IOM report *America's Health Care Safety Net: Intact but Endangered* noting that the ED safety net lacks integration of services and reflects the voids in the healthcare system, specifically, the lack of any follow-up care. The lack of integration in the healthcare safety net is particularly relevant for NTDC patients who do not receive definitive care in EDs and who lack an identifiable dental home. Without an identified dental home, the "uninsured, Medicaid, and other vulnerable patients," marginalized and impecunious populations must seek oral pain relief from the existing healthcare safety-net (NMCOHRC, 2011, para 5). Though DeVoe et al. (2003) stated that a "...consistent source of care...has been associated with lower use of the emergency department..." (p. 786), in a national study of 49,603 adults Weber et al. (2005) found that ED use was more prevalent among individuals who had identified a usual source of medical care. Ideally, the dental safety net system would serve only as an occasional alternative to care provided by usual sources of oral care. The concept that all citizens have a "dental home" which provides consistent, cost-effective preventive care and optimizes oral health outcomes is supported by the IOM (2011a). Unfortunately, research indicates that the reality is very different. Sheller, Williams and Lombardi's 1997 Washington State study, conducted at a metropolitan children's hospital, found that ED care was the first dental treatment for one in four children three and one-half years of age or younger, with many of these patients requiring multiple extractions and the use of papoose board restraint.

Other recent studies have examined risks associated with use of EDs as primary entry points for treatment of oral pain. Pourat and Nicholson (2009) reported that, in 2007, more than 500,000 California children missed at least one day of school due to a toothache or other dental symptoms. Other health and quality

of life risks associated with delay of oral health care include missed work and school attendance (Davis et al., 2010) and increased incidence of domestic abuse (Smedley, 2003). Other diseases associated with serious health consequences without early detection and treatment include delayed detection of oral cancers, Human Immunodeficiency Virus (HIV), sexually transmitted diseases (STDs), dental abscesses, domestic and child abuse, and exacerbation of diseases including diabetes and death (Flaer, et al., 2010; Rahin-Williams et al., 2009). Others researchers identified varicella, influenza, hypertension, kidney disease, depression, alcoholism, and hospitalization as serious diseases or conditions with early oral manifestations (Cohen, Bonitio, Akin, Manski, et al., 2008; Cohen, Magder, et al., 2003; Cohen, Manski, et al., 2002; Davis et al., 2010; Dolan et al., 2005; Edelstein, 2010; Hong et al., 2011; Lewis et al., 2003; Nagarkar, et al., 2012; Pajewski et al., 2012; Reschovsky et al., 2005; Shortridge & Moore, 2010; Smedley, 2003; Vargas et al., 2009).

Researchers have identified several serious concerns related to using EDs as primary care facilities. Emergency dental care in EDs is expensive (Davis et al., 2010; Cohen. Bonito, Akin, Manski, et al., 2008, Cohen, Bonito, Eicheldinger, Manski, Macek et al., 2011; Cohen, Magder, et al., 2003; Cohen, Manski, et al., 2002; Pajewski et al., 2012). Nagarkar et al. (2012) found the total fees for ED and ambulatory surgical facilities in New York State rose from $18.5 million in 2004 to $27.8 million in 2008, with an average single ED charge for the treatment of early childhood caries of $4,887; for an Ambulatory Surgical Facility visit the average ED charge was $6,293. Additionally, others concurred that: (1) emergency physicians and staffs are not trained to treat the underlying dental disease or perform definitive treatment; (2) diagnosis of dental pain symptoms might not be accurate due to lack of specialized knowledge and expertise of ED providers; (3) prescriptions provided by ED staff might not be appropriate for Non-Traumatic Dental Complaints (NTDCs); (4) most EDs are not logistically equipped to provide definitive diagnosis and treatment of NTDCs; (5) the lack of definitive treatment of NTDCs results in return ED treatments for many (Cohen. Bonito, Akin, Manski, et al., 2008, Cohen, Bonito, Eicheldinger, Manski, Macek et al., 2011; Cohen, Magder, et al., 2003; Cohen, Manski, et

al., 2002; Davis et al., 2010; Okunseri, Okunseri, Chilmaza, et al., 2013; Okunseri, Okunseri, Thorpe, et al., 2012; Okuseri, Pajewski, et al., 2011; Pajewski et al., 2012).

Impact of Geographic Residence on Access to Oral Healthcare

Despite extensive study of America's oral health care crisis, and definition of the characteristics of those most affected by this crisis, closer scrutiny is warranted to gain comprehensive understanding of treatment variables experienced by NTDC patients in different geographic differences. Little has been identified in the literature regarding the extent and quality of resource access for persons living in RTU and URB areas. The National Rural Health Association (2012) noted several trends in rural health which included the following: (1) rural residents tend to be poorer than their urban counterparts, with more than 24% of its children living in poverty; (2) alcohol, tobacco, and smokeless tobacco use is higher in rural youth; (3) half as many dentists work in rural areas as urban areas; (4) diseases and conditions such as stroke, hypertension, myocardial infarction, mental illness, and suicide are higher in rural residents; and (5) they are less likely to have employer-provided insurance benefits.

Shortridge and Moore (2010) attempted to show whether rural and urban populations utilize EDs at similar rates and to identify localized oral health conditions that "drive patients to seek care at the ED" (p.2), but other researchers question the validity of compressing geographic residency to a dichotomy for comparison (Hall et al., 2006 Hart et al., 2005; Heaton et al., 2004; Wall et al., 2012; Ziller & Lenardson, 2009). What is known regarding resources for those living in pastoral settings, for those who live in rural settings and commute to urban areas for employment and services, or those living in or proximal to large communities, has not been fully addressed in recent literature. The American Hospital Association and the Chartis Group (2006) reported that, for those living in extremely rural areas, access to ED care is particularly challenging due to distances to ED care facilities, lack of infrastructure, and climatic barriers.

Public health researchers are interested in population characteristics and health behavior differences between geographic regions because, as they have demonstrated in the case of healthcare policy and funding including oral healthcare, one size does not fit all (Coburn, MacKinney, McBride, Mueller, Slifkin, & Wakefield, 2007; Hart et al., 2005; Global Health University, 2011; Milgrom & Reidy, 1998; West, et al., 2010). Some researchers have studied income levels and population density information from both the U.S. Department of Labor (2011) and the Census Bureau (2009). Yet different terms have been used to describe communities where NTDC patients seek care, creating Hart et al. (2005), examining both rural and urban taxonomies, noted that "careful definition of terms" carries significant consequences for public health policy development. The term "rural" is most frequently found in works reviewed in this chapter and was found relevant because it refers to the culture, demography, economics, and environmental characteristics of the communities. Relative to this author's study were rural U.S. counties having populations of less than 10,000 residents. Based on current reviewed literature, characteristics of such rural counties include: low population density; lower per capita incomes; greater poverty; more elderly and children; longer transit times to healthcare, emergency care, and employment; more chronic diseases, tobacco and alcohol use among youth, obesity, and hypertension; lower healthcare literacy; less healthcare resources and providers; higher uninsured rates; lack of specialty healthcare providers; and poor healthcare provider retention rates (Global Health University, 2011; Hall, et al., 2006; Hart et al., 2005; National Rural Health Association, 2007). Heaton et al. (2004) described the factors of dental services utilization in both rural and urban communities which were salient to this research investigation: high population density, numerous healthcare resources, wider variance in per capita income, more populations with high-risk behaviors, poor sanitation conditions and air quality, higher degrees of life-stress, higher immigrant and transient populations, two-tiered healthcare systems, and more established "safety-net" resources, showing that these correlated with higher utilization of healthcare resources. Ziller et al. (2009)

reported that the "rural" uninsured, those most likely to be NTDC patients, are more numerous than their "urban" counterparts.

Though the need for improved oral healthcare access, the use of EDs by NTDC patients, and the costs and risks associated with these phenomena have been established, various methods of quantifying and qualifying ED use by NTDC patients in other states and in various settings have been suggested. Only one review article on this topic could be located. Results from the Rawlinson et al. (2010) review confirmed similar difficulties experienced by dental and non-dental healthcare providers and rural residents previously identified in this chapter. Particularly relevant were the challenges of ED rural providers and their staff in identifying inadequacies of and lack of professional preparation among rural ED providers to treat NTDC patients. Definitive methodologies for gathering NTDC ED occurrences in Washington State, which would address this investigation's hypotheses, appear lacking in the literature, with the possible exception of Heaton et al.'s 2004 study.

Also relevant to this investigation, in that it compared dependent variables in rural and urban populations, Heaton et al. (2004) examined factors influencing patient utilization of dental services using data from two rural area clinics and one urban area clinic. From a total respondent population of 275, the investigation identified age, gender, and responses to a pre-tested questionnaire about three primary dependent variables: oral health self-evaluation, dental services attendance, and dental fears. Results of this study were similar to other oral health behavioral studies in that there were no significant differences in the three primary independent variables between the specific rural and urban populations studied. However, the authors failed to identify rationale for samples used, nor did they provide a rationale for administering only selected items from the Geriatric Oral Health Assessment Index to only some of the survey participants. The strength of this study was that it stressed the necessity for providers to promote oral health literacy by providing oral health education

as well as treatment, a conclusion which again raises the question of how well ED providers are prepared to treat NTDC patients seeking pain relief.

In another study comparing rural and urban populations, Reschovsky et al. (2005) used data from clustered and non-clustered samples of 12,406 physicians and 59,725 civilians from the 2000-2001 Community Tracking Study to compare medical healthcare access and quality differences in rural and urban populations. The researchers found that rural medical Medicare providers were compensated higher than their urban counterparts. Also noted were the challenges to measuring access to care because of the multi-factorial nature of the topic, including unmet or postponed medical care, timing and travel issues related to care appointments, and finding providers willing to work with patients' financial and insurance benefit circumstances. Significant rural and urban medical services differences were found and partially attributed to differences in healthcare provider supply and cultural demand for services. However, little difference was found in outpatient utilization, such as ED utilization, between rural and urban populations. Limitations to this study included sparse description of existing variances within the large populations studied by means of the analysis methods selected. Also, the subjective nature of the surveyed populations might have been indicative of cultural differences in rural and urban populations. Strengths included the size of the pooled populations and explorations of both provider and patient perspectives of medical care.

Other studies have investigated issues related to NTDC ED utilization. Cohen, in each of his studies cited in this investigation, explored several variables of utilization. Notably, the 2002 Cohen, Manski, et al. study described ED utilization in Medicaid patients during a four-year period during which the State of Maryland eliminated Medicaid reimbursement for adult emergency dental treatment. This study used Poisson regression models to identify demographic associations and selected ICD-9 codes to review combined weighted samples of pre- (n = 1,831) and post- (n =1,888) policy change claims from one metropolitan hospital. Results of the 2002 study indicated that the majority of study participants were black females 21 to 44 years of age. The

most frequent diagnosis of their dental complaint was ICD-9 code 522.9, unspecified disorder of the teeth and supporting structures. During the post-change period, the rate of ED claims for dental complaints increased and indicated a shift in demographics, showing an increase in claims by older patients, whites, and men.

Results of the Cohen, Madger, et al. 2003 study indicated that the majority of the study participants were also black females from an age range of the same 21 to 44 years of age as the 2002 study. The most frequent diagnosis of their dental complaint was ICD-9 code 522.5, periapical abscess with a secondary code of "cellulitis" or a mental condition such as schizophrenia (n=13), especially in the hospital admission cases, though how this diagnosis was achieved was not disclosed. Only about 2% of the ED visits resulted in hospital admissions. The 2003 study found that the Medicaid policy change did decrease dental claim reimbursements while increasing NTDC ED utilization. Although generalizability was limited, the strength of this study is that it illustrates the dramatic impact on quality of life factors, especially on the poor, when only economics are considered in healthcare policy enactment.

