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Hospital Based Emergency Department Visits With Dental Conditions: Outcomes and Policy Implications in the States of California, Nebraska and New York

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HOSPITAL BASED EMERGENCY DEPARTMENT VISITS WITH DENTAL CONDITIONS: OUTCOMES AND POLICY IMPLICATIONS IN THE STATES OF CALIFORNIA, NEBRASKA AND NEW YORK.

by

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A DISSERTATION

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University of Nebraska Medical Center, June 2017

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DISSERTATION ABSTRACT

The purpose of this dissertation was to present state-level estimates of hospital-based emergency department (ED) visits with dental conditions across all ages in the states of California, Nebraska, and New York. Also, this dissertation examined the outcomes and impact of changes in Medicaid policies on the utilization of ED with dental problems. State Emergency Department Databases (California, Nebraska, and New York), a component of the Healthcare Cost and Utilization Project (HCUP) was used for this dissertation. Dental conditions were identified by using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. High-risk groups visiting EDs with dental conditions were identified. This dissertation highlights the need for the provision of increased resources, such as dental-related preventive programs and community clinics particularly for the high-risk groups who visit ED for dental problems.

LIST OF ABBREVIATIONS

ADA	American Dental Association
ACA	Affordable Care Act
AHRF	Area Health Resource File
AHRQ	Agency for Healthcare Research and Quality
CHCS	Center for Health Care Strategies
CHIP	Children's Health Insurance Program
DAMA/AMA	Discharge Against Medical Advice
DS	Discharge Suppressed
ED	Emergency Department
EHB	Essential Health Benefits
EPSDT	Early and Periodic, Screening, Diagnosis, and Treatment
FIPS	Federal Information Procession Standards
HCUP	Healthcare Cost and Utilization Project
HHC	Home Health Care
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
NCHS	National Center for Health Statistics
NEDS	Nationwide Emergency Department Sample
SEDD	State Emergency Department Database

CHAPTER – 1 BACKGROUND

Importance of oral health

General systemic health and oral health are closely interlinked to each other.[1] There are multiple studies (Surgeon General's first report, 2000) that suggest that dental problems could exert a serious effect on other body functionalities.[1,2] Oral diseases could result in ear/sinus infections, heart and lung diseases and lower the immune system of the body as a whole.[1] Poor oral health not only affects interpersonal relationships at personal and professional fronts but also affects the self-esteem and efficiency of the individual greatly.[1] The long list of issues from bad breath to troubled speaking and displeasing oral visual conditions could drive others away, which in turn would adversely affect the confidence of the person.[3] Learning capabilities and performance productivity would also reduce drastically, especially in the case of children.[3] The pain and the discomfort caused by poor oral health makes it difficult for them to concentrate on studies.[3]

Dental related hospital-based emergency department visits

The number of dental-related hospital-based emergency department (ED) visits has been increasing during the past two decades in the United States.[4,-7] There was a reported 4 percent annual increase in non-traumatic ED dental visits during the period 1997-2007.[5] Specifically for the year 2007, non-traumatic ED dental visits represented 1.4 percent of the overall hospital-based ED visits. In a separate study conducted by the American Dental Association, more than 900,000 ED visits and nearly 13,000 hospital inpatient stays related to dental conditions were reported in the year 2009 alone.[7] The incidence of ED visits for patients seeking dental treatment also increased by 16 percent (from

874,000 to 936,432 visits) between 2006 and 2009.[9] The study also found that the number of patient visits to hospital emergency departments has doubled over the past decade from 1.1 million in 2000 to 2.1 million in 2010. Common oral conditions leading to ED visits are dental caries, pulpal or periapical lesions and gingival and periodontal lesions. Below is an analytical snapshot of the numbers for each of the stated dental disease condition and their related ED costs.

Dental caries – Every year more than 330,000 hospital-based ED visits are attributed to dental caries.[8] A large proportion of these ED visits are made by the uninsured (around 45 percent) and people who have low-income (around 68 percent). Prior published estimates showed that for this cohort the mean annual household incomes were lower than $47,000.[8] The numbers clearly indicate that low-income individuals are postponing routine dental care until pain necessitates and ED visit.

Pulpal or Periapical lesions – Pulpal and periapical lesions result from untreated dental caries. More than 400,000 dental emergency cases, every year, are attributed to pupal or periapical lesions.[9, 10] The incurred total hospital charges are around $163 million with a mean charge of $480 per visit. In the year 2007, almost 8000 patients who made ED visits for pulpal or periapical lesions required hospitalization. A substantial proportion of these patients were uninsured (around 21 percent).[9, 10]

Gingival and Periodontal lesions – Irritation of gingival tissues by plaque causes gingival lesions. Close to 85,000 ED visits are attributed annually to this dental condition.[11] The uninsured account for a large portion of these patients (around 33 percent).[15] Patients who reside in regions where mean annual household income is less than $47,000 account for 53 percent of those presenting to EDs with these conditions.

The total hospital-based ED charges are close to $33 million annually with an average charge of $ 456 per ED visit.[11]

A study conducted by Allareddy et al, examined dental health care costs and effectiveness.[6] They used data from the Nationwide Emergency Department Sample (NEDS) for the years 2008 to 2010 and found that more than 4 million patients have relied on hospital EDs to have their dental problems treated. Results from this study suggested that more than 40 percent of all patients that used EDs for dental-related conditions were uninsured. The estimated cost of dental care services provided to the patients was around $2.7 billion cumulatively which clearly is very high. The ED charges are an overburden on the entire healthcare system and these could have been easily avoided had patients sought periodic preventative oral health care. What is more interesting to note is that the research suggests that hospital-based EDs are not the best settings to treat dental conditions as most of the patients are treated symptomatically using prescription medications and are not provided any definitive care to address the dental conditions.[6]

Dental related hospital-based inpatient admissions

In the year 2008, a total of 50,658 (0.13 percent of all hospital admissions in the US) hospital admissions were primarily attributed to dental-related conditions resulting in a total of 174,496 hospitalization days and hospitalization charge of $1.22 billion.[12] These findings expose the economic burden associated with hospitalizations attributed to dental conditions. These numbers are high considering the fact that dental conditions are typically treated in dental clinics. However, if periodic preventative dental care is not sought then conditions such as dental caries (tooth decay) or gum diseases (gingivitis and

periodontitis) may progress in severity, which may necessitate patients seeking care in hospital-based settings.[12] Hospital based outcomes such as costs, length of stay, and disposition status are dependent on a multitude of factors.[12] Prior studies have shown that patients with infections such as mouth cellulitis and Ludwig angina require hospitalization and are associated with excess length of stay in hospitals, high complication rates, increased utilization of hospital resources, and occasionally even terminal outcomes such as death.[13] Most of these cases could have been avoided if treated by timely interventions. These infections typically tend to be sequelae of untreated dental conditions such as dental caries and pulp and periapical lesions.[1, 13]

Dentally uninsured

Most of the health insurances do not offer dental coverage in their plans. Only a few medical insurance plans reimburse for dental care.[19] The dental insurance plans are very costly and unaffordable for low and mid-level income families. This is the primary reason why as many as 130 million Americans are dentally uninsured[19, 28]. They account for almost one-third of the United States population. Dental insurance presents challenges not only to participant patients but also to suppliers. In many ways, dental insurance is quite different from the regular medical insurance[19]. Dental issues are predictable to a larger extent and pose a much lesser risk when compared to other medical needs. The need for dental procedures is more predictable on a relative basis when compared to other medical procedures[19]. The American Dental Association (ADA) had precisely pointed out this difference when it stated that

> "Most medical needs and treatments are unpredictable, catastrophic, high cost and an insurable risk. Most dental needs and treatments are predictable, non-catastrophic, high cost and low risk."

These stated differences are the main reasons for dental coverage being so unpopular among insurance providers and patients. Predictability combined with low risk has cut down the need for coverage drastically, at least in the patients' minds. Dental insurance is not perceived to be as important as medical insurance[19]. They barely feel the necessity of dental insurance, unless a cavity is expected, which could be easily predicted and avoided by regular care and immediate attention[28]. Most individuals prefer to set aside a certain amount of money for urgent dental care rather than having insurance and pay regularly over the year[28]. They hardly see a financial disadvantage in not having a dental insurance[28]. Hence, there is decreased demand for dental coverage.