Using a stratified randomized weighted sample of 4,200 Maryland households and a telephone survey of 272 interviewees yielding a weighted sample of n = 15,394, the Cohen, Bonito, Akin, Manski, et al. 2008 study explored variances in treatment sought by patients in varying healthcare settings: hospital EDs, physicians offices, or dental offices or clinics. This study concluded that most patients sought care for dental pain from dental offices, lower income respondents were less likely than more affluent respondents to receive a prescription, and those seeking relief in EDs from acute pain were associated with pain intensity rather than demographic characteristics. However, patients seeking care at EDs were the least likely to receive any definitive treatment, a finding concurring with other studies cited in this chapter (Cohen, Bonito, Eicheldinger, Maski, Macek, Edwards, et al., 2011; Cohen, Magder, et al., 2003; Cohen, Manski, et al.; 2002; Guay, 2004, 2006; Okunseri, Okunseri, Thorpe, Xiang, & Szabo, 2012; Okunseri, Pajewski, Jackson, & Sazabo, 2011). This study acknowledged limitations intrinsic with the use of the telephone surveys, recalled patient experiences, and

limited generalizability in the population demographics used in this study. Strengths included the selection of analysis methodologies and its ability to identify access to dental care issues by specific minorities, as well as the impact of healthcare literacy and culture on care-seeking behaviors.

In their 2008 study, Cohen, Bonito, Akin, D., Manski, et al. studied an important aspect of NTDC ED treatment, that of subsequent hospital admission among Medicaid patients in Maryland. Of 4,326 NTDC adult patients presenting to EDs between 1991 and 1995, 85 (2%) were admitted to hospitals. Differences in demographic composition and costs were examined using a specific set of ICD-9 dental related codes, length of hospital stay, Chi-square, and t-tests. Frequency distributions revealed that obviously advanced periapical abscesses and caries accounted for 67% of admissions, attributed to the ease of diagnosis by those who "generally receive minimal training in the management of dental conditions" (p. 543). These researchers regarded hospital admission for NTDC as the ultimate consequence of disease prevention failure which might be the result of a lack of access to care, dental fears, and oral health illiteracy.

The lack of oral health literacy was the topic of another notable study by Cohen, Bonito, Eicheldinger, Manski, Macek, Edwards, et al. (2011). A stratified random sample of low-income Hispanic, white, and black adults who had experienced dental pain during a twelve-month period were surveyed by telephone. As health literacy markers, three questions were asked about their self-assessed ability to understand their provider (physician, dentist, or ED provider), the forms they had to complete or sign, and their ability to get the provider to understand them. Through the use of Chi-square tests and a SUDAAN analytical package, these researchers found that language limitations compounded health illiteracy among Hispanic subjects, but language limitations were not significant among any studied subsets of Hispanics, whites, or blacks, except for those with compounding race/ethnicity and gender factors.

In contrast to this study, Olives et al. (2010) explored health literacy issues relating to urban ED utilization in a 960-person medical patient convenience sample using the validated Short Test of Functional

Health Literacy in Adults. These researchers found that the older that participants were, the more likely they were to exhibit inadequate health literacy. Inadequate or marginal health literacy was positively associated with increasing age, homelessness, males, non-white ethnicity, non-native English speakers, and specific housing circumstances such as whether they had or did not have any source of consistent housing. The rigor of the methodological design of this study contributed to its strength despite the low subject participation rates, the exclusion of some language speakers due to a lack of interpreters, and difficulties encountered with categorizing the fluidity of homeless participants. Strong relevance to this investigation lay in the underscoring of the importance of health literacy in accuracy of ED diagnoses and patient education.

Effective ED provider communication also was considered by Trivedy, Kodate, Ross, Al-Rawi, Jaifanesh, Harris, and Anderson (2012). The attitudes and awareness of 103 London ED physicians' knowledge, confidence, and attitudes when treating NTDC ED patients at two teaching hospitals with various levels of experience and demographics underscore the impact and need for effective provider-patient communication. A validated three-point scale questionnaire was used to assess (1) NTDC management confidence, (2) who should be responsible for their care, and (3) by which specialty provider they themselves would prefer to be treated for dental complaints. Results indicated that only 10.7% of providers had received any formal dental emergency training. Confidence levels were expressed for interpreting radiographs and dental avulsions and were highest in suturing ability. Only 3.9% of the participating ED providers chose for themselves to be treated by another ED provider for dental complaints, while the majority, 28.6%, preferred a maxillofacial specialist as responsible for NTDC emergencies. Fifty-eight of the participants also were queried about their perceptions of dental emergencies and choice of learning resources for NTDC emergencies. Most, 75%, concurred that certain dental complaints were true emergencies and 88% agreed that other complaints, such as lost fillings or oral ulcers, were not. Chi-square testing indicated that neither prior experience with dental emergencies nor expressed

confidence levels in treating dental trauma or avulsions predicted the provider's ability to recognize true dental emergencies, again underscoring the need for improved dental-related education of ED providers.

Stressing the need for improved medical-dental education integration from a national perspective, Lewis, Lynch, and Johnston, (2003) sought to provide a broad view of NTDC occurrence using multivariate logistic regression to analyze 1997 to 2000 data from the National Hospital Ambulatory Medical Care Survey. This study used only two ICD-9 Codes for the 693 NTDC ED encounters identified in the survey, with the burden of the complaint experienced by the 19 to 35 age range and occurring most often on weekends, a variable also considered in this thesis investigation. More than 80% of patients received at least one prescription as their only provided treatment. Less than 1% were admitted to the hospital, and most NTDC ED visits occurred in urban hospitals.

Contributing to what is known about geographic oral health disparities, Ahn, Burdine, Smith, Ory, and Phillips (2011) considered dichotomous urban and rural geographic oral health disparities in the context of external and individual differences. Cochran-Mantel-Haenszel statistics for categorical variables were used to analyze mailed and telephoned survey data provided by participants in both English and Spanish. External environmental factors and access to dental care, such as predisposing, enabling, and individual life-style elements found in the 2,951 participants, were examined to elucidate the contextual understanding of oral healthcare disparities. Findings demonstrated that all oral health complaints were related to delay of care, regardless of geographic residency. Interestingly, results in this sample population indicated dental complaint experience was “much higher" than national averages (p. 37). As in other studies, low response rate and the secondary nature of the survey data limited the generalizability of this study. The study did, however, provide some evidence to support efforts to direct oral healthcare policy toward improving oral health behaviors and literacy in order to lower risk factors for oral diseases.

The review of literature on ED utilization for NTDC indicated that more information is needed to formulate cost-effective and substantive policy reform to positively affect oral health access for those most in need. Investigation of inner-state, regional, and national variations and underlying nidi affecting rural and urban populations might provide data that could alter current ineffective and costly ED care for emergent dental pain.

Improving Oral Healthcare to Reduce ED Utilization

Chattonpadhyay (2008) stated, "Merely documenting oral health disparity in the absence of oral health equity does not allow us to take considered action toward the betterment of population oral health status" (p. 298). ED utilization by NTDC patients must be considered in the context of the complex societal and political powers that limit and perpetuate oral health disparities (Patrick et al., 2006). Exploring various elements of the present oral healthcare delivery system, such as the preparation of providers, clarification of precipitating ED utilization factors, and system voids, are necessary to develop improvement strategies. Clues to oral healthcare improvements to reduce ED utilization and improve NTDC patient outcomes were found in the review of current literature and revealed several recurrent themes:

Alternative oral healthcare providers and settings. Utilization of oral health providers other than dentists, such as mid-level providers, dental therapists, and advanced dental hygiene practitioners, as well as legalized expansion of existing dental hygienists' functions, have been supported by numerous investigators (Edelstein, 2010; USGAO, 2011; Galen, & Vlahow, 2005; Lashley, 2008; Leake & Birch, 2008; Johnson, Loomer, Siegel, Pilcher, Leigh, Gillespie, Simmons, & Turner, 2007; Ma, et al., 2004; Milgrom & Reidy, 1998; Nash, 2009; Patrick et al., 2006; Pew Center on the States, 2010; Rawlison & Crews, (2010); Reidy, Ly, Ybarra, & Milgrom, 2007; Summerfelt, 2011; U.S. Agency for International Development Bureau for Global Health Office of Health, Infectious Diseases and Nutrition, 2004; Vargas & Arevalo, 2009). Kisby (2011) reiterated the American Academy of Pediatric Dentistry findings that early preventive oral care was more cost-effective and superior to emergency dental care for children, and concluded that dental hygienists play a critical role as

educators of pregnant women and new mothers to decrease the likelihood of transmission of Streptococcus *mutans* from mother to child. Dental hygienists also provide essential dietary counseling and oral hygiene product selection and technique education. Most importantly, dental hygienists can provide education about parafunctional habits that lead to malocclusion and skeletal dysplasias (Kisby, 2011). Nash (2009) described the current dental workforce as "...inadequate..." and experiencing "...sub-optimal distribution, ethnicity, education [particularly in treatment of children], and practice orientation" (p. 470). To remedy this conundrum, Nash advocated for the use of dental therapists/hygienists as a cost-effective, safe alternative particularly suited to fulfill the currently unmet dental needs of marginalized, low-income children. Uswak and Keller-Kurysh (2012) reported that the use of dental therapists provided a cogent, competent, and cost-effective remedy for the severe maldistribution of dentists in Canada, particularly in remote and isolated regions, and attested to the efficacy of using dental therapists to reduce barriers to oral healthcare for those most in need. Summerfelt (2011) described the use of teledentistry by affiliated practice dental hygienists to fulfill the PPACA's mandate for an alternative dental workforce. This report will be discussed later in this section.

Alternative oral healthcare delivery systems might provide more options for NTDC patients. Current U.S. oral healthcare is delivered either in a private practice or public health clinics (Guay, 2004). Patrick et al. (2006) suggested that a more effective care delivery system would include "retail dentistry, mobile dentistry", also advocated for by Colangelo (2009); independent practice of dental hygienists; and deployment of dental therapists (p. 13). Increase in the number of community healthcare clinics staffed by educated and trained community members versed in local cultural practices could effectively address many financial and cultural barriers to oral healthcare (Colangelo, 2009; Patrick et al., 2006). The USGAO (2011) suggested diverting ED patients to community health centers for care. Such options might include Federally Qualified Health Centers (FQHCs), community health centers (CHCs) and migrant health centers containing dental departments that would expand participation in Practice-Based Research Networks (PBRNs), an NIDCR initiative, as supported

by Reidy et al. (2007) as a win-win scenario. Populations served by FQHCs and CHCs often experience a preponderance of oral healthcare disparities. FQHC, CHC, and migrant health center participation in PBRNs would provide quality oral healthcare to those in need while contributing to the greater body of knowledge. Reidy et al. (2007) explained that in such a partnership, FQHCs and CHCs control the research agenda while collaborating with communities, academic institutions, researchers, and grant funders. Wendling (2010) and Robinson (2009) preferred the use of Expanded Function Dental Assistants, the ADA proposed Community Dental Healthcare Coordinators, increased volunteerism, and implementation of innovative funding programs for dental services such as the Michigan Medicaid "Healthy Kids Dental Program," "Give a Kid a Smile" program, the American Indian/Alaska Native Volunteer Program, and the Beaumont, Texas "125 Dentists of the Day" program to expand access to preventive oral healthcare. Colangelo (2009) suggested specialized training for foreign-trained dentists to help alleviate provider shortages.