Policy implications on oral health care

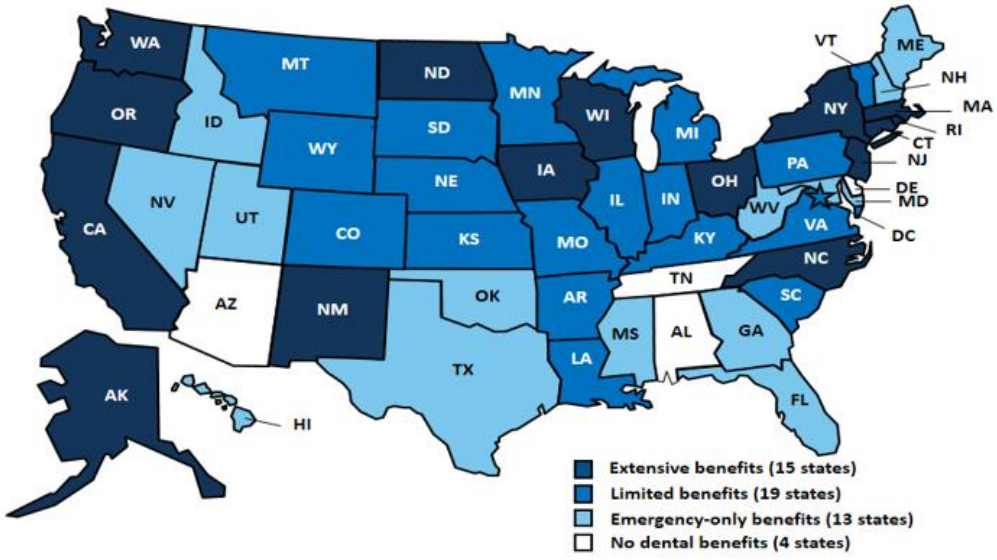
Affordable Care Act (ACA) effects on oral health care – According to American Dental Association, an estimated 6.7 million Americans gained dental benefits from the Affordable Care Act expansion in 2014.[14] An estimated 17.7 million adults are expected to gain some level of dental benefits from the Affordable Care Act by 2018. Of this, 4.5 million adults are expected to receive extensive dental benefits from Medicaid.[15] Since 2014, Affordable Care Act included pediatric dental coverage as a part of the essential health benefits (EHBs). This suggests that small group and certain market health plans are required to cover these benefits. As far as the dental benefit for children is concerned, around 3 million children are expected to gain assistance by the year 2018.[16] One-third will gain Medicaid dental coverage and two-thirds will gain private dental coverage

through health insurance exchanges and employer-sponsored plans. In summary, the percentage of children without dental insurance is expected to be reduced by approximately 55 percent.[16,17] Though there are many perceived advantages of the Affordable Care Act, it actually does very little on the administrative front to resolve the low reimbursement rates, which is the primary reason why many dentists are unwilling to accept Medicaid patients.[18] There is evidence that increasing the reimbursement rates (to match the market rate) and reforming the program structure would increase the Medicaid patient acceptance by the dentists.[17]

Medicaid expansion – Initiated as a joint funded program by state and federal governments in 1965, Medicaid provides healthcare insurance coverage to low-income individuals and families. Medicaid offers assistance to its beneficiaries for dental care. By law, state Medicaid programs are required to provide comprehensive dental benefits for children in all states. Dental benefits for Medicaid adults is optional. Nevertheless, it is the children who benefit the most out of Medicaid dental coverage. Medicaid in association with Children's Health Insurance Program (CHIP) provides them with better care from an early age through the Early and Periodic, Screening, Diagnosis, and Treatment (EPSDT) program.[19, 20, 21] Center for Health Care Strategies (CHCS) categorized dental benefits for Medicaid adults into four categories: No coverage (no dental services covered), Emergency services (services provided for relief of pain under defined emergency situations), Limited services (Fewer than 100 diagnostic, preventive, and minor restorative procedures recognized by the American Dental Association (ADA)), and Extensive services (more than 100 diagnostic, preventive, and minor and major restorative procedures approved by the ADA).[21] As of February 2016, only 15

states provide extensive dental benefits for Medicaid adults and 19 states provide limited dental benefits (Figure 1.1). Following are the four states that do not have any dental benefits for Medicaid adults: Alabama, Arizona, Delaware, and Tennessee. The rest of the states either provide some limited dental benefits or emergency services only. In recent times, many states have changed dental benefits for Medicaid adults especially those faced with financial challenges. In July 2009, California eliminated non-emergency dental services for Medicaid adults.[23, 24] For Medicaid adults, Idaho limited the dental benefits to only emergency services. In recent years, states like Illinois and South Carolina have expanded dental benefits from emergency services only to limited dental services.

Figure 1.1: Medicaid coverage of adult dental benefits, February 2016.



SOURCE: *Medicaid Adult Dental Benefits: An Overview*, Center for Health Care Strategies, Inc., February 2016, http://www.chcs.org/resource/medicaid-adult-dental-benefits-overview/

In conclusion, most of the above stated studies have examined hospital-based ED visits using nationally representative datasets. There are limited studies examining dental-related emergency department visits using state specific emergency department samples. The purpose of this dissertation project is to examine the hospital-based emergency department visits in the states of California, Nebraska, and New York. These three states have different state adult Medicaid policy for dental services. For example, California and New York provide extensive dental coverage, Nebraska provides only emergency services. The study results will support more evidence-based recommendations for developing health policies and interventions to improve access to dental care. The following are the primary objectives for this dissertation –

1. To provide state-level estimates of hospital-based ED visits with dental conditions in three states (California, Nebraska and New York) and examine how dental-related ED visits rates have changed over the study period.

2. To examine the association between patient-related characteristics and hospital emergency department charges with dental conditions.

3. To examine the impact of the elimination of non-emergency dental services for adults in the Medicaid programs in California and reduction in Medicaid reimbursement fee for dental services in the state of New York on the utilization of ED with dental problems.

CHAPTER 2 – CONCEPTUAL FRAMEWORK

The conceptual framework used in the present dissertation for assessing access to dental care and impact of state Medicaid policies for dental care services on the utilization of hospital-based emergency departments with dental conditions is adapted from the Aday & Andersen models (Figure 2.1).

Health policy

This component of the model can be conceptualized as state Medicaid policy (for example, elimination of Medicaid dental benefits for adults, changes in Medicaid reimbursement rate for dental services) to be one of the many factors to influence the utilization of emergency department for dental-related conditions. State Medicaid policy for adult dental benefits varies across the states because these benefits are optional. Medicaid has an important role in covering low-income families. Financial barriers and lack of dental insurance are important reasons for dental care access problems.[2] Most health insurance plans do not offer dental coverage in their plans.[2, 25] Usually, people without any dental insurance are less likely to seek dental care at the dentist office, and thus may visit ED for dental-related conditions as a consequence. [25, 26, 27]

Patient-related characteristics

Potential confounding factors include age, gender, insurance status, patient location, race/ethnicity, income level, and co-morbid burden. Based on the Anderson healthcare utilization model, patient-related characteristics can be divided into three major components: predisposing, enabling and need.[29, 30] The predisposing component include age, gender and race/ethnicity. The characteristics pertaining to enabling are insurance

status, patient location, and income level. The need component describes co-morbid burden.

Access to dental care

Availability of sufficient dentists in all geographical areas is an important component in this conceptual framework. Lack of sufficient number of dentists can be a major factor impacting the utilization of EDs for dental problems. We can hypothesis that dental-related ED visits would be less in the areas where the number of dentists per population is higher.

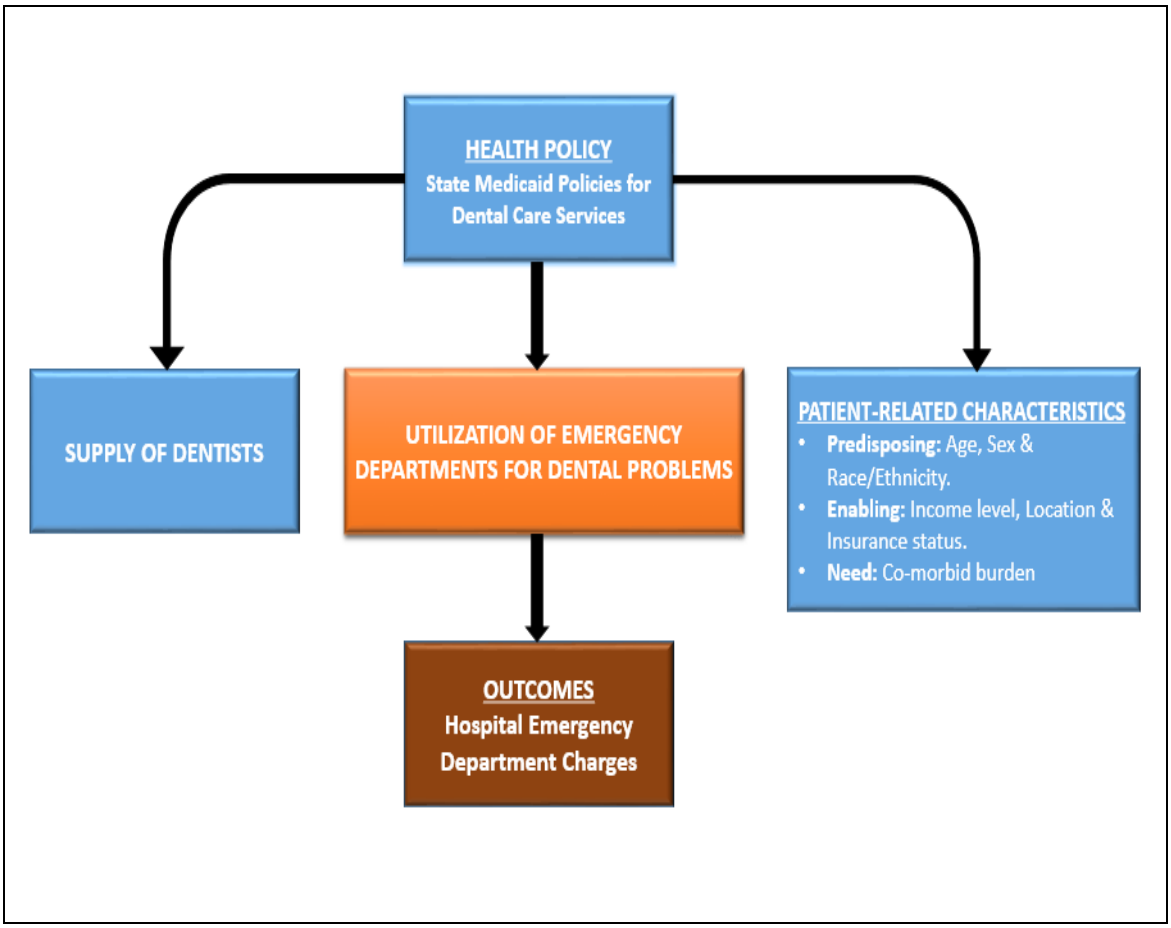
Utilization of emergency departments with dental conditions