Changes in traditional dental education and recruitment. Nash (2010) noted that more than mastery of complex knowledge and motor skills set is required of dentists and posited that ethics, empathy, and cultural competency need to be increasingly incorporated and emphasized in dental curriculae. Edelstein (2010) advocated for combining extramural dental training with "bona fide service learning" and reflective learning exercises to accurately meet community needs and preferences (p. 536). Additionally, Edelstein (2010) recommended utilization of dental therapists, promotion of best practices, cultural skill development, and cooperative community collaboratives into dental education. Lashley (2008) proffered the benefits of both interdisciplinary education and compassion-empathy training through community-academic partnerships as examples of the bona fide service learning recommended by Edelstein (2010). Johnson et al. (2007) also proposed that dental curriculae could be enhanced while contributing to improvement in access to care by partnering with community leaders to provide community-based educational experiences for students. Vargas and Arevalo (2009) noted deficits in dental curricula, requiring changes to adequately prepare graduates to treat

elderly, special needs, pediatric, and minority patients. These researchers also cited the homogeneity of dental providers as a concern for both the profession and the public, noting that minorities tend to seek healthcare providers of their own ethnicity. Anderson (2007) recommended emphasis on critical thinking and decision-making skills, particularly important in light of the litigious nature of U.S. culture. Anderson further admonished dental educators to be prepared for the advent of transformational technologies which could eminently change the course of dental disease and, cogently, the way dentists and allied professionals are educated. An example would be the development of a vaccine to prevent dental caries that would change the use of restorative materials, dental care delivery, and the dental industry.

Implementation of new technologies for oral healthcare delivery. Other researchers have advocated for the use of product innovations and innovative technologies such as flavored fluoride varnishes, MI pastes, and xylitol toothpastes (Colangelo, 2009); telemedicine/dentistry, Internet, and other remote monitoring technologies to improve access to quality oral healthcare in remote or underserved areas (Hing & Bhuiya, 2009; Laskowski, McLeod, Friesen, Podaima, & Alfa, 2009; Salazar-Fernandez, Herce, Garcia-Palma, Delgado, Martin, & Soto, 2012; Sommerfelt, 2011); the use of bedside ultrasound technologies to detect dental abscess (Adhikari, Blaivas, & Lander, 2011); and flashing alerts in electronic patient records to avoid mistakes (Atchison, 2003).

Hing and Bhuiya (2009) studied increasing wait times for ED patients and found a positive correlation with increased ED crowding and ambulance diversions. Laskowski, McLeod, Freisen, Podaima, and Alfa (2009) considered the use of staffing scenarios and computerized analysis of queuing and operating procedures using specialized software to reduce emergency room patient waiting times and integrate patient needs with regional patient health information systems in real time. Such innovations could improve ED patient safety and efficient routing of ambulance patients presenting to EDs.

The issue of inadequate diagnostics performed on NTDC ED patients was raised by Anderson, (2007), Cohen, Bonito, Akin, Manski, et al. (2008), Cohen, Bonito, Eicheldinger, Manski, Edwards, et al., (2011), Cohen, Madger, et al., (2003), Guay, (2004), and others. Adhikari et al. (2011) compared the use of bedside ultrasound to panorex radiograph in nineteen patients to evaluate efficacy of ultrasound as a diagnostic of dental abscesses. Ultrasound is nonionizing, less expensive, and was found to be equally accurate as the more time-consuming, logistically cumbersome panorex radiograph, which requires yet additional time for interpretation by a radiologist in the ED. In light of a reported growing trend of using computed tomography, which is vastly more expensive and exposes patients to greater amounts of radiation, the use of ultrasound imagery holds promise to improve ED NTDC patient outcomes.

Atchinson (2003) investigated the use of information technology for community-based research to improve oral healthcare delivery efficiency and organization. He also advocated for the use of electronic patient records, computerized pharmaceutical prescribing and decision-making software, electronic patient recall software, electronic communication of all aspects of patient-centered care including laboratory results, evidence-based care decisions, and electronic patient education to support the "continuous healing relationship" essential in oral healthcare delivery. Such efficiency would result in cost savings, improved treatment safety, and improved ED patient outcomes.

The use of new technologies is particularly important to rural areas due to long distances to healthcare in emergencies, logistical difficulties, limited types of specialty providers, and technologic resource limitations (Rawlison & Crewes, 2003). With financial support of the Rural Hospital Flexibility Program of 1997, the use of Geographic Information Systems can be used to pre-determine the most effective mode of transportation--air or ground--to emergency care. Rawlison and Crewes (2003) posited the use of telemedicine via the use of telephones, radio, faxes, and "store and forward" video and audio clips of patient data sent through email as essential for rural areas. The use of cameras and microphones set up in remote treatment facilities allowed

expert providers elsewhere to direct local providers treating emergency patients and has been proven to be effective and to provide improved patient outcomes. The use of the telemedicine workstations equipped with a document reader and other digitalized instruments might be adaptable to dentistry for emergent care in remote areas. The "store and forward" telemedicine system also was proffered by Salazar-Fernandez et al. (2012) as a cost-effective and accurate diagnostic aid which shortened treatment delay and prevented complications when studied in temporomandibular joint displacement patients.

Of particular interest and relevance was the Summerfelt (2011) report mentioned above and the use of teledentistry technologies in training affiliated practice dental hygienists. The details of this example of the combined use of well-educated dental hygienists and technology reveal enormous potential for NTDC ED utilization reduction in many different settings. The unique Northern Arizona University (NAU) teledentistry model was designed to fulfill oral health needs in rural areas using specialized computer software, digital imaging management software, intraoral cameras, a digital x-ray film scanner, a portable hand-held X-ray radiograph system, lap-top computers, a projector, and portable storage equipment costing $25, 000. Training in use of all equipment was conducted according to the manufacturers' certification requirements. The program was pre-tested using 117 pediatric patients during a volunteer event, field tested at eighteen northern Arizona Head Start Centers over a 27,000 square mile rural area, and coordinated care with a contracted pedodontist three hours away. Analysis of the test clinic radiographs indicated statistical equality in remote and NAU clinic site radiographs in blind tests. Between October 2009 and June 2010, NAU dental hygiene students participated in a maternal and child health program and provided oral screening and other affiliate practice dental hygiene services in thirteen locations, twelve of which were accessible by road and one by helicopter, treating a total of 183 children. It was noted that the intraoral cameras were especially useful under even the most remote conditions. Areas of concern were photographed and telecommunicated for review by a dentist who assessed the need for patient referral. In one particular site, the nearest access to dental care was 225 miles away from

one Native American community where four children were in need of immediate dental care. The use of teledentistry by dental hygienists spared the patients a 450-mile round trip for care. Concurrence among the affiliated practice dentists, dental hygienists, parents, and patients of the value of this technology was unanimous and its application to other settings to prevent dental emergencies warrants further investigation.

Improved oral health literacy for healthcare providers and general populous. Oral health literacy enables: (1) improved patient-provider communication; (2) navigation of the healthcare system and forms comfortably by patients; (3) communication of important personal data; (4) performance of self-care and chronic disease management; (5) compliance with healthcare instructions; and (6) understanding of treatment risks and benefits relevant to ED and other healthcare settings (Cohen, Bonito, Eicheldinger, Manski, Edwards, et al., 2011; USDHHS, n.d.b). Oral health literacy can be particularly challenging when combined with LEP issues (Cohen, Bonito, Eicheldinger, Manski, Edwards, et al., 2011). To improve oral health literacy and decrease ED utilization for NTDC, Patrick et al. (2006) suggested implementing a broader provider understanding of relevant social, power differential, and individual factors. Their conceptual model of oral health influences and disparities indicated that failure to incorporate cultural competency into attempts to improve oral health literacy are doomed, as evidenced by examples of failed or adverse effects shown studies conducted in Alaskan Native American and U.S. Latino populations (Grossman, 2004 as cited in Patrick et al., 2006; Roberts et al., 2002 as cited in Patrick, 2006). Guay (2004) suggested that increased utilization of dental services is a function of a triad of factors, one of which is *demand*, a function of oral health literacy.

With improved oral health literacy, local constituents could use community activism as an effective weapon in the battle for improved oral health, collaborating and demanding changes in zoning codes, promoting local financial investments in infrastructural improvements and insisting in better schools, all of which foster healthier neighborhoods in which oral health is a priority (Patrick et al., 2006).

Summary of Chapter 2

Review of the current literature relevant to NTDC utilization of ED as a primary resource for oral healthcare paints a sobering picture of the suffering and fiscal toll of the present U.S. oral healthcare delivery system and its low priority in the national conscience. Despite calls for reform from national healthcare agencies and scientists, the current protracted economic downturn has undermined progress. Juxtaposed with mounting scientific evidence of oral and systemic health inter-relationships, lagging support for oral healthcare reform needed most by the vulnerable in society is disturbing. The impact of this shortfall is born more heavily on the most vulnerable and disenfranchised, and those in varying geographic locations. Without adequate functioning community resources and safety nets, the most vulnerable are forced to seek relief from pain resulting from preventable oral disease by utilizing the most expensive and least effective resource, hospital emergency care. While the literature describing this national situation is extensive, few details are known about how populations, providers, and treatments vary across the geographic spectrum of population densities.

The purpose of this study was to gain information about the experiences of -rural-to-urban commuting (RTU) and urban (URB) NTDC patients in Washington State seeking relief from oral pain in EDs by comparing data including patient demographic profiles, institutional administrative experiences, and clinical experiences. Although some studies of NTDC patients have been reported in the literature, this data set has yet to be considered in the context of RTU and URB NTDC patients. Analysis of these data attempted to discern empirical evidence for improving oral health access opportunities for the vulnerable population.

Chapter 3 Methodology

The current protracted economic crisis in the U.S. has caused a breach in its healthcare system (ADA, 2007; Garcia, et al., 2008; Gibbs, Nsiah-Jefferson, McHugh, Trivedi, & Prothrow-Stith, 2006; Pew Center on the States 2011, 2012; Shelley, Russell, Parikh, & Fahs, 2011; Smedley, 2003; Shortridge & Moore 2010; USDHHS, 2000; U.S. Senate Committee on Health, Education, Labor, & Pensions Subcommittee on Primary Health and Aging, 2012). Many Americans lack appropriate resources for routine and preventive oral healthcare and seek emergent pain relief in hospital EDs. The cost of such care is escalating, straining federal and state budgets, including that of Washington State. Data on Washington State NTDC ED patient demographic profiles, institutional administrative experiences, and clinical experiences, as well as the possible influence of geographic residency, defined as rural-to-urban commuting (RTU) and urban (URB), is lacking. Presently, Washington State lacks the financial means to conduct research necessary to collect evidence for healthcare policy development (Reed, 2013). To contribute to such evidence, this chapter described the methodology used for examining NTDC patient utilization of EDs in Washington State.

Design

Study overview. This retrospective study was designed to gain knowledge about the demographic profiles, institutional administrative experiences, and clinical experiences of NTDC patients presenting to sample EDs in Washington State.

Research design. The research design selected for this retrospective study is also known as a quantitative comparative ex post facto study. Because it considers the differences between the same sets of dependent variables on two very different independent variables (LoBiondo- Wood & Haber, 2010), this type of design best addresses the research questions and hypotheses of this investigation. Logic dictates the practicality of using retrospective data to discern the *history* of transpired NTDC ED utilization. The unique relationship of

the independent variable (geographic residency) upon the dependent variables (the demographic variables, the institutional administrative variables, and the clinical variables) has been entered into the NTDC ED patient medical records. In this study, it was extracted from these records and subjected to appropriate analysis. No attempt at causality is made (LoBiondo- Wood & Haber, 2010).