We hypothesized that introduction of health policies (changes in Medicaid reimbursement rates for dental services or elimination of Medicaid dental benefits for adults) are likely to increase/decrease hospital-based emergency department visits with dental problems.

Outcomes

Dental conditions are typically treated in dental clinics. Hospital-based EDs are ill-equipped to treat dental conditions. For assessing burden associated with dental-related ED visits, hospital ED charges were used as an outcome measure.

Figure 2.1: Conceptual framework for assessing access to dental care and impact of state Medicaid policies for dental care services on utilization of hospital-based emergency departments with dental conditions.



Note: Adapted from Aday & Anderson Model

CHAPTER 3 - Trends in Dental-Related Emergency Department Visits in the State of California from 2005 to 2011

ABSTRACT

Objective: The objective of this study was to examine hospital-based ED visits with dental conditions in the state of California during the year 2005 to 2011. Also, this study examined the role of patient-related demographic factors on discharge against medical advice

Methods: We used 2005 to 2011 data from California State Emergency Department Database (SEDD). We examined all ED visits related to dental conditions.

Results: In 2005-11, the number of ED visits that were dental-related increased 58%, rising from 44,516 to 70,385 in 2011. These visits accounted for 402,077 dental-related ED visits in California. Most of these visits were for dental caries (44.0%) and pulp/periapical lesions (48.6%) in 2011. Nearly one-third patients visiting the ED were uninsured, and the percentage of Medicaid patients increased from 30.3% in 2006 to 35.1% in 2011.

Conclusions: The number and rate of visits to the ED for dental-related problems have increased substantially in recent years in California. A large proportion of these patients are uninsured and those covered by Medicaid.

INTRODUCTION

Despite the fact that overall oral health has improved over the past few decades, significant oral health problems still remain in the United States.[2] For example, the number of dental-related hospital emergency department (ED) visits has been on the rise.[2,4,5,31] Non-traumatic ED dental visits increased 4% each year from 1997 to 2007.[5] The most common oral conditions for which patients visit hospital EDs are for dental caries and abscesses (e.g., pulpal or periapical lesions, gingival and periodontal lesions).[1,31] Dental caries is one of the most common dental conditions and can be easily treated with dental fillings and routine restorative care if diagnosed at an early stage. However, more than 330,000 hospital ED visits are attributed to dental caries each year.[3] Dental abscesses result in nearly half a million dental-related ED visits.[8, 32] However, an ED visit is unlikely to result in effective treatment of the dental problem. Nearly 90% of patients who visit EDs receive no dental procedures, and most are treated with only prescription medications to manage pain.[2] Consequently, care delivered to patients in the ED is focused primarily on treating symptoms rather than addressing the etiology of the disease.

Regular preventive oral health potentially could avert many of these ED visits. However, lack of access to timely dental care due to uninsurance and out-of-pocket dental expenses, for example, is an important barrier to seeking preventive care.[2] Many private health insurance plans do not include dental coverage except at an additional cost, and dental coverage for adults is not included as an essential benefit under the Affordable Care Act.[33] Although states are required to provide dental benefits to children covered by Medicaid, less than half of states provide non-emergency dental coverage to adults, and

there are no minimum benefits required for states that do provide this coverage.[11] Little information exists concerning multi-year trends in dental-related ED visits among the uninsured and other vulnerable populations in the United States. To address this gap, we used administrative records for every ED visit in the state of California to examine trends in visits related to clinically diagnosed dental conditions for the years 2005 to 2011. We identified the most prevalent dental problems resulting in an ED visit and trends stratified by demographic and access to care characteristics. This study also examined whether certain patient-related factors (insurance status, race/ethnicity, age, sex, and patient location) were associated with being discharged against medical advice following an ED visit. Patients discharged against medical advice are more likely to be non-compliant with health care providers and may be less likely to seek preventive services compared to other patients. Multiple studies have examined discharge against medical advice for various conditions, including asthma, pneumonia, and trauma, showing significantly higher readmission rates and poor outcomes.[34, 35] To our knowledge, the present study is the first to examine whether this is an important issue for dental-related ED visits.

METHODS

Data Source

This retrospective study utilized data for the years 2005 to 2011 from the California State Emergency Department Database (SEDD).[39] The SEDD is a part of the Healthcare Cost & Utilization Project (HCUP) group of databases sponsored by the Agency for Healthcare Research and Quality (AHRQ). For California SEDD, 2011 is the most recent year available from HCUP. It contains information on all visits to hospital-affiliated emergency department visits in the state of California that do not result in

hospitalizations. The SEDD is composed of more than 100 clinical and nonclinical variables for each hospital visit including age, sex, race, age group, insurance status, disposition status and patient location. The HCUP-AHRQ data user agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. Consequently, these were numbers denoted by "DS" (Discharge Suppressed). Because the current study used publicly available data, it was granted exempt status by the Institutional Review Board of the University of Nebraska Medical Center, Omaha, Nebraska.

Measures

We selected all hospital-based ED visits involving patients with any dental conditions in the State of California (years 2005 to 2011) for the analysis. There were no exclusions. Dental conditions were identified on the basis of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. ICD-9-CM codes were used to identify dental-related visits for dental caries, pulp & periapical lesions, gingival, periodontal and mouth cellulitis (Table 3.1). This study examined the characteristics of all ED visits related to dental conditions (including Dental Caries, Pulp & Periapical lesions, Gingival disease, Periodontal conditions and Mouth cellulitis), sex, year of age, expected primary source of payment (Medicare, Medicaid, private insurance, uninsured), race/ethnicity (white non-Hispanic, Black non-Hispanic, Hispanic, Asian, Native American, Other), disposition status (routine, transfer to another hospital, died, home health care (HHC), left against medical advice), and patient location. For patient location, we used six category urban-rural classifications developed by the National Center for Health Statistics (NCHS). Age was categorized into five groups: 0 to 17 years, 18 to 24 years, 25 to 44 years, 45 to 64 years and 65 plus.

Analytical Approach

Descriptive statistics were used to summarize the data. An individual ED visit was the unit of analysis. We presented the total numbers and population-based incidence rates of ED visits based on census estimates stratified by year and clinically diagnosed dental condition for 2005 to 2011. Number and percentage of patients stratified by sex, age, payer, race/ethnicity, and disposition status are also estimated. We also calculated trends in dental-related ED visits by urban versus rural county location. Finally, multivariable logistic regression analyses were used to identify the patient-related characteristics (age, sex, primary payer, race/ethnicity and patient location) that significantly predict discharge against medical advice. Because discharge against medical advice was coded as a binomial variable, a multivariable logistic regression analysis was used to fit the model. All the statistical analyses were conducted using SAS 9.3 (SAS Institute, Cary, NC).

RESULTS

Trends in emergency department visits with dental conditions in California

During the study period (years 2005 to 2011) a total of 64,653,918 ED visits occurred. Of these, 402,077 were due to dental-related conditions examined in the present study (dental caries, pulpal or periapical lesions, gingival conditions, periodontal conditions and mouth cellulitis or abscess) [Table 3.2]. Over the study period, the proportion of ED visits attributed to dental conditions tended to increase. The proportion was lowest in the year 2005 (proportion of ED visits due to dental conditions is 0.52) and highest in the year 2011 (proportion is 0.695). The number of ED visits stratified by year of visit and

clinically diagnosed dental conditions are summarized in Table 3.3. Among these dental conditions, pulp & periapical lesions (48%) were the most frequently diagnosed conditions, accounting for half of all visits. The number of emergency department visits attributed to dental conditions increased from 44,516 in the year 2005 to 70,385 in 2011 (Figure 3.1). In the year 2005, there were 124.2 dental ED visits per 100,000 population in California compared to 186.7 in the year 2011 (Figure 1).