This study described data collected and analyzed from NTDC patients presenting to EDs in Washington State hospitals in each of two selected counties. What is currently known about the demographic profiles, institutional administrative experiences and clinical experiences of Washington NTDC patients presenting to EDs was the subject of this investigation.

Research Context

This research was conceived as a response to concern over escalating costs of the phenomenon of NTDC ED care, a national healthcare issue. Because Washington State is geographically divided by the Cascade Mountain range, it has developed a distinctive "dichotomous" healthcare and economic ethos which presented a unique research opportunity. As illustrated in Figure 1, recognition of NTDC ED utilization as an ineffective treatment modality and an economic burden on state coffers is the foundation of the original concept for this research. The research concept evolved as an examination of Washington State RUCA populations from an Advocacy paradigm. As noted by Flaer et al. (2010) in Chapter One, the tenets of the Health Belief Model(HBM) present as a logical theoretical model when applied to what is currently known about NTDC ED patients in Washington State. Though believed to have evolved as an amalgam of the works of Kasl, and Cobb, Becker, Drachman, Kirsch, Rosenstock and others (Burns, 1992), Cardella, et al. identified six tenets of the HBM to be: "(1)... perceived susceptibility, (2)... perceived severity, (3)... belief that taking actions reduced susceptibility, (4)...believe the costs of taking action are outweighed by the benefitsm (5)... perceptive to cues to action, and (6)... self-efficacy" (Rimer & Glanz, 2006 in Cardella et al., 2008, p. 408).

Figure 1. Research Questions and Hypotheses Development Concept, Conceptual Model, and Theory

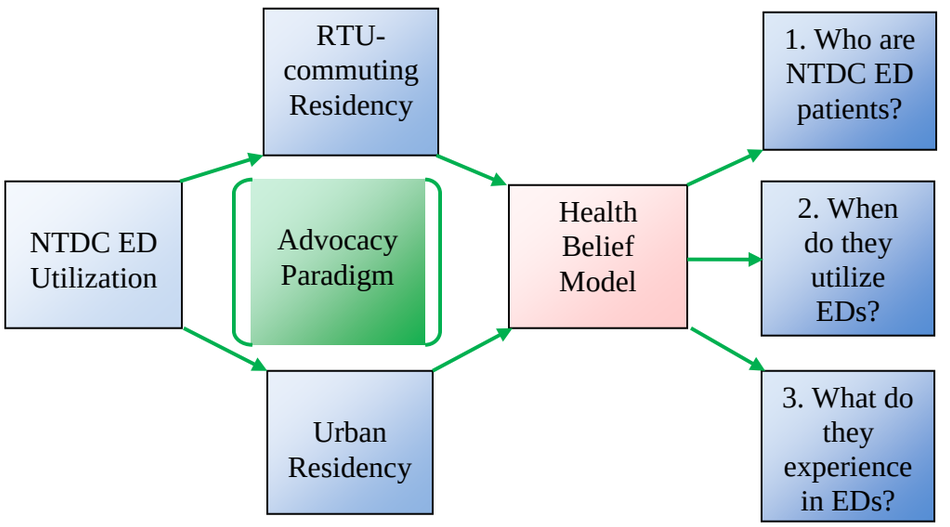

Figure 1. Research conceptual model developed as a progression from theory-based concept to research questions and hypotheses.

Research Participants

Sample description. Of 42 RTU hospitals contacted, only one agreed to participate. The URB hospital was recruited for participation because of its central location within Washington State's largest city and had agree to participate in this investigation. Though Shortridge and Moore (2009, 2010) had established a precedent of collapsing thirty-three RUCA classifications into only two, rural and urban, as noted in Chapter One, originally this study aspired to include populations from three RUCA classifications, "isolated rural," "rural-to-urban commuting," and "urban," to provide a more accurate profile of NTDC ED patients in Washington State. US Census Bureau data were consulted to identify Washington State counties that fell into these three categorical criteria by population (U.S. Census Bureau, 2013). Coburn, MacKinney, McBride, Mueller, Slifkin and Wakefield (2007) cautioned that definitions of "rurality" vary widely even within the federal government, which uses 15 different "rural" definitions. Hart et al. (2005) and Hall et al. (2006) both

stressed the importance of choosing definitions of rurality or urbanality according to the needs of a specific study or project. However, after forty-seven (n=47) isolated rural institutions were contacted to participate in this investigation by telephone and email, forty-five (n = 45) did not respond and two (n=2) declined study participation citing "lack of resources" as the reason they declined.

The rationale for including a “rural-to-urban commuting" facility was that this institution was located in a RUCA-classified area possessing many essential rural characteristics, including some remote and isolated areas (Morrill, et al., 1999). The urban institution was recruited because of its central location within a metropolitan area and its Level 1 trauma status. Thus, the study's convenience sample ultimately represented only two legally designated counties, each containing several RUCA classifications. Profile data describing each participating county were taken from the U.S. Census (2013) and the Washington State Employment Security Department (2013) for each county. It is important to understand that data used from the participating hospitals were drawn from populations whose access to oral healthcare might vary within county hospital districts located within counties. Some patients might experience more travel difficulties to access care, a point essential for accurate interpretation of the data. Discussion of the different languages spoken in each area was included to illuminate additional challenges to both NTDC ED patients and providers during healthcare encounters. These two institutions provided quantitative data for the independent variables including de-identified patient record numbers, patient demographic profiles, institutional administrative experiences, and clinical experiences. The variable data were collected from each site from NTDC ED patients presenting to the sample institutions over a period of twelve consecutive months, from March, 2012 through March 2013. Figure 2 illustrates the variety of RUCA population concentrations found within Washington State.

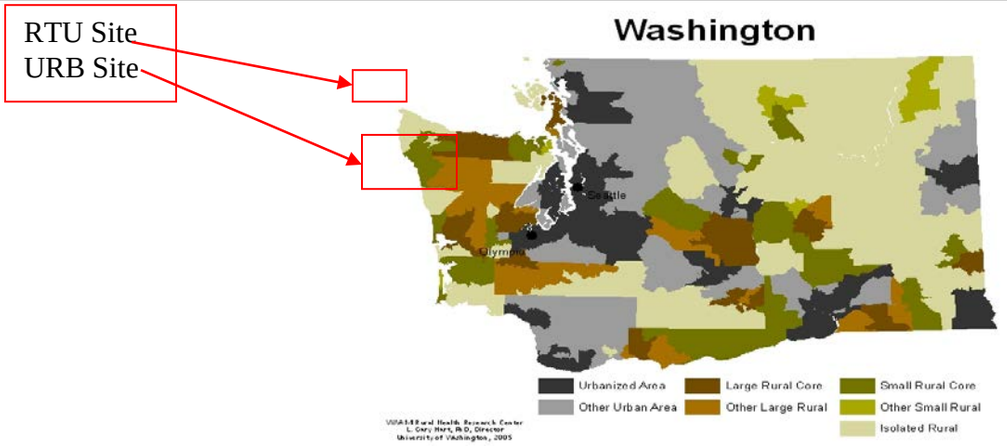

Figure 2. Washington State RUCA Map illustrating geographic research sites.
(Morrill, Cromartie, , & Hart, G.,1999)

RTU Commuting (RTU). Data from the Washington State Employment Security Department revealed that the RTU county's area was 1,731.20 square miles and averaged 67.5 persons per square mile. The population of this county was estimated at 118,109, of which 91.4% were white, 17.3% were Hispanic, 2.6% were American Indian and Alaskan Native, 2.0% were Asian, 0.9% were black, and 0.3% were Native Hawaiian or Pacific Islander. Some 87.9% of its population had a high school education or higher including 23.7% with a baccalaureate degree or higher. The median household income was $55,555 and the non-seasonally adjusted unemployment rate was 9.2%, slightly above the current national average. The average commuting time to employment was 25.3 minutes and the estimated percentage of persons living at or below the poverty level was 12%. The town in which the facility was located, with a 2011 population of 32,070, was the largest of the county's three major towns and was located on the Interstate 5 (I-5) corridor in the western middle section of the county. The local economy was dependent on agriculture, especially tulips, berries, and seed crops, private services, oil refining, boat-building, forestry, and government employment (Washington State Employment Security Department, 2013). This county was considered to have a "well-rounded economy" and was limited by its sparse and challenging infrastructure as demonstrated by the May 23, 2013 collapse of

the I-5 bridge, considered "functionally obsolete," over a river, an occurrence which crippled the local economy and disrupted commerce from British Columbia to Mexico (Carter, Brumfield, & Barrett, 2013). Due to its relative proximity to the Canadian border, immigrant populations, and a U.S. military installation, twenty different languages were spoken at home in this county: English, Spanish, Tagalog, French, Japanese, German, Russian, Dutch, Chinese, Croatian, Norwegian, Ukrainian, Korean, Italian, Finnish, Czech, Cantonese, Swedish, Vietnamese, and Kutenai (a local Native American dialect) (CDC, 2007b). At least three indigenous Mexican dialects, Mixteco alto, Mixteco bajo, and Trique, are also spoken in that county, correlating with local immigration patterns.

The participating RTU hospital chose to participate in this investigation when invited because of concerns held by its administration and the county public health director for the relatively large numbers, costs, and inefficacy of NTDC ED patients the hospital treats annually (C. Davis, July, 2013; P. Browning, August, 2012).This facility was a logical choice because, of the three hospitals located within the county, it is the largest, serves a population most representative of the local population, and is most centrally located. It is a 137-bed, full-service facility with a full staff of physicians, hospitalists, ARNPs, and PAs, and is a Level III trauma center. It possesses the technical sophistication to extract the requested data. Approximately 508 NTDC ED patients were treated at this facility in a 12-month period. This county is designated a dentally underserved area, with a shortage of six providers and an HPSA score of 13 (USDHHS, n.d.b).

Urban (URB). This county's area is 2,115.57 square miles and averages only 912.9 persons per square mile. The population of this county is estimated at 1,969,722 and is very diverse. Specifically, 71.9% of this county's population was white, 15.0% was Asian, 9.2% was Hispanic, 6.5% was black, 1.1% was American Indian and Alaskan Native, 4.7 was multiracial, and 0.8% was Native Hawaiian or Pacific Islander. Nearly 92% of its population had a high school education or higher, and 45.5% held a baccalaureate degree or higher. The median household income was $70,567 and the unemployment rate was 6.1%, well below the national average.

The average commuting time to employment was 26.6 minutes and the estimated percentage of persons living at or below the poverty level was 10.5%. This county had 39 separate cities. The local economy was dependent on the "aerospace industry, professional, scientific, and technical services, retail trade, healthcare, leisure and hospitality, and government" (Washington State Employment Security Department, 2013, para. 7). One hundred and eighteen different languages were spoken at home in this county, from every continent, including several Native American languages. The twenty most frequent included English, Spanish, Chinese, Vietnamese, Tagalog, Korean, Japanese, German, Russian, French, Mon-Khmer Cambodian, Cantonese, Ukrainian, Amharic, Persian, Laotian, Panjabi, Mandarin, Hindi, and Arabic. The ten least spoken included Salish (Native American), American Indian, Puget Sound Salish, Tlingit (Native American), Scottic Gaelic, Uighur, Welsh, Pennsylvania Dutch, Marshallese, and Cree.Though this county had 29 other hospitals which have EDs, this participating hospital was recruited to participate in this investigation because it was an award-winning, 413-bed facility with Level I trauma center status, was affiliated with a major university and, as such, possessed an ethos supportive of research, and was located in the center of this county's largest city (University of Washington Medicine, 2012). The estimated number of NTDC ED patients treated in a 12-month period was approximately 1,200 (R. Lin, personal communication, July, 11, 2013; University of Washington Medicine, 2012). This county was designated as a dentally underserved area, with a shortage of one provider and an HPSA score of 12 (USDHHS, n.d.b).

Human subjects protection. According to the Idaho State University Human Subject Manual for Investigators, this study met conditions for exemption certification from an Institution Review Board because it used de-identified patient identification numbers and ages identified only by range to ensure patient confidentiality and anonymity (Idaho State University, 2008). At no time, under no circumstances, were actual patient identities made known to the investigators (see Appendix A for the exemption request). This study employed a unique combination of dependent variables to investigate possible differences and patterns found

within and between NTDC ED patients at two Washington State hospitals and utilized strategies specifically selected to protect the identity of the patients whose records were studied, thereby preventing possible "data triangulation."

The confidentiality and anonymity of the participating facilities was insured by withholding their names and using only general facility descriptions. Names of counties in which the facilities were actually located were also withheld. Data from participating institutions were downloaded to a disc and emailed to the Primary Investigators's (PI's) password-secured laptop. The original disc was then shipped, by insured FedEx using overnight express, to the Department of Dental Hygiene of the Idaho State University in Pocatello, Idaho. Upon receipt of data from the participating institutions, following data analysis, and upon completion of the thesis process, all data will be kept in locked files in the Department of Dental Hygiene for at least seven years.

Data Collection

Procedure. After approval from the Human Subjects Committee was received, the institutions agreeing to participate in the study were contacted by email to notify them of the approval and to request the data for this investigation (see Appendix B). Data was collected at each participating institution by a combination of their medical records and fiscal management staff, whose time was donated for the sake of this investigation. The understanding between the PI and each institution was that results from this investigation, including only data relevant to that participating institution, would be shared. The length of time required to collect these data was dependent upon institutional resources of workforce time and priorities. A list of requested research variables and conceptual definitions was provided each institution to ensure accuracy and completeness of data collection. The PI was also personally accessible by telephone to resolve any questions the data collectors may have had.

The use of existing data, NTDC ED patient medical records, presented both advantages and disadvantages consistent with those noted by LoBiondo-Wood & Haber (2010). Advantages included the existence of large numbers of records and consistent reliability of the data those records contained. The disadvantage of using these data was the effort and time required to negotiate with organizations and institutes to participate in this investigation and finally achieve sharing of data.

The dependent variables selected for this investigation were based on voids in current literature on the subject. The dependent variables--de-identified patient record number, gender, age in a five-year range, race, ethnicity, day of the week treated, ICD-9 code, comorbidity, provider type, treatments provided, and dichotomous hospital admission status--were tallied and statistically analyzed within and between the independent variables of site geographic location for patterns and comparisons.

Limitations. Washington State has 39 counties which vary widely in demographics, economics, and geographic locations. Examination of only two counties provided limited information to the true extent of NTDC ED utilization in Washington State. A convenience sample of data from participating hospitals was due to the fact that, even though 47 hospitals were invited to participate in this study, only two accepted. This study acknowledged three of the four disadvantages of using convenience sampling defined by LoBiondo-Wood and Haber (2010). The first limitation relates to the collection of scientific observational data for this study, problematic in that it posed difficulty in checking the actual data input from each institution due to the investigators' lack of access to the physical data input locations. This researcher had (a) to rely on assurances of accuracy from the supervisors who trusted their staff and computer software; and (b) to recognize the limitations imposed by the secondary nature of this data. A second concern was that the number of actual patients’ records from the two participating institutions remained unknown until the researchers were in receipt of the actual data. An insufficient number of subject records would have negatively impacted the strength of the conclusions. Another limitation imposed by the use of a convenience sample was that a convenience sample

would possess the weakest level of evidence, weaken the ability to generalize this study's findings, and pose a greater risk of bias because the patients who presented to ED with NTDC might have been a group non-representative of the general population (LoBiondo-Wood et al., 2010).

Other limitations of this study are similar to the limitations found by Bhagavatula et al.(2012) in that this Washington State study also used RUCA classifications which, as noted by Bhagavatula et al., are urban-focused and do not capture the true "rural" challenges of residents dwelling miles away from urban centers yet dependent on metropolitan areas for employment and services.

Statistical Analysis. Retrospective data from both hospitals was electronically extracted from NDTC ED patient records from a period from March 1, 2012 to March 1, 2013. Data from each collection site was formatted to an Excel spreadsheet and sent electronically to the PI. Both descriptive and inferential statistics were used in the analysis of the data. Descriptive statistics were used to describe and summarize the data and included quantification of standard deviations, means, mode, age mid-point ratios, and frequency distributions for each variable (LoBiondo-Woods & Haber, 2010). Age was expressed as a midpoint value of the age in a five-year range. These data were found to be of Gaussian distribution by Student *t*-test analysis. A chi-square test was used for analysis of the dependent categorical variables of race, ethnicity, ICD-9 codes, day of the week the NTDC patient presented to the ED, and type of treating provider. A Fisher's Exact test was used to analyze nominal binomial variables of gender and patient hospital admission status. Analysis tests were coded and recorded onto an Excel spread sheet by the PI for statistical analysis by a ISU statistician using SSPS software. Probability was established at $p = .05$. Further, individual analogs for each variable at each site were written to ensure accuracy of counts as analysis preparation.

Summary of Chapter 3

This chapter described the scope and design of this investigation, its rationale, sampling strategies, data collection site descriptions, analysis methodology, and study limitations. This chapter reflected the culmination of efforts to further scientific knowledge about the growing problem of NTDC ED utilization in Washington State from a novel approach in response to specific issues raised by several professional organizations noted elsewhere in this paper. The methods used in this investigation aspired to provide scientific evidence which will contribute to improved development of evidence-based healthcare policy, particularly oral healthcare policy, for the citizens of Washington State and beyond.

The results and discussion sections of this thesis are presented as a manuscript for submission to the *International Journal of Dental Hygiene*. Author guidelines are found in Appendix C of this document.

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Appendix A Data Collection Request Letters and Permission Emails

Mr. Gregg Davidson, FACHE
Chief Executive Officer
Skagit Valley Medical Center
1415 E. Kincaid Street
Mount Vernon, WA, 98273

Jacqueline A. Juhl, RDH, BS
ISU MSDH Student
6751 Big Cedar Lane
Anacortes, WA, 98221

May 24, 2013

Dear Mr. Davidson,

I am a Master of Science student enrolled in both Dental Hygiene Education and Community/Rural Health specialty areas at Idaho State University. As a Washington State resident and oral healthcare provider, I am very concerned about rural access to oral healthcare and the costly utilization of emergency departments (EDs) by patients suffering non-traumatic dental complaints (NTDC) and its fiscal burden to hospitals. For my thesis, I am developing a research proposal to compare variables from NTDC patients utilizing EDs in rural, RTU-commuting, and urban counties in our state. These data are critical for future healthcare policy and funding decisions; however, our state cannot afford to collect these data on its own. This fact was confirmed in my recent telephone conversation with our State Department of Health's Epidemiologist, Ms Phyllis Reed, although she expressed an interest in the results of such an investigation.

Prior to completing the thesis research proposal and application to the university's internal review board, sources of data need to be identified. Therefore, I am inquiring if your institution would consider being a data source, providing *de-identified* data related to ER patients seeking care for non-traumatic dental complaints for a 12

month period from May 1, 2012 to May 1, 2013. A letter of agreement to provide data is needed for the application for human subjects approval. No data will be requested until my thesis research proposal is approved by my thesis committee as well as the application to the university's Human Subjects Committee. The Human Subjects Committee will require the protection of your institution's confidentiality and anonymity and de-identified patient data.

The benefits to your hospital for participation in this research would include:

- Excellent public relations for your hospital as you could reveal your support of and contribution to higher education at your discretion.
- Shared access to this valuable data for internal planning purposes.
- Substantively contribute to the greater body of knowledge.

Thank you for considering this request. Could you please let know your decision at your earliest convenience?

Most gratefully,

Jacqueline A. Juhl, RDH, BS,

ISU MSDH Student

Skagit Valley Resident

RE: Formal Invitation for Research Participation

Davidson, Gregg [GDavidson@skagitregionalhealth.org]

You replied on 6/23/2013 5:22 AM.

Sent: Tue 6/18/2013 8:29 AM
To: Jacqueline Juhl
Cc: Davis, Connie L; Torgerson, Betty

Jacqueline, I discussed your request with Dr. Connie Davis, our Chief Medical Officer, we agreed we would like to work with you on your project.

Please contact Connie at 360-428-2294

Best Regards

Gregg

Gregg Davidson , FACHE
Chief Executive Officer

Skagit Valley Hospital & Skagit Regional Clinics

Ms Denise Leverentz,

Director, Cost Management & Performance Measurement

UW Medicine Finance & Budget

UW Tower, 6th floor; Mailbox 359416

4333 Brooklyn Ave NE, 6th Floor

Jacqueline A. Juhl, RDH, BS

ISU MSDH Student

6751 Big Cedar Lane

Anacortes, WA, 98221

June 11, 2013

Dear Ms Leverentz,

I am a Master of Science student enrolled in both Dental Hygiene Education and Community/Rural Health specialty areas at Idaho State University. Thank you for agreeing in principle to participate in my thesis data collection. From information received from Mr. Brian Sales of the Washington State Hospital Association, I understand that you are not prepared to address this issue until the middle of June. However, I wanted to formally present an invitation to participate in my investigation and provide details of the data I am seeking. As a Washington State resident and oral healthcare provider, I am very concerned about rural access to oral healthcare and the costly utilization of emergency departments (EDs) by patients suffering non-traumatic dental complaints (NTDC) and its fiscal burden to hospitals. For my thesis, I am developing a research proposal to

compare variables from NTDC patients utilizing EDs in rural, RTU-commuting, and urban counties in our state. These data are critical for future healthcare policy and funding decisions; however, our state cannot afford to collect these data on its own. This fact was confirmed in my recent telephone conversation with our State Department of Health's epidemiologist, Ms Phyllis Reed, although she expressed an interest in the results of such an investigation.

Prior to completing the thesis research proposal and application to the university's internal review board, sources of data need to be identified. Therefore, I am inquiring if your institution would consider being a data source, providing *de-identified* data related to ER patients seeking care for non-traumatic dental complaints for a 12 month period to be determined at a later date. A letter of agreement to provide data is needed for the application for human subjects approval. No data will be requested until my thesis research proposal is approved by my thesis committee as well as the application to the university's Human Subjects Committee. The Human Subjects Committee will require the protection of your institution's confidentiality and anonymity and de-identified patient data.

The benefits to your hospital for participation in this research would include:

- Excellent public relations for your hospital as you could reveal your support of and contribution to higher education at your discretion.
- Shared access to this valuable data for internal planning purposes.
- Substantively contribute to the greater body of knowledge.

Thank you for considering this request. Could you please let know your decision at your earliest convenience?

Most gratefully,

Jacqueline A. Juhl, RDH, BS,

UW School of Dentistry Class of '96

ISU MSDH Student

RE: Description of Method of Data Transferrance and Data Sharing

Lin Rui [rui@u.washington.edu]

Follow up.
You replied on 9/24/2013 9:05 PM.

Sent: Mon 9/23/2013 10:24 AM
To: 'Jacqueline Juhl'
Cc: dml@u.washington.edu

Hello Jacqueline,

I talked your request with my manger Denise. We could start to provide the data for you. Do you have the list of the patients so you could send it to me? Thanks.