Characteristics of patients visiting emergency department's with dental conditions

The characteristics of patients visiting hospital-based ED's due to dental-related problems are summarized in Table 3.4. Patients were equally distributed by sex with no clear trend over time. The percentage of children (aged less than 18) decreased from 15.9% to 11.5%, while the percentage of adults aged 45 and older increased from 23.0% to 26.3% through years 2005-2011. In all years, Medicaid was the most frequently reported primary payer. The Uninsured also accounted for close to 33% of all dental-related ED Visits. During the study period, the proportion of Whites decreased while the proportions of Blacks and Hispanics increased. About 99% of all dental ED visits resulted in routine discharge, and 0.5% were discharged against medical advice. There was no clear trend in patient disposition over time. The location origin of those visiting hospital based ED's due to dental conditions is summarized in Table 3.5. Metro areas with >=1 million population accounted for close to 45% of all dental-related ED visits.

Characteristics associated with discharge against medical advice

Results from the multivariable logistic regression model examining the association between patient-related characteristics (age, sex, primary payer, race/ethnicity and patient

location) and discharge against medical advice are presented in Table 3.6. Compared with those 45 to 64 years old, those in younger groups were associated with lower odds for discharge against medical advice ($p<0.01$). Female patients were associated with lower odds for discharge against medical advice compared to males (adjusted odds ratio [AOR], 0.88; 95% confidence interval [CI], 0.80-0.97, $p=0.009$). Those covered by Medicare (AOR, 1.56; 95%CI, 1.25-1.95, $p<0.001$), Medicaid (AOR, 1.29; 95% CI, 1.10-1.51, $p=0.001$), Other insurance plans (AOR, 1.38; 95%CI, 1.12-1.69, $p=0.002$), and the uninsured (AOR, 1.78; 95%CI, 1.53-2.06, $p<0.001$), were associated with higher odds for discharge against medical advice compared with those covered by private insurance. Blacks were associated with higher odds for discharge against medical advice compared with white non-Hispanic patients (AOR, 1.27; 95%CI, 1.12-1.45, $p<0.001$). Patients residing in "Fringe" counties of metro areas of >=1 million population, counties in metro areas of 250,000-999,999 population, counties in metro areas of 50,000-249,999 population, micropolitan counties and non-core counties were associated with significantly lower odds for discharge against medical advice compared with those residing in "Central" counties of metro areas of >=1 million population ($p<=0.01$).

DISCUSSION

The current study used data on every emergency department visit not resulting in hospitalization in the state of California to analyze multi-year trends in visits resulting from clinically diagnosed dental conditions. These conditions included dental caries, pulpal, or periapical lesions, gingival, periodontal conditions and mouth cellulitis or abscess. Demographic characteristics, payer status, disposition and location of patients were examined. Results of our analysis indicated that both the number and per-capita rate

of dental-related ED visits have increased substantially over time in California. An increasing number of patients were older, minorities, and covered by Medicare or Medicaid. An increasing percentage of these visits were occurring in large population counties. Multivariable regression modeling also suggested that patients discharged against medical advice were more likely to be male, uninsured or covered by public insurance.

Our finding on the increase in dental ED visits is consistent with prior studies.[2, 4, 5, 38] According to a study conducted by Wall and colleagues, the number of patient visits to hospital emergency departments in the United States doubled over the past decade from 1.1 million in 2000 to 2.1 million in 2010.[5] The same study documented an increase in dental-related ED visits as a share of total emergency department visits, rising from 1.1% in 2000 to 1.7% in 2010.[5] In our study, dental ED visits per 100,000 population increased by 50% after 2005, and the number of these visits surpassed 70,000 per year by 2011. Furthermore, an increasing percentage of these visits occurred among older adults.

Our results also suggest that there was a decline in the proportion of ED visits covered by private insurance, and an increase in ED visits covered by Medicaid. The latter finding may be attributed to the elimination of non-emergency dental services for adults in the Medicaid programs of many states including California. For California's Medi-Cal program, the elimination of this benefit was effective starting July 1, 2009.[24,40,41] A study conducted by Singhal and colleagues examined the impact of the benefit revisions for California's Medicaid adult enrollees.[41] Using ED data, this study suggested that the benefits change was associated with a significant increase in dental ED visits among the Medicaid population.[41] Results from our study also indicated a similar pattern. Our data

show that the proportion of dental ED visits among Medicaid patients increased from 31.9% to 35.1% after 2008. In addition to the elimination of dental services for Medicaid adult enrollees, most dental practitioners are unwilling to provide services to patients unable to pay out-of-pocket or covered by Medicaid.[24] Dentists report being dissatisfied with low reimbursements by Medicaid and also the paperwork involved.[24] The Government Accountability Office (GAO) reports only about one in five dental professionals serve Medicaid patients.[24]

Our study findings show that a major portion of the patients who visit EDs for dental-related issues are uninsured or were insured by Medicaid. For example, we showed that the number of dental visits made by uninsured patients increased from 13,599 (30.6% of all dental ED visits) in 2005 to 22,085 (31.4%) in 2011. Unfortunately, information on dental insurance is not available in our data. Consequently, the number of patients without dental insurance could be much higher than the proportion without health insurance. Most health insurance plans do not offer dental coverage.[24] The dental insurance plans are costly, and thus less likely to be purchased by low and middle-income families. In addition, dental insurance is significantly different in terms of risk compared to regular medical insurance.[24] Dental problems are predictable to a larger extent and pose a substantially less financial risk to individuals when compared to other medical issues such as cancer or cardiovascular disease. This relative predictability of dental needs combined with low financial risk are likely to decrease demand for dental insurance for many individuals.

Results from the current study suggested that patients reporting most often to EDs with dental problems are those residing in “central” counties of metro areas with at least one

million population. This is despite the fact that there are more dentists in urban areas compared to rural areas.[19] Disparities in the number of dentists practicing in rural versus urban areas are well-known.[19, 42] However, a larger low-income and uninsured population in central and fringe counties compared to micropolitan and non-core counties may explain our findings.[43]

Prior literature for health conditions other than dental-related conditions has shown that patients who leave the hospital against medical advice have increased risk of readmission and mortality.[44-49] To our knowledge, no prior study has examined this issue for patients with dental-related hospital visits. We looked at patient-related characteristics (age, sex, primary payer, race/ethnicity and patient location) as predictors of discharge against medical advice for patients with dental-related ED visits. We found that only 0.5% of all dental ED visits resulted in a discharge against medical advice (that is, a patient chooses to leave the hospital ED before the treating physician recommends discharge). Our multivariable results show that these patients tend to be older, male, non-Hispanic Black, located in large population counties, and either uninsured or covered by public insurance. However, the policy implications of dental-related discharges against medical advice for hospital readmissions and costs are unclear given their small proportion of ED visits.

More research is needed to understand why trends in dental ED visits have been on the rise in recent years. Our study results highlight the need for increased efforts to improve access to primary care as an alternative to reliance on emergency departments to fulfill dental care needs. Dental coverage of adults was not included as an essential benefit under the Affordable Care Act.[35] In addition, few state Medicaid programs provide non-

emergency dental benefits for adults.[36] This may help explain our findings on the increasing percentage of adults seeking care in the ED relative to children.

LIMITATIONS

The findings of our study should be interpreted within the context of certain limitations. First, we do not have data on dental health history for ED patients, and thus we have no information on dental care before or after the ED visit. Our data did not provide any information on the severity of the diagnosed dental condition. ICD-9-CM codes were used to identify specific types of dental conditions in our study, but not all dental conditions have assigned ICD-9-CM codes. Thus, our study may provide a conservative estimate of the actual number of dental-related ED visits in California. In addition, miscoding of conditions by hospital providers is possible. It is not possible to identify multiple visits for a patient or the procedures such as pain management that were used by the ED for patients. No information was provided on the resources available in each ED to treat patients with dental-related conditions or if the patients were evaluated by a dentist or other physician in the ED. Finally, we do not have information on treatment costs in the ED, and these are likely to vary significantly across dental problems.