Rui

From: Jacqueline Juhl [mailto:ja.juhl@comcast.net]
Sent: Friday, September 06, 2013 5:39 AM
To: dml@u.washington.edu
Cc: 'Lin Rui'
Subject: Description of Method of Data Transferrance and Data Sharing

Dear Ms Leverentz and Ms Lin,

As required by my institution's IRB Committee, I need to know specifically what secure methods you wish to employ to secure the confidentiality of the research data to me, once it is collected. Would it be acceptable to you and your institution's HIPAA and Quality Assurance staff if the data were transferred by downloading it onto a computer disc which I would receive in person and then load in to my computer which is secured with a secure password? If you would prefer another method of transfer, please advise me at your earliest convenience. Also, at your request, I will be happy to share the complete analysis of my thesis investigation salient to Harborview Medical Center only with you and your staff in accordance with my institution's IRB requirements. I hope you will find the information useful.

Again, please receive my sincere gratitude for your participation in my thesis investigation and for your prompt response.

Jacqueline A. Juhl, RDH, BS,
MSDH Student

Appendix B Author Guidelines

Appendix B Author Guidelines

Author Guidelines for the International Journal of Dental Hygiene

International Journal of Dental Hygiene

The Official Journal of the International Federation of Dental Hygienists (IFDH)

Edited by:

Prof. Kerstin Öhrn

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TopAuthor Guidelines

Content of Author Guidelines: 1. General, 2. Ethical Guidelines, 3. Manuscript Submission Procedure, 4. Manuscript Types Accepted, 5. Manuscript Format and Structure, 6. Checklist for Authors. 7. After Acceptance.

1. GENERAL

International Journal of Dental Hygiene publishes full-length research papers, review articles, case reports, project reports, short communications, letters to the editor and professional issues related to dental hygiene and oral health

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2. ETHICAL GUIDELINES

International Journal of Dental Hygiene adheres to the below ethical guidelines for publication and research.

2.1. Authorship and Acknowledgements

Authors submitting a paper do so on the understanding that the manuscript have been read and approved by all authors and that all authors agree to the submission of the manuscript to the Journal.

International Journal of Dental Hygiene adheres to the definition of authorship set up by The International Committee of Medical Journal Editors (ICMJE). According to the ICMJE authorship criteria authorship should be based on 1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content and 3) final approval of the version to be published. Authors should meet conditions 1, 2 and 3.

As of February 1st, 2012, it is a requirement that the corresponding author submit a short description of each individual's contribution to the research and its publication. Upon submission of a manuscript all co-authors

should also be registered with a correct e-mail addresses. If any of the e-mail addresses supplied are incorrect, the corresponding author will be contacted by the Journal Administrator.

It is a requirement that all authors have been accredited as appropriate upon submission of the manuscript. Contributors who do not qualify as authors should be mentioned under Acknowledgements.

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5.1. Format

Language: The language of publication is English. Authors for whom English is a second language must have their manuscript professionally edited by an English speaking person before submission to make sure the English is of high quality. A list of independent suppliers of editing services can be found at

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All manuscripts submitted to *International Journal of Dental Hygiene* should include title page, abstract, main text, references and tables, figures, figure legends and acknowledgements as appropriate:

Title Page: should contain an informative title, author(s) names and their affiliations. Name, address, telephone and fax numbers and e-mail address of the corresponding author. If the title exceeds 40 characters (letters and spaces) a running title of no more than 40 characters must be supplied. Financial support should be acknowledged as a footnote to the title. Also provide 3-10 key words that will assist indexers in cross-indexing the article. Use terms from the Medical Subject Headings list from Index Medicus whenever possible.

Abstract: should not exceed 250 words and should be arranged in a structured fashion (to include objectives, methods, results and conclusions.) It should state the purpose of the study, basic procedures (study subject/patients and methods), main findings (specific data and statistical significance), and principal conclusions.

Main Text of Original Articles should include introduction, study population and methodology, results and discussions.

Clinical Relevance: This section is aimed at giving clinicians a reading light to put the present research in perspective. It should be no more than 100 words and should not be a repetition of the abstract. It should provide a clear and concise explanation of the rationale for the study, of what was known before and of how the present results advance knowledge of this field. If appropriate, it may also contain suggestions for clinical practice. It should be structured with the following headings: scientific rationale for study, principal findings, and practical implications. Authors should pay particular attention to this text as it will be published in a highlighted box within their manuscript; ideally, reading this section should leave clinicians wishing to learn more about the topic and encourage them to read the full article.

Introduction: Present the background briefly, but do not review the subject extensively. Give only pertinent references. State the specific questions you want to answer.

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Standard journal articles

1. International Steering Committee. Uniform requirements for manuscripts submitted to biomedical journals. N Engl J Med 1997; 336: 309.

2. Carl DL, Roux G, Matacale R. Exploring dental hygiene and perinatal outcomes. Oral health implications for

pregnancy and early childhood. AWHONN Lifelines 2000 Feb-Mar;4(1):22-7.

Books

3. Koch G., Poulsen S. Pediatric Dentistry: a clinical approach. Copenhagen: Munksgaard, 2001.

Chapter in a book

4. Bergenholtz G, Hasselgren G. Endodontics and Periodontics. In: Lindhe J, Karring T, Lang NP, editors. Clinical Periodontology and Implant Dentistry. Copenhagen: Munksgaard, 1997: 296-326.

Proceedings

5. Schou, L. Behavioral aspects of dental plaque control measures: An oral health promotion perspective. In: Lang, NP, Attstrøm, R, Løe, H, editors. Proceedings of the European Workshop on Mechanical Plaque Control, Quintessence, 1998: 287-99.

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- Study population and methods
- Results
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Conflict of Interest and Sources for Funding

- Acknowledgements

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Title Page of Manuscript

Title: Geographic Comparisons of

WA NTDC ED Patients

Running Title: Washington State NTDC ED Patients

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Title Page of Manuscript

Title: Geographic Comparisons of Washington State Non-Traumatic Dental Complaint Emergency Department Patients

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Manuscript Abstract

Objectives: The investigation compared geographic differences in demographic profiles, institutional administrative experiences, and clinical experiences of Non-Traumatic Dental Complaint [NTDC] patients presenting to rural-to-urban (RTU) and urban (URB) communities in Washington State from March 2012 to March 2013. For this retrospective study, 1380 NTDC patients comprised the sample.

Methods: After IRB approval, (HSC #4005), data were electronically extracted from 1183 URB and 197 RTU de-identified patient records and analyzed using a Pearson Chi-square analysis, and Fisher's Exact test with a 0.05 alpha level.

Results: Statistically significant differences between geographic sites were found in: ages ($\boldsymbol{x}^2$ = 75.761, p = 0.001, df = 7), sex (p = 0.007), and numbers of NTDC ED patients (x^2 = 7.527, df = 1, p=0.006); month of the year these patients presented to EDs (x^2 = 192.328, df = 11, p = <0.001); and patient ICD-9 code category diagnoses (Code 525 p<0.001; Code 522 p<0.000; Code 520 p<0.001; Code 784.2 p=0.010; Code 873.63 p<0.001).

Conclusions: Address of this investigation's findings are needed: 1) geographically specific patient profiles, ED use, admissions, and diagnostic patterns must be considered for ED staffing purposes, healthcare funding, and policy development; 2) strategies to ensure appropriate and accurate provider utilization of diagnostic codes and comorbidities-oral disease inter-relationships are needed to improve NTDC patient outcomes; 3) cost-effective ED workforce models to improve NTDC ED patient diagnoses and outcomes should be implemented; and 4) renewed efforts to improve equitable oral health access and outcomes are urgently needed. Ineffective ED treatment and unnecessary suffering by NTDC patients can no longer be tolerated.

Keywords: emergency department, rural-to-urban commuting, non-traumatic dental complaint, urban, uninsured

Geographic Comparisons of Washington State Non-Traumatic Dental Complaint Emergency Department Patients

Introduction

Geographic residency is a consideration in understanding the growing use of emergency departments (EDs) for Non-Traumatic Dental Complaints [or Condition] (NTDC). (1-4) The U.S. economic crisis has increased pressure on public and private sector fiscal resources and negatively impacted access to preventive and routine dental care. Concomitantly, preventive care has been denied to many of the most vulnerable in our society. (5-9) More than 100 million Americans cannot access dental care and suffer dire health consequences; some, even death (3,4,10). In excess of 47 million people live in geographic areas where access to oral healthcare is difficult or unavailable. (11-13) Investigators have established that, without other perceived recourse, patients with severe dental pain not caused by trauma--NTDC patients--seek care in EDs for pain relief. (2,12-16) Some question the efficacy and appropriateness of ED treatment for NTDC patients by non-dental professionals. (12,14,17-19) The cost of loss of productivity, missed education, social implications of dental pain and tooth loss, quality of life issues, and increased risk of systemic co-morbidities and death was estimated at 164 million USD (20) A survey of 53 Washington State Hospitals reported that more than 23,000 ED visits for NTDC occurred in an 18 month period between 2008-2009 at a cost of 36.3 million USD. (21)

Review of the current literature relevant to NTDC utilization of ED as a primary resource for oral healthcare paints a sobering picture of suffering and fiscal burden on the present U.S. oral healthcare delivery system and its low priority in the national awareness. Despite calls for reform from national healthcare agencies and scientists, the current protracted economic downturn has undermined progress. (1-3, 5) Juxtaposed with mounting scientific evidence of oral and systemic health inter-relationships, lagging support for oral healthcare reform needed most

by the vulnerable in society is disturbing. The impact of this shortfall is born more heavily on the most vulnerable and disenfranchised, and those in varying geographic locations. (1, 9) Without adequate functioning community resources and safety nets, the most vulnerable are forced to seek relief from pain resulting from preventable oral disease by utilizing the most expensive and least effective resource, hospital emergency care. (3, 4, 11) While the literature describing this national situation is extensive, few details are known about how populations, providers, and treatments vary across the geographic spectrum of population densities; thus, indicating a need for further research of the impact of geographic residency as a possible factor influencing NTDC ED utilization.

This study used Rural/Urban Commuting Areas (RUCA) classifications (22) to gain insight to the experiences of these populations. Washington State contains a variety of RUCA classification areas. Although some studies of NTDC patients have been reported in the literature, the phenomenon has yet to be considered in the context of rural-to-urban (RTU) and urban (URB) NTDC patient experience comparisons nor has it been assessed in Washington State due to a lack of research funding (Reed, J. Washington State Department of Health, 22 May 2013). It follows that, since most dental pain is preventable, (2,12-16) seeking care in an emergency setting for severe dental pain is considered behavior that results from a complex set of circumstances and perceptions, including the lack of access to oral healthcare in rural and urban populations, oral health literacy, dental providers and their maldistribution. (1-4,12-16, 22) In Washington State, *all* 39 counties are designated Dental Health Professional Shortage Areas (DHPSAs), contributing to access to oral healthcare challenges. (23) Residency in a DHPSA presents unique challenges to achieving and maintaining optimal oral health. (24) The United States Department of Human and Health Services [USDHHS] designates a county's DPHSA status by calculating the ratio of its population to the number of dentists, along with consideration of other population-specific factors. Each DPHSA is given several different scores from zero to 26 indicating need and depending on the types of at-risk populations each county contains. (24) Specific at-risk or disadvantaged populations might

include large concentrations of immigrants, Native American Tribal populations, Low Income/Farm Worker populations, or geographic isolation areas. A score of greater than 10 is considered high and represents the lack of access to care. The county in which the RTU site is located has been designated by the USDHHS as a DHPSA with five DHPSA category scores from 12 to 21. The DHPSA category scores for the URB site county ranged from 12 to 23.

Morrill (25) demonstrated that, in Washington State, as geography differs, population concentrations differ. Sparse population densities have fewer oral health resources and might need to access hospital settings for care. Therefore, the purpose of this study was to the investigate the differences in RTU and URB NTDC patients presenting to two Washington State hospital Emergency Department [EDs] based on their geographic location.

Study Population and Methodology

This quantitative retrospective study used de-identified patient record numbers from NTDC ED patients presenting to the sample institutions over a period of twelve consecutive months, from March 2012 through March 2013. This study met conditions for exemption certification from the Idaho State University Institution Review Board, (HSC #4005). The collection of de-identified patient data and ages were identified only by range to ensure patient confidentiality and anonymity.

The independent variable (geographic residency) and the dependent variables (demographic variables, institutional administrative variables, and clinical variables) were electronically extracted from records of NTDC patients presenting to a RTU and an URB EDs in Washington State. Table 1 delineates the dependent variables. The dependent variables selected for this investigation were based on voids in current literature on the subject.

Both descriptive and inferential statistics were used in the analysis of data. Descriptive statistics were employed to summarize the nominal and categorical data. A Pearson chi-square test of independence was used for analysis

of the dependent categorical variables of age, month, and day of the week the NTDC patient presented to the ED, and type of treating provider. A Fisher's Exact test for independence was used to analyze the nominal variables of ICD-9 codes, gender, and patient hospital admission status. The alpha level was established at $p \leq .05$.

Results

From the RTU site, data from 197 NTDC ED patient records were electronically transmitted for analysis. From the URB site, 1,711 ED patient records were electronically transmitted for analysis, of which only 1,183 were found to be NTDC patient records. Data are presented according to each research variable.

Table 2 presents age ranges for NTDC patients presenting to RTU and URB EDs. As can be seen from this table, the peak age distribution in both sites were patients in the 21-40 year range. A Pearson Chi-Square test for independence revealed a significant difference in RTU and URB age distributions ($\boldsymbol{x}^2 = 75.761$, $p = 0.001$, $df = 7$). Twice as many of the youngest RTU NTDC patients presented to EDs than did their URB peers. Conversely, *half* as many of the *oldest* RTU NTDC patients presented to ED than did their URB counterparts.

Findings of this study showed that RTU females represented 47.2% (n= 93) of the sample while RTU males consisted of 52.8% (n=104). Females represented 36.9% (n=437) of the URB sample while males represented 63.1% (n=746) respectively. Therefore, male NTDC patients comprised the majority of NTDC patients at both RTU and URB ED sites. Furthermore, a higher percentage of URB male NTDC patients visited the ED than did RTU male NTDC patients. Using a Fisher Exact Test for independence ($p=0.007$), a significant difference was found between the geographic male and females patients.

No statistical analysis was possible for either variable of race or ethnicity due to data inconsistencies received from each site.

Table 3 provides a summary of administrative experiences and clinical experiences of the RTU and URB sites which were not statistically analyzed. Of the 197 NTDC patients utilizing the RTU ED, only one (0.5%) patient returned for one additional NTDC visit. Of those 1183 URB NTDC patients, only 94 (7.95%) had return ED visits. These visits ranged from one to four visits per patient with one patient returning 18 times during the research period. Specifically, 92.5% (n = 1089) of NTDC patients had one visit, 6.5% (n = 77) had two visits, 0.93% (n = 11) had three visits, and 0.42% (n = 5) had four visits within the study period. Though multiple visits occurred in 1183 URB NTDC patients, only data from first ED visits were used in this study for all statistical analysis.

The peak month of RTU NTDC ED utilization was May (*n*=27, 13.7%) while the lowest utilization occurred during the months of March and September (*n*=6, 3.0% in both months). In comparison, the peak month of URB NTDC ED utilization was April (*n*=208, 17.6%) while the lowest utilization occurred in August and November (*n*=0, 0.0% in both months). The Pearson Chi Square test for independence was used to compare month of year between geographic locations. Statistical significance was found between geographic locations based on month of the year in which NTDC patients presented to the respective EDs (x^2 = 192.328, *df* = 11, *p* = <0.001).

Most NTDC patients at RTU site presented to the ED on Thursdays (20.8%, *n* = 41); whereas, at the URB location, NTDC patients visited the ED on Mondays (16.2%, *n* = 192). The Pearson Chi Square test for independence was used to compare day-of-the-week with geographic location. No significant differences were found between the day-of-the-week NTDC patients presented to the EDs and geographic location (x^2 = 7.672, *df* = 6, *p*=0.263).

In this investigation, most RTU NTDC patients presented to the ED from noon to 3:59 p.m. The next most reported time of day was from 4:00 p.m. to 7:59 p.m. No data concerning time of day were provided by the URB site; therefore, no statistical comparison could be made between the two sites.

Only one (0.5%) RTU NTDC ED patient was admitted to the hospital. In the URB sample, 154 (13%) NTDC ED patients were admitted to the hospital. Since only data from the first ED visits were used in this study, and hospital admissions occurred after the first visits in some cases, no statistical analysis was performed for hospital admissions. Additional data relevant to each admission, such as specifics of the patient's condition at the time of admission, was not sought for this investigation**.**

As described in Table 3, ED treatments, diagnostics or prescriptions provided to NTDC patients were not provided by either site. NTDC ED Patient Comorbidities requested for this study were for malignancies, diabetes, mental illnesses, hypertension and cardiovascular diseases, pulmonary diseases infectious diseases, and for pregnancy. Only the RTU site provided data on NTDC ED patient comorbidities, as also shown in Table 3. The three most frequently diagnosed comorbidities found in 197 RTU NTDC ED patient records were the following categories: 1) mental illnesses ICD-9 code 305.1, tobacco abuse/addiction: (*n*=169, 85.8%) and other mental conditions such as developmental conditions and psychoses (n=4, 2%); 2) diabetes category (*n*=8, 4.1%); and 3) hypertension and cardiovascular diseases category (*n*=7, 3.6%). Because data concerning co-morbidities were not provided by the URB site, no statistical comparisons can be made between co-morbidities and geographic location.

Table 3 also illustrates the type of ED providers included in this investigation. ED providers for this study were identified as the five following types: physicians, physician assistants, nurse practitioners, dentists and oral surgeons, and medical residents. Provider type data were furnished only by the URB site and revealed that physicians conducted 51.1% (n=605) of diagnoses, physician assistants conducted 23.1% (n=273), nurse

practitioners conducted 23.4% (n=277), and dentists and oral surgeons conducted 1.3 % (n=15), similar percentages as medical residents 1.1% (n= 13). Since data on provider type for the RTU site were not available, it is unknown if differences in ED provider type influenced actual NTDC patient diagnoses.

It is important also to note that in the RTU sample, multiple ICD-9 code diagnoses were given for all patients while only one was given for each URB patient. Table 4 presents the results of ICD-9 diagnostic code utilization for both RTU and URB sites by medical and dental ED providers. This table also provides definitions of ICD-9 code categories and the range of ICD-9 codes found within each category used in the study. As can be seen from this table, a preponderance of 525 category diagnosis codes were found to be used by the RTU and URB total providers, followed by utilization of the 522 and 520 diagnosis codes. Lesser utilized ICD-9 code categories included 784.2 and 873.63. A Fisher's Exact test for independence revealed significant differences between the RTU and URB sites in five ICD-9 code categories (Code 525 $p<0.001$; Code 522 $p<0.001$; Code 520 $p<0.001$; Code 784.2 $p=0.010$; Code 873.63 $p<0.001$). No significant differences were found using the Fisher's Exact test for independence in the 523 and 682 categories. ICD-9 code 524 was not utilized sufficiently by either site to meet required Fisher's Exact test for independence statistical analysis assumptions.

Discussion

The present study provides new insights to complex and expensive oral health and fiscal problems of NTDC patients seeking care in EDs in Washington State. Both research sites are located in geographic areas declared DPHSAs by the USDHHS (23). Residency in a DHPSA presents unique challenges to achieving and maintaining optimal oral health. (28) The DPHSA scores ranges for the RTU and URB sites respectively are 12 to 21and 12 to 23 for portions of their populations. In Washington State, *all* of its 39 counties are designated DSHPAs, with 32 counties having scores of 10 or higher. The highest scores are found in geographically isolated counties which contain large impoverished and/or Native American populations (29, 30). It has been posited that

provider distribution could be affected by population concentration possibly exacerbating NTDC ED utilization. (2, 22)

Analysis of RTU and URB differences found in the age variable might be seen as an indicator of each area's oral health resources or access to resources. The majority of NTDC ED patients presenting to both sites were between 21 and 70 years of age (RTU *n*=175, 88.8%; URB *n*=1163, 98.3%) with the highest single age group being the 21-30 year olds (RTU n=67, 34.0%; URB *n*=347, 29.3%). The results of this investigation indicate that the majority of patients in this age group were treated for retained dental roots, tooth and supporting structure disorders, and soft tissue abscesses which require time to develop and are preventable by regular preventive oral healthcare (3, 4). Without an established dental home, as stated previously, NTDC patients from the 21-70 age group would be likely to seek dental pain relief in EDs due to the scarcity of dental providers willing to accept them as patients. Guay (22) and others (9, 14, 16, 19) posited reasons for a lack of a dental home stating that many dental providers will not accept Medicaid patients and have remuneration policies which are beyond the ability of patients of middle or low incomes and further stated that many of these providers have inflexible emergency policies. Additionally, the availability of providers for any NTDC patients varied between sites. Of the 45 RTU area general dentists, only eight were pediatric dentists, and there are no specialists in geriatric dentistry. (26) In contrast, the URB area has 120 dental practices willing to treat children from infancy to less than 19 years old, and 1,700 dentists of varying practice types, only 50 of who are willing to accept adult Medicaid patients. (27)

Analysis of the demographic variable of sex differed from most other NTDC studies (14, 15, 29, 31-33) except for a recent Oregon State study, which also found more male NTDC ED utilization. (34) While other NTDC studies indicated higher NTDC ED use by females, this investigation indicated more male NTDC ED use occurred. (2,12,16-19, 24, 25, 29, 32) The preponderence of male NTDC ED patients might also be a function of

oral health resource availability, including access to transportation or infrastructure, or, as McCaughan and McKenna (36) indicated that males are more likely to delay treatment more frequently than women.

No statistical analysis was possible for either variable of race or ethnicity due to data inconsistencies received from each site; although, Sun and Chi (34) and Hong (35) found that whites were more likely to use EDs for NTDCs than other races, while other researchers (14, 15, 39-41) found blacks to more frequently use EDs for NTDCs . Consequently, information which might contribute to development of improved Washington state oral health care policies and funding based on what is known about the oral health needs of specific NTDC ED populations invites further study.

The return visits to ED rate of the two sites were very different; only one (0.5%) RTU geriatric patient who had several comorbidities returned to the ED, while 94 URB (7.95%) had return ED visits. From data collected in this investigation, it cannot be determined if the return visits by the URB patients were related to dental complaints for the same or multiple dental problems; although, Sun and Chi (34) attributed proximal residence to an ED as a contributing factor in understanding return visit rates. Further investigation might determine if the quantitative differences seen in the return ED visit rates provide more detailed clues to demographics, oral health literacy, or oral health resource availability differences between the two geographic areas. Such data might clarify specific policy development and oral health access and resource funding needs.

Knowing the time of day NTDC ED patients are most likely to present to EDs might assist optimal hospital staffing. Though time of day statistical comparison was not possible between the two geographic areas, it is worth considering what was learned from data collected from the RTU site. While Cassamassimo et al. (37) and Shortridge and Moore (3, 4) concluded that NTDC patients might delay seeking treatment until after working hours to avoid loss of wages or when transportation or child care are available from others, this study indicated that most RTU NTDC ED patients were men aged 20-59, presenting on Thursdays from noon to 3:59 p.m.