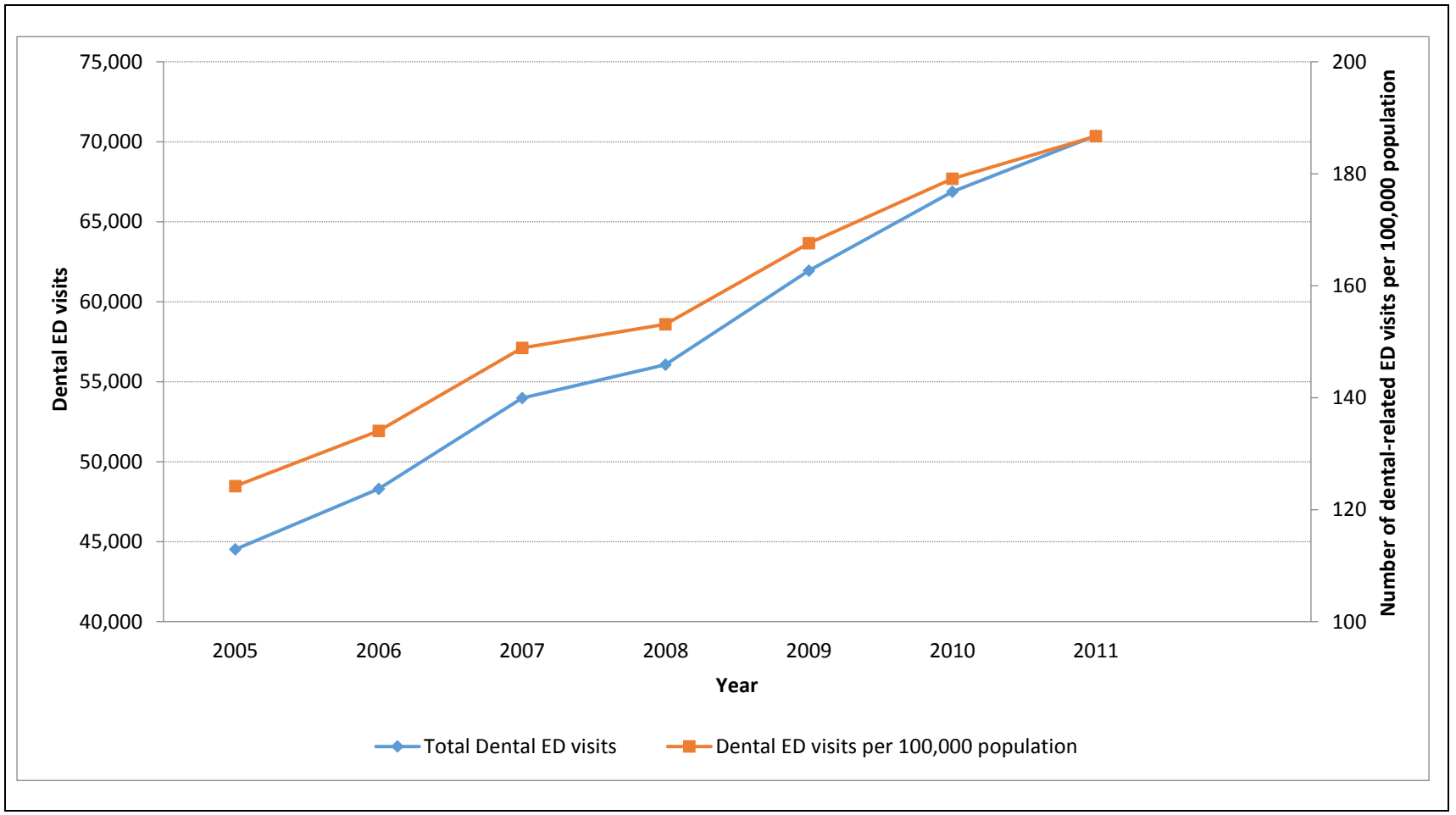
CONCLUSIONS

Our study suggests there is an increasing trend of ED visits related to dental conditions in the state of California. Furthermore, a large proportion of patients who visit EDs with dental-related issues are uninsured or covered by Medicaid. Uninsurance and Medicaid coverage were also associated with higher odds of patient discharge against medical

advice. This study also highlights that the proportion of Medicaid patient visiting EDs with dental conditions increased after the year 2008.

FIGURE

Figure 3.1: Total number and rate of dental-related ED visits per 100,000 population in California, SEDD 2005 – 2011



ED, emergency department; SEDD, State Emergency Department Database

TABLES

Table 3.1: ICD-9-CM codes used to define different dental conditions.

Dental Conditions	ICD-9-CM codes
Dental caries	521.00, 521.01, 521.02, 521.03, 521.04, 521.05, 521.06, 521.07, 521.08 & 521.09
Pulpal or Periapical lesions	522.0, 522.1, 522.2, 522.3, 522.4, 522.5, 522.6, 522.7, 522.8 & 522.9
Gingival or Periodontal conditions	523.00, 523.01, 523.10, 523.11, 523.20, 523.21, 523.22, 523.23, 523.24, 523.25, 523.3, 523.30, 523.31, 523.32, 523.33, 523.40, 523.41, 523.42, 523.5, 523.6, 523.8 & 523.9
Mouth cellulitis or Abscess	528.3

ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification

Table 3.2: Total ED visits, dental related ED visits by year

Year	ED visits related to dental conditions	Total ED visits	Proportion of dental-related ED visits
2005	44,516	8,560,741	0.520
2006	48,303	8,529,030	0.566
2007	53,981	8,791,773	0.614
2008	56,060	9,033,327	0.621
2009	61,951	9,875,972	0.627
2010	66,881	9,738,477	0.687
2011	70,385	10,124,598	0.695

ED, emergency department

Table 3.3: Number of ED visits stratified by year of visit and clinically diagnosed dental condition, SEDD 2005-2011

Types of dental conditions	2005	2006	2007	2008	2009	2010	2011
Dental caries	16,994	19,196	22,386	23,331	26,422	29,182	30,987
Pulp & Periapical lesions	22,310	23,833	26,537	26,786	29,218	32,173	34,204
Gingival	4,515	5,034	5,270	6,031	6,791	6,636	6,388
Periodontal	2,925	3,102	3,221	3,207	3,265	3,378	3,642
Mouth cellulitis or Abscess	1,654	1,904	2,103	2,342	2,584	2,580	2,643

ED, emergency department; SEDD, State Emergency Department Database

Table 3.4: Number (percent) of patients with dental-related ED visits in California stratified by patient characteristics, SEDD 2005 -2011[*]

Characteristics	2005	2006	2007	2008	2009	2010	2011
Sex							
Male	21,000 (49.5)	22,861 (49.5)	25,516 (48.7)	27,109 (49.3)	29,899 (49.1)	32,330 (49.1)	33,685 (48.6)
Female	21,386 (50.5)	23,330 (50.5)	26,844 (51.3)	27,859 (50.7)	30,955 (50.9)	33,468 (50.9)	35,634 (51.4)
Age group							
0 to 17	6924 (15.9)	7586 (16.0)	7923 (14.9)	8125 (14.6)	8321 (13.5)	8066 (12.1)	8031 (11.5)
18 to 24	6896 (15.8)	7303 (15.4)	8564 (16.1)	8769 (15.8)	9896 (16.1)	10,207 (15.4)	10,540 (15.1)
25 to 44	19,787 (45.3)	21,277 (44.9)	24,198 (45.4)	25,277 (45.5)	27,938 (45.5)	31,240 (47.0)	32,942 (47.1)
45 to 64	8631 (19.8)	9599 (20.2)	10,847 (20.4)	11,509 (20.7)	13,206 (21.5)	14,423 (21.7)	15,769 (22.5)
65 and over	1408 (3.2)	1644 (3.5)	1766 (3.3)	1888 (3.4)	2090 (3.4)	2481 (3.7)	2658 (3.8)
Primary payer							
Medicare	2844 (6.4)	3402 (7.1)	3812 (7.0)	4013 (7.2)	4608 (7.4)	5536 (8.3)	6025 (8.6)
Medicaid	13,759 (30.9)	14,625 (30.3)	16,977 (31.5)	17,891 (31.9)	20,927 (33.8)	23,021 (34.4)	24,719 (35.1)
Private Insurance	9481 (21.3)	10,273 (21.3)	10,737 (19.9)	11,217 (20.0)	11,255 (18.2)	11,300 (16.9)	12,030 (17.1)
Other insurance	4812 (10.8)	4371 (9.1)	4422 (8.2)	4038 (7.2)	4806 (7.8)	5218 (7.8)	5513 (7.8)
Uninsured	13,599 (30.6)	15,624 (32.3)	18,021 (33.4)	18,889 (33.7)	20,352 (32.8)	21,795 (32.6)	22,085 (31.4)

Race/ethnicity							
White	21,234 (55.7)	23,174 (55.5)	26,589 (54.8)	27,902 (53.7)	30,390 (52.4)	32,431 (51.5)	33,592 (50.5)
Black	4738 (12.4)	5406 (12.9)	6335 (13.0)	7027 (13.5)	8247 (14.2)	9407 (14.9)	10,354 (15.6)
Hispanic	10,352 (27.1)	11,329 (27.1)	13,361 (27.5)	14,560 (28.0)	16,409 (28.3)	17,626 (28.0)	19,014 (28.6)
Asian	751 (1.9)	655 (1.6)	861 (1.8)	970 (1.9)	1218 (2.1)	1290 (2.0)	1479 (2.2)
Native American	179 (0.5)	152 (0.4)	143 (0.3)	174 (0.3)	220 (0.4)	221 (0.4)	224 (0.3)
Other race	868 (2.3)	1040 (2.5)	1243 (2.6)	1374 (2.6)	1558 (2.7)	2010 (3.2)	1886 (2.8)
Disposition status							
Routine	43704 (99.07)	47414 (98.99)	52941 (98.93)	55435 (98.95)	61220 (98.86)	66050 (98.79)	69362 (98.57)
Transfer to short-term hospital	108 (0.24)	149 (0.31)	174 (0.33)	168 (0.30)	211 (0.34)	195 (0.29)	276 (0.39)
Transfer Other: Includes SNF, ICF, Another Type of Facility	76 (0.17)	89 (0.19)	85 (0.16)	148 (0.26)	218 (0.35)	293 (0.44)	332 (0.47)
Home Health Care (HHC)	DS	13 (0.03)	DS	DS	13 (0.02)	14 (0.02)	38 (0.05)
Against Medical Advice (AMA)	222 (0.50)	228 (0.48)	302 (0.56)	270 (0.48)	266 (0.43)	308 (0.46)	362 (0.51)
Died	DS	DS	DS	DS	DS	DS	DS

ED, emergency department; SEDD, State Emergency Department Database; DS, Discharge Suppressed

HCUP-AHRQ data user agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. These cells are denoted by "DS" (Discharge Suppressed).

* The sum of individual counts may not add up to the total number of visits because of missing information for certain variables.

Table 3.5: Number (percent) of patients with dental-related ED visits stratified by patient location, SEDD 2005-2011

Patient location	2005	2006	2007	2008	2009	2010	2011
"Central" counties of metro areas of >=1 million population	19,377 (44.4)	21,392 (45.0)	23,682 (44.4)	24,769 (44.6)	27,639 (45.2)	30,961 (46.8)	32,768 (47.1)
"Fringe" counties of metro areas of >=1 million population	6265 (14.4)	6859 (14.4)	8105 (15.2)	8534 (15.4)	9245 (15.1)	9838 (14.9)	10,363 (14.9)
Counties in metro areas of 250,000-999,999 population	10,862 (24.9)	11,446 (24.1)	12,575 (23.6)	13,283 (23.9)	14,721 (24.0)	15,486 (23.4)	16,237 (23.3)
Counties in metro areas of 50,000-249,999 population	3137 (7.2)	3492 (7.3)	4146 (7.8)	4240 (7.6)	4399 (7.2)	4560 (6.9)	4902 (7.0)
Micropolitan counties	3107 (7.1)	3462 (7.3)	3744 (7.0)	3533 (6.4)	3985 (6.5)	3991 (6.0)	3952 (5.7)
Non-core counties	871 (2.0)	853 (1.8)	1066 (2.0)	1141 (2.1)	1229 (2.0)	1333 (2.0)	1402 (2.0)

ED, emergency department; SEDD, State Emergency Department Database

Table 3.6: Adjusted odds ratios from multivariable logistic regression analysis of discharge against medical advice by patient characteristics, SEDD 2005-2011

Characteristics	Categories	Discharge Against Medical Advice, AOR (95% CI)	P-value
Age	0 to 17	0.51 (0.42 – 0.62)	<.01
	18 to 24	0.75 (0.64 – 0.87)	<.01
	25 to 44	0.83 (0.74 – 0.93)	<.01
	45 to 64	Reference	
	65 and over	0.83 (0.62 – 1.10)	0.192
Sex	Female	0.88 (0.80 – 0.97)	<.01
	Male	Reference	
Primary Payer	Medicare	1.56 (1.25 – 1.95)	<.01
	Medicaid	1.29 (1.10 – 1.51)	<.01
	Private Insurance	Reference	
	Other insurance	1.38 (1.12 – 1.69)	<.01
	Uninsured	1.78 (1.53 – 2.06)	<.01
Race/ethnicity	White	Reference	
	Black	1.27 (1.12 – 1.45)	<.01
	Hispanic	0.95 (0.84 – 1.07)	0.417
	Asian	1.09 (0.77 – 1.53.)	0.625
	Native American	1.62 (0.77 – 3.42)	0.207
	Other race	1.12 (0.84 – 1.49)	0.451
Patient Location	"Central" counties of metro areas of >=1 million population	Reference	
	"Fringe" counties of metro areas of >=1 million population	0.77 (0.67 – 0.88)	<.01
	Counties in metro areas of 250,000-999,999 population	0.86 (0.76 – 0.96)	<.05
	Counties in metro areas of 50,000-249,999 population	0.68 (0.55 – 0.84)	<.01
	Micropolitan counties	0.41 (0.31 – 0.54)	<.01
	Non-core counties	0.40 (0.24 – 0.65)	<.01

AOR, adjusted odds ratio; CI, confidence interval; SEDD, State Emergency Department Database

APPENDIX

Appendix 3.1: Number of emergency department visits with dental conditions per 100,000 populations in California, 2005-2011

Characteristics	2005	2006	2007	2008	2009	2010	2011
Total dental ED visits	44,516	48,303	53,981	56,060	61,951	66,881	70,385
Population Estimates	35,827,943	36,021,202	36,250,311	36,604,337	36,961,229	37,338,198	37,691,912
Dental ED visits per 100,000 population	124.2	134.1	148.9	153.1	167.6	179.1	186.7

CHAPTER 4: Emergency Department Utilization Related to Dental Conditions & Distribution of Dentists, Nebraska 2011-2013.

ABSTRACT

Purpose: This study aims to provide estimates of hospital-based emergency department (ED) visits due to dental conditions in Nebraska and to examine patient-related characteristics associated with ED charges. Additionally, this study provides dental-related ED visits and distribution of dentists by county.

Methods: For this study we used the State Emergency Department Database for Nebraska for the years 2011 through 2013 and the Health Resources and Services Administration's Area Health Resource File. All ED visits with dental conditions in Nebraska were selected. The primary outcome variable was hospital-based ED charges. A multivariable linear regression model was used to examine the effects of patient-related factors on ED charges.

Results: During the study period, a total of 9,943 dental-related ED visits occurred. Of these, 55.5% patients aged between 25 and 44 years. Twenty counties in Nebraska do not have a dentist and nine counties had more than 50 ED visits per 10,000 population. The mean and total ED charges attributed to dental conditions for the entire study period were $934 and $9.3 million respectively.

Conclusion: Patients who are uninsured, aged 25 – 44 years, covered by private insurance and residing in urban areas are identified to be at high-risk. There is a need to develop health policies and programs to improve access to dental care in rural states.

INTRODUCTION

Use of emergency department (ED) for dental-related problems has increased over the past decade.[4, 5, 7] This rise is more prevalent among adults aged between 18 to 44 years, uninsured and low-income individuals. According to one study, the number of patient visits to hospital emergency departments for dental problems nearly doubled over the past decade, increasing from 1.1 million in 2000 to 2.1 million in 2010.[7] In a separate study conducted by Allareddy et al. using a nationwide emergency department sample, total ED charges were estimated to be around $2.7 billion from 2008 to 2010.[6] Much of these ED charges may have been avoided with periodic preventative oral health care. Prior literature suggests general systemic health and oral health are closely interlinked to each other and untreated dental conditions exert a substantial adverse impact on individuals' systemic health, quality of life, and work productivity.[1,50,51] In 2009, it was reported that approximately 164 million hours of work were lost by annually due to dental disease and dental visits.[52]

According to a Health Resources and Services Administration (HRSA) report, the United States is acutely short of dental healthcare professionals.[53] A net increase of approximately 7,300 providers are required to address the unmet dental needs of the US population.[53] The uneven distribution of dentists throughout the country has led to regional shortages of dentists. In the state of Nebraska, forty-four out of ninety-three counties are considered as shortage areas for general dentistry.[54] A large portion of dentists prefer not to practice in inner cities and rural areas.[19] As a result, people residing in rural areas and inner cities may have difficulty finding access to dentists and dental care. The underlying primary cause for dental problems and unmet dental care may be the

lack of access to timely dental care in many areas.[2, 6] With timely preventive oral health treatment, many conditions can be easily avoided or minimized.[6] If dental conditions are not treated in a timely manner, they could pose severe problems at a later stage and may necessitate visits to hospital-based emergency departments (ED) and even subsequent hospitalizations.[6]

The purpose of the present study is to provide estimates of hospital-based ED visits for dental conditions in the state of Nebraska. There are three objectives for the present study. First, we will provide characteristics of dental-related hospital-based ED visits in Nebraska for the years 2011 to 2013. Second, we will map the number of dental-related ED visits with the distribution of dentists in Nebraska for each county. Finally, we will examine hospital emergency department charges for dental-related visits and the effect of patient-related factors (age, sex, insurance status, patient location, income level and co-morbid conditions) on these charges. The findings from the present study would have important implications for policymakers and dental care providers. They would aid in developing, tailoring, and implementing preventive oral health programs in areas that are identified as having access to care issues.

METHODS

Data Source

The Nebraska State Emergency Department Database (SEDD) for the years 2011 to 2013 was used for the present study. SEDD is a component of the Healthcare Cost & Utilization Project (HCUP) family of databases sponsored by the Agency for Healthcare Research and Quality (AHRQ).[39] SEDD databases provide information on more than 100

patient and hospital-related variables including age, sex, insurance status, the presence of co-morbid conditions, charges, disposition status, patient location, and income level). This database captures an only emergency visit that has not resulted in hospitalization. According to the HCUP-AHRQ data user agreement, individual cell counts less than or equal to 10 were blinded so as to preserve patient confidentiality and were denoted by "DS" (Discharge Suppressed). For this study we also used the Health Resources and Services Administration's Area Health Resource File (AHRF), which includes detailed health professions data reported by the American Dental Association, the American Medical Association and other organizations.[55] AHRF is a county-level database providing detailed demographic, economic, environmental, and health services information for every county in the US.