Collection of similar data in further studies might provide evidence for ED staffing which would include oral health providers capable of conducting and providing appropriate diagnostics, treatment, and medications upon which evidence-based clinical decision would be based. This, in turn, could result in improved patient outcomes. Similar considerations of data for day of the week and month of the year might be applied for future hospital staffing particularly in rural farming communities such as the RTU site which experiences seasonal population flux due to seasonal agricultural workers.

While only slight differences were observed in the day of the week NTDC patients presented to URB and RTU sites, a subtle pattern of increased RTU patient ED utilization was observed in the months of April through August, possibly associated with this community's robust agricultural season. During these months, an increase of RTU NTDC ED utilization was observed likely due to an influx of minority seasonal workers and a local lack of infrastructure inhibiting access to regular preventive oral healthcare care.

Perhaps the most significant finding of this research can be found within the surprisingly few numbers of periodontal diagnostic codes reported (ICD-9 codes 523-523.9: RTU: 6.1%, *n*= 47; URB: 9.6%, *n*=113). These results differed from results found by Ekee, et al.(42) who, using the 2009 and 2010 National Health and Nutrition Examination Survey database, found that over 47% of the U.S. population had some form of periodontal disease. Results of the current investigation suggest three questions for consideration: 1) Were patients in this study under-diagnosed for periodontal diseases because appropriate diagnostics were not conducted?, 2) If diagnostics tests were conducted by ED personnel, were they accurate? and 3) Were diagnoses assigned based on provider preference?

Without the presence of qualified personnel in the RTU or URB EDs to conduct appropriate oral diagnostics, the number of ICD-9 codes for periodontal disease presented in this study might not accurately reflect the NTDC patient disease experience. If, indeed, the diagnoses found in both sites *were* based on appropriate and accurately

conducted diagnostics, and using the largest age group (21-30 year olds) as an example, the first visit ICD-9 code-diagnoses-by-age analysis in this investigation revealed that 84% (*n*= 56) of the RTU sample had a primary diagnosis of ICD-9 525 category while 48.4% (*n*= 168) of the URB sample had a primary diagnosis of ICD-9 525 category, results which were consistent with another northwestern U.S. study. (34) Given these findings, it would appear that, indeed, periodontal disease is under-diagnosed in this age group. Further, these findings might be the result of the non-fluoridated public water supply found in the RTU county and the fluoridated water supplies found in the URB public water system.

Additionally, the range of ICD-9 diagnostic codes used by providers was less in the RTU sample while a broader range was used by providers in the URB sample. In the RTU sample code categories 523, 524, 683, 784.2 were not used for any NTDC patients while all ICD-9 code categories were used by providers in the URB sample. The significance of these results might relate to provider preference.

Further, evidence-based practice dictates assigning diagnoses (and, therefore, diagnostic codes) *after* diagnostic tests have been conducted and analyzed (43-44) rather than *assigned* to (NTDC ED) patients by providers based on the experience or preference (20) of providers who lack sufficient expertise to make such diagnoses. (12, 14-16, 20, 22, 29, 31-33) Accuracy of diagnosis requires the availability of ED personnel who are professionally educated in evidence-based data collection to accurately perform appropriate diagnostic tests, assessments, and treatment of NTDC ED patients. Without the requested diagnostic testing and treatments data from both the URB and RTU sites, required in evidence-based practice, the validity of ED NTDC diagnoses is questionable. If changes to improve NTDC ED patient outcomes are to be made in the future, staffing EDs with personnel possessing the education and skills to appropriately diagnose and treat NTDC patients is essential. (2, 16-25) This situation further suggests the need to implement a workforce model found internationally and only rarely in the U.S. which includes staffing of hospital-based dental hygienists who would be available for ED service. (47, 49-52) These dental hygienists could be aided by the use of teledentistry technologies as suggested by Salazar-

Fernandez et al. (53) and Summerfelt (54). Allareddy et al. (32) noted that emergency physicians most often do not use evidence-based research to diagnose NTDC patients presenting to EDs. The veracity of assigned ICD-9 codes for diagnosis of NTDC patient complaints without the use of appropriate diagnostic tests, possibly based instead on physician reliance on personal experience or examination, might reasonably be questioned.

While comorbidity data were provided by the RTU site, comorbidities of the URB NTDC ED patients might have provided insights to (a) the relationship between comorbidities and dental disease at the time of hospital admission or (b) future preventive strategies for patients experiencing specific comorbidities and dental diseases. Considering that there was only one admitted NTDC ED patient at the RTU site which provided comorbidity data and 94 first visit NTDC ED patient admissions at the URB site which did *not* provide comorbidity data, no conclusions can be drawn regarding any oral-systemic disease inter-relationships which might have contributed to the admission. The lack of comorbidity data from *both* sites prevented statistical analysis which might have provided insights to oral and systemic disease interactions in these groups. However, inferences might be drawn about possible oral disease-oral health literacy-life-style correlations relevant to the frequency of the RTU diagnoses for periodontal diseases, cellulitis, and head, neck, and facial swelling, especially in light of the high percentage of tobacco abusers indicated by ICD-9 code 305.1 in this population was 83% (n = 142 of 179).

Efforts were made to ensure consistency of data reported from each site, however inconsistencies between the data requested and the data received resulted in significant study design modifications. Such inconsistencies are an inherent risk of the use of secondary data such as hospital records or databases. (55-57) Comorbidities of URB patients was requested of the URB hospital personnel. They instead extracted requested *types* of comorbidity data from *any* ED patient record from the requested time period. Unfortunately, these data were not useful for this investigation's purposes. Requested race, prescriptions, and treatment data from both institutions also contained inconsistencies or were not provided which necessitated data analysis modification.

It is acknowledged that the use of a convenience sample would possess a risk of bias because the patients who presented to ED with NTDC might have been a group non-representative of the general population. As noted by Schneeweiss & Avorn (56) and Cox et al., (57) using secondary data have intrinsic limitations, but can also yield unexpected results worth consideration for future research. Washington State has 39 counties which vary widely in demographics, economics, and geographic characteristics. Examination of only two counties provided limited information to the true extent of NTDC ED utilization in Washington State.

Conclusions

Several conclusions might be drawn from this investigation. First, differences in demographic populations who utilize EDs for NTDC might be considered for future ED staffing purposes, healthcare funding and policy development. Secondly, strategies to ensure appropriate and accurate provider utilization of ICD-9 or other future diagnostic codes relevant to dental complaints should be instituted to improve patient outcomes. To this end, new cost-effective ED workforce models might be included to improve NTDC ED patient diagnoses and outcomes. (47, 49-54) Such models could include licensed oral health professionals such as registered dental hygienists or mid-level dental hygiene practitioners who are thoroughly educated and qualified to conduct such diagnostics in non-traditional settings. (43-44, 47, 49-54) Thirdly, the inter-relationships of comorbidities and oral diseases should be considered in the treatment of NTDC ED patients to further optimize patient outcomes. (58-60) Further study to achieve such improvements is clearly warranted and present practices appear to only perpetuate expensive and poor NTDC ED patient outcomes.

Finally, though the initiation of the Affordable Care Act and healthcare reform for medical treatment are a beginning, it is well established that provisions for consistent, regular, preventive care are still inadequate. These preventive deficits contribute to oral health care benefit voids which, in turn, contribute to the mounting inefficacy and waste of NTDC ED utilization. Renewed national and state-wide effort toward improvements in

oral health literacy and cultural competency education for providers will contribute to improved oral health outcomes by improving (1) the desire for preventive care from providers, and (2) skills in appropriately communicating needed patient education and services as documented in this research. In Washington State, and in the U.S. as a whole, the waste of ineffective ED treatment and unnecessary suffering by NTDC patients can no longer be tolerated.

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Table 1. Research Variables

Demographic Profiles	Institutional Administrative Experiences	Clinical Experiences
Age	Return Visits to ED Rate	Providers
Sex	Day of the Week	ICD-9 Codes
Ethnicity	Time of Day	Co-morbidities
Race	Month of the Year	Treatment
	Hospital Admissions	Prescriptions

Table 2. Age Range Results[a]

Age Range	RTU		URB	
≤ 10	*n* = 16,	8.1 %	*n* = 8,	0.7%
11-20	*n* = 13,	6.6 %	*n* = 50,	4.2 %
21-30	*n* = 67,	34.0 %	*n* = 347,	29.3%
31-40	*n* = 47,	23.9 %	*n* = 290,	24.5 %
41-50	*n* = 32,	16.2%	*n* = 290,	21.7 %
51-60	*n* = 12,	6.1%	*n* = 175,	14.8 %
61-70	*n* = 4,	2.0 %	*n* = 44,	3.7 %
≥ 70	*n* = 6,	3.0 %	*n* = 12,	1.0 %

[a] Pearson x^2= 75.761, *p*=0.001, *df*=7

Table 3. Summary of Other Research Variables [a]

Administrative Experiences		
	Rural-to-Urban Commuting	**Urban**
Rate of Return Visits	*n*=1, 0.5%	*n*=94, 7.95%
Peak Month of ED Utilization	May: *n*=1, 0.5%	April: *n*=208, 17.6%
Peak Day of the Week of ED Utilization	Thursday; *n*=41, 20.8%	Monday; *n*=192, 16.2%
Peak Time of Day of ED Utilization	12:00pm - 3:59 pm	data unavailable
Admissions	*n*=1, 0.5%	*n*=154, 13.7%
Clinical Experiences		
	Rural-to-Urban Commuting	**Urban**
ED Treatment, Diagnostics or Prescriptions provided to NTDC patients	data unavailable	data unavailable
NTDC ED Patient Comorbidities	Extensive data provided: Most frequent of 197 records: Tobacco addiction/abuse: *n*= 169, 85.8% Diabetes: *n*= 8, 4.1% Cardiovascular: *n*= 7, 3.6%	data unavailable
Provider Types		
Physicians	data unavailable	*n*=605, 51.1%
Physician Assistant		*n*=273, 23.1%
Nurse Practitioner		*n*=277, 23.4%
Dentist or Oral Surgeon		*n*=15, 1.3%
Other (medical resident)		*n*=13, 1.1%

[a] For valid statistical comparison, only first visits were compared because only the URB site had multiple return visits

Table 4. Site Comparison First Visit ICD-9 Dental Codes Utilization and Analysis Data Summary (df=1)

First Visit ICD-9	ICD-9 Code Range	Description	RTU *n*	RTU %	URB *n*[a]	URB %	Fisher's Exact Test *(2 sided)*
ICD -9 520	520 521 - 521.9	Diseases of hard tissues of the teeth	47	18.2%	113	9.6%	<.001[b]
ICD -9 522	522 - 522.9	Diseases of the pulp and perioapicacl tissues	32	12.4%	362	30.6%	<.001[b]
ICD -9 523	523 - 523.9	Gingival and periodontal diseases	12	.39%	37	3.1	.057
ICD -9 524	524.60	Temporomandibular joint disorder, unspecified	0	0.0%	5	0.4%	1.000
ICD -9 525	525.3 and 525.9 and 528.3	Retained dental root and unspecified disorder of the teeth and supporting structures; and cellulitis and abscess of oral soft tissues	163	62.9%	525	44.4%	<.001[b]
ICD -9 682	682	Cellulitis and abscess of unspecified sites	1	0.039%	44	3.7%	0.015[b]
ICD -9 784.2	784.2 and 784.92	Swelling, mass, or lump in head and neck; and jaw pain	4	1.5.0%	3	0.3%	0.010[b]
ICD -9 873.63	873.63	Internal structures of mouth, without mention of complication, broken tooth	0	0.0%	80	6.8%	< .001[b]
ICD-9 Codes counted but not analyzed			0	0	14	1.2%	

[a]Multiple dental ICD-9 code diagnoses per patient,
[b] Statisically significant results