Measures

For this study, all hospital-based ED visits in patients with dental conditions in the State of Nebraska in 2011 to 2013 were selected. Dental conditions were identified on the basis of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. The ICD-9-CM codes used were dental caries (ICD-9-CM codes 521.00, 521.01, 521.02, 521.03, 521.04, 521.05, 521.06, 521.07, 521.08 and 521.09), pulpal or periapical lesions (ICD-9-CM codes 522.0, 522.1, 522.2, 522.3, 522.4, 522.5, 522.6, 522.7, 522.8 and 522.9), gingival or periodontal conditions (ICD-9-CM codes 523.00, 523.01, 523.10, 523.11, 523.20, 523.21, 523.22, 523.23, 523.24, 523.25, 523.3, 523.30, 523.31, 523.32, 523.33, 523.40, 523.41, 523.42, 523.5, 523.6, 523.8 and 523.9), and mouth cellulitis or abscess (ICD-9-CM code 528.3). Patient demographic characteristics

such as age, sex, insurance status, patient location, income level and co-morbid conditions were examined. NE-SEDD does not provide information on race.

Outcomes

Number of dental-related ED visits, number of dental-related ED per 10,000 population by county, and hospital ED charges (in dollars) are the main outcome variables of interest. Hospital charges refer to the charges that the hospital levied to patients and not the cost of care provided to patients or the amount of reimbursement for services rendered. Hospital charges were adjusted to 2013 US dollars for inflation using the Bureau of Labor Statistics Consumer Price Index.

Analytical Approach

An individual ED visit was the unit of analysis. Descriptive statistics were used to summarize the data. US Census 2013 population estimates were used to compute population-based incidence rates of ED visits related to dental conditions per 10,000 population for each county. Population-based incidence rates of dental-related ED visits were stratified by Nebraska patient county code of residence (FIPS). The AHRF was used to estimate the distribution of dentists in Nebraska. Total numbers of professionally active non-federal dentists per 10,000 population for the year 2013 (includes Total Full-time and Total Part-time Private Practice; Dental School Faculty; Hospital Staff Dentist; Graduate Student/Resident; Other Health/Dental Organization Staff; and Part-Time Faculty/Part-Time Practice) were stratified by FIPS county codes. The co-morbid burden was computed using the Charlson comorbidity severity index.[56] Each co-morbid conditions can have a score of 1,2,3 or 6. A comorbidity severity index score of 0

indicates absence of co-morbid conditions. Multivariable linear regression analysis was used to examine the effects of patient-related factors on ED charges. All the statistical analyses were conducted using SAS 9.3 (SAS Institute, Cary, NC). For mapping purposes, ArcGIS software was used.

RESULTS

Patient Characteristics

A total of 9,943 dental-related emergency department (ED) visits were reported in the State of Nebraska during 2011 to 2013. The number of dental-related ED visits per 10,000 population in Nebraska increased from 17.6 in the year 2011 to 18.7 in 2013 (Table 4.1). Table 4.2 presents the summary of prevalence of different dental conditions. Dental caries and pulpal lesions were the conditions most frequently identified followed by gingival disease, periodontal conditions, and mouth cellulitis. Dental-related ED visits stratified by patient characteristics are presented in Table 4.3. Close to half of all dental-related ED visits were made by females. The average age was 34.2 years. Those aged between 25 years and 44 years constituted a predominant proportion of all dental-related ED visits (55.5%), and those aged 45 years and 64 years comprised 18.2% of all dental-related ED visits. Two-thirds of ED visits occurred during weekdays. Private insurance was listed as the primary payer for 35.8% of all dental ED visits. Self-pay/uninsured comprised about 39% of all dental ED visits. With regards to disposition of patient following an ED visit, 99.1% were discharged routinely. About 79% of all dental ED visits occurred in the geographical areas where the median household income was below the second quartile. The average charge for each dental-related ED visit was $934. The total ED charges attributed to dental conditions across the entire Nebraska State over the

study period (years 2011 to 2012) was $9.3 million. Dental-related ED visits stratified by patient location is summarized in Table 3. Overall, close to 64% of all Dental ED visits occurred in urban areas, followed by large rural town (21.5%), small rural town (7.8%) and isolated rural (6.5%). Based on the Charlson comorbidity severity index, about 94 percent of hospital-based ED visits related to dental conditions did not have a comorbid condition.

Geographic Information System

The distribution of population based estimates of dental ED visits and dentist in Nebraska by county are presented in Maps 1 and 2 respectively. Total number of active dentists in Nebraska in the year 2013 was 1,205. Of these 1161 were active non-federal dentists. Counties that do not have a dentist include Arthur, Banner, Blaine, Brown, Frontier, Gosper, Grant, Greeley, Hayes, Hitchcock, Hooker, Keya Paha, Logan, Loup, McPherson, Rock, Sherman, Sioux, Thomas and Wheeler (Map 4.1). Arthur, Banner, Keya Paha, Perkins, Thomas, and Wheeler counties had no dental ED visits (Map 4.2). Adams, Box Butte, Dodge, Douglas, Gage, Lincoln, Red Willow, Scotts Bluff, and York counties had more than 50 ED visits per 10,000 population.

Dental emergency department visits charges and patient factors

Results from the multivariable linear regression analysis examining the effect of patient related factors on hospital-based emergency department charges are summarized in Table 4.4. Those aged 25 to 44 years ($203.9, $P<0.01$), 45 to 64 years ($560.1, $P<0.0001$), and 65 and over (1316.2, $P<0.0001$) were significantly associated with higher charges compared to those aged up to 17 years. Those covered by Medicare, Medicaid, and

uninsured patients had $224.7 (P<0.01), $226.4 (P<0.0001) and $170.3 (P<0.001) lower ED charges respectively than those covered by private insurance. Those residing in large rural towns, small rural towns or isolated rural areas had $229.1 (P<0.0001), $402.1(P<0.0001) and $220.4 (P<0.001) lower ED charges respectively than patients residing in urban areas. An increase in the Charlson comorbidity severity index score was associated with increase in ED charges.

DISCUSSION

To our knowledge, the current study is the first study to examine hospital-based ED visits for dental conditions in Nebraska. While prior studies have examined dental-related ED visits in urban states such as California, there is no data documenting the burden of dental-related ED visits in Nebraska which is a predominantly rural state.[24, 41] Such data would pave the way for developing health policies and interventions to improve access to dental care in rural states. The present study results indicate that a total 9,267 ED visits were attributed to dental conditions resulting in total ED charges of close to $9.28 million during the study period (from 2011 to 2013). These numbers are high considering the fact that dental conditions are typically treated in dental clinics and ideally patients should not be visiting hospitals on an emergency basis for these conditions. Hospital-based EDs are not the best places to treat dental conditions as EDs may be ill-equipped to provide adequate care, and most hospital EDs do not have a dentist on call.[31] This is particularly true in rural states where the number of dentists is fewer. Our study results show that the mean charges for each dental-related ED visit was $934. This average charge is high considering the fact that most patients are typically just given prescription medicines in the EDs instead of any definitive treatment for the condition that leads to the ED visit.

The same dental condition could have been treated more effectively and efficiently in a dental clinic setting as opposed to in a hospital-based ED. Hospital based EDs are not equipped with the necessary support systems and personnel to treat dental conditions. Despite this, the charges in hospital EDs are higher because the ED visit charges includes fees for emergency physician, pharmacy, laboratory or radiology and other miscellaneous fees. Our study findings further illustrate the point that dental ED visits should be treated in dental clinics as opposed to in hospital-based EDs. The present study findings showed that those covered by Medicare and Medicaid and the uninsured had significantly lower ED charges compared to those covered by private insurance plans after adjusting for several other potential confounders. We speculate that the lower ED charges for these (Medicare, Medicaid, and Uninsured) cohorts could be due to lesser services delivered to them in the ED settings compared to the private insurance cohort. For example; those covered by private insurance plans could have had more diagnostic tests or more definitive treatments, while the rest could have just been prescribed a pain killer and discharged from the ED. Those residing in rural towns (either large, small or isolated rural towns) had significantly lower charges compared to those residing in urban areas. It is likely that the rural populace visited hospital-based EDs close to their residence (rural hospitals) and the urban populace visited hospital-based EDs in urban areas. It is likely that the hospital-based EDs in urban areas provided more services and hence levied higher charges to their patients when compared to hospital-based EDs in rural areas. This needs to be explored further in future studies as it may have important policy implications.

Consistent with prior research, our study also documented dental caries and pulp and periapical lesions to be the most frequently reported dental conditions for visiting EDs.[2,6] Our study showed higher percentages of dental-related ED visits were made by those who are uninsured, aged 25 – 44 years, covered by private insurance and residing in urban areas. This suggests that these groups may be at high-risk, and future intervention programs should be earmarked for these cohorts. The present study determined that 39% of hospital-based dental ED visits were constituted by the uninsured. This percentage is not surprising because the likelihood of having dental insurance coverage is substantially lower compared to lack of medical insurance in the US.[19, 20] Multiple studies have shown that lack of private insurance, Medicaid insurance, and age are at high risk of visiting the ED for dental conditions.[1, 2,6] An important finding is that those living in low-income quartile ZIP codes (quartile 1) had higher charges compared to those living in high-income quartile areas (quartile 4). The reason may be because unmet needs and lack of routine dental care are more prevalent for the low-income groups compared to high-income groups.[25-27]

From Maps 4.1 and 4.2, there is clear evidence that dental-related ED visits are more common in counties where the numbers of dentists per population are higher. The reason could be due to more low-income and uninsured population in these counties. However, this needs further empirical support. Maps were used to present differences in usage patterns of EDs for dental care across geographic areas in Nebraska. These results highlighted the consequences of unmet dental needs among these largely rural populations. Periodic preventive oral health programs and educational interventions targeting high-risk cohorts (such as those identified in the present study) should be

implemented in rural states especially in counties that have been identified as having higher numbers of ED visits. During the three-year study period, there were around 64% of dental-related ED visits that occurred in urban areas. Our study highlighted more ED visits in urban areas. This could be due to a multitude of factors including lack of understanding and awareness of the importance of oral health in the urban populace despite relatively better access to dental care in urban settings[57], drug (opiod) seeking behavior among ED patients, etc. It is very crucial that awareness be created among the general population on dental care and related outcomes. More programs that are modeled to propagate good oral health and awareness should be implemented.

LIMITATIONS

The current study has certain limitations, and the findings of our study should be interpreted while keeping these limitations in perspective. A cause and effect relationship for outcomes cannot be established in retrospective studies such as the present one. Nebraska state emergency department database does not have information on dental insurance status, ED admission time, and patients' education. Consequently, the effect of these potential confounders cannot be addressed. The present study estimated dental-related emergency visits only in hospital-based settings. Consequently, the true burden of emergency visits (which occur in private practice dental clinics, community centers, etc.) was not determined.

CONCLUSION

The results from the present study suggest that those aged 25 to 44 years and uninsured are the high-risk groups to visit ED for dental-related problems. Also, the findings

emphasize more dental problems exist in urban areas, although dentist population is more in these areas. Future studies should focus on identifying barriers to access routine dental care in these high-risk cohorts.

TABLES

Table 4.1: Number of dental-related ED visits per 10,000 population in Nebraska: SEDD 2011-2013

Characteristics	2011	2012	2013
Total ED visits related to dental conditions	3243	3205	3495
Population Estimates	1,842,383	1,855,973	1,869,300
Dental-related ED visits per 10,000 population	17.6	17.3	18.7

ED, emergency department; SEDD, State Emergency Department Database

Table 4.2: Number and percent of ED visits stratified by clinically diagnosed dental condition, SEDD 2011-2013

Types of dental conditions	Number (Percent)
Dental caries	4927 (45%)
Pulp & Periapical lesions	4778 (44%)
Gingival	498 (4%)
Periodontal	390 (4%)
Mouth Cellulitis	333 (3%)

ED, emergency department; SEDD, State Emergency Department Database

Table 4.3: Dental-related ED visits in Nebraska stratified by patient characteristics, SEDD 2011 -2013[*]

Characteristics	Number (Percent)
Sex	
Male	4850 (48.8)
Female	5083 (51.2)
Age group (in years)	
0 to 17	611 (6.2)
18 to 24	1663 (16.7)
25 to 44	5520 (55.5)
45 to 64	1809 (18.2)
65 and over	340 (3.4)
Mean Age (year)	34.2
Primary payer	
Medicare	831 (8.4)
Medicaid	1519 (15.3)
Private Insurance	3557 (35.8)
Other insurance	162 (1.6)
Uninsured	3874 (39.0)
Admission Day	
Weekday	6545 (65.8)
Weekend	3398 (34.2)
Disposition status	

Routine	9417 (99.1)
Transfer to short-term hospital	51 (0.5)
Transfer Other: Includes SNF, ICF, Another Type of Facility	14 (0.2)
Home Health Care (HHC)	DS
Against Medical Advice (AMA)	21 (0.2)
Patient Location	
Urban	6310 (64.2)
Large rural town	2109 (21.5)
Small rural town	765 (7.8)
Isolated rural	643 (6.5)
Median household income national quartile for patient ZIP code**	
First quartile	3613 (36.7)
Second quartile	4112 (41.8)
Third quartile	1491 (15.2)
Fourth quartile	616 (6.3)
Patient's Charlson Comorbidity Severity Index score	
0	9376 (94.3)
1	504 (5.1)
2	48 (0.5)
=> 3	15 (0.1)
Hospital ED charges (inflation adjusted to 2013 US dollar value)	
Mean charges	$ 934.0
Total charges	$ 9,280,075.8

ED, emergency department; SEDD, State Emergency Department Database; DS, HCUP-AHRQ data user agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. These numbers were denoted by "DS" (Discharge Suppressed).

* The sum of individual counts may not add up to the total number of visits because of missing information for certain variables.

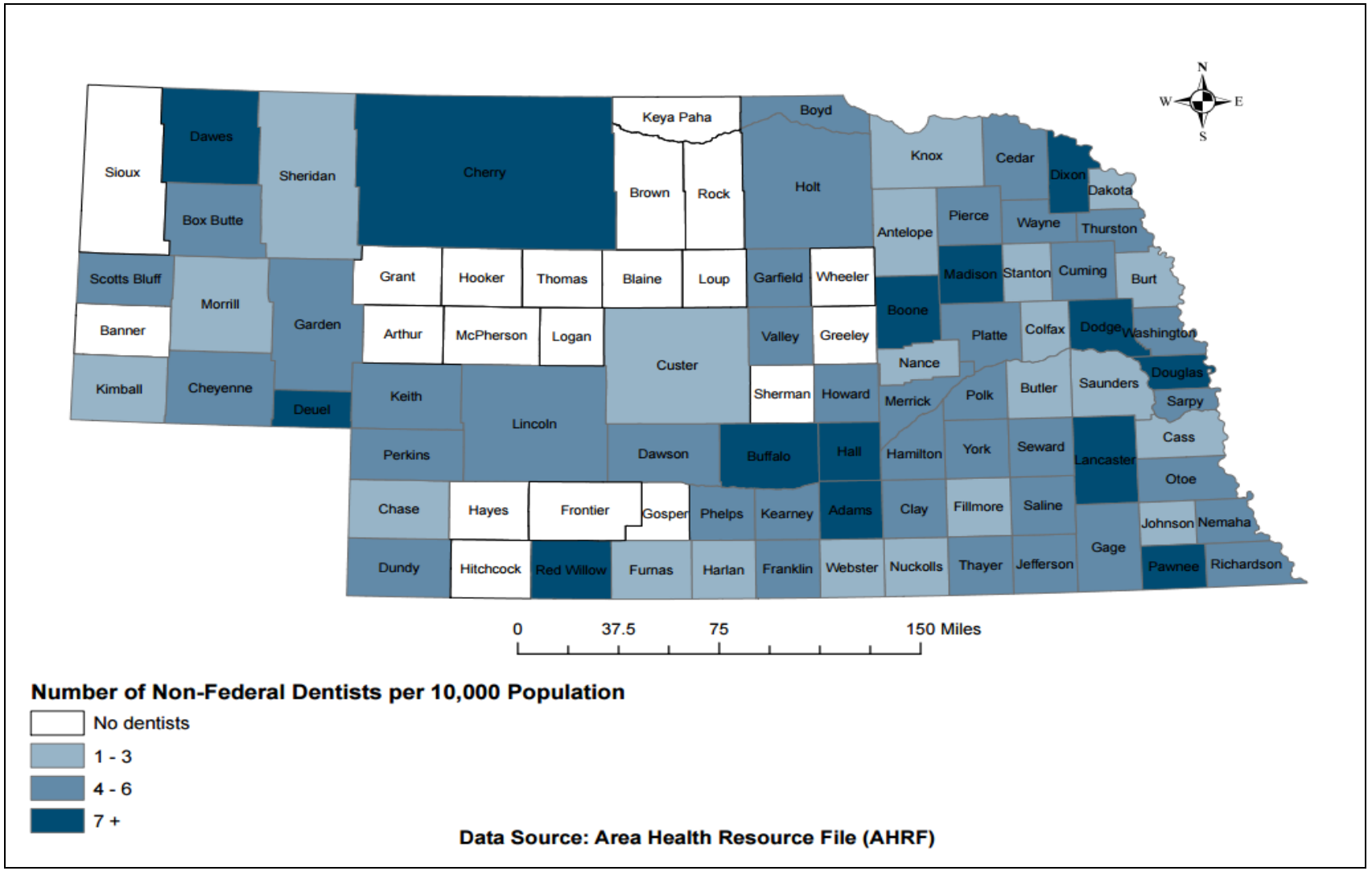
** Median household income quartiles of residents in the patient's ZIP code vary by year. For 2011, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4). For 2012, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $62,999 (quartile 3) and $63,000 or higher (quartile 4). For 2013, the levels were $1 to $37,999 (quartile 1), $38,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4).

Table 4.4: Multivariable linear regression analysis for hospital-based emergency department charges.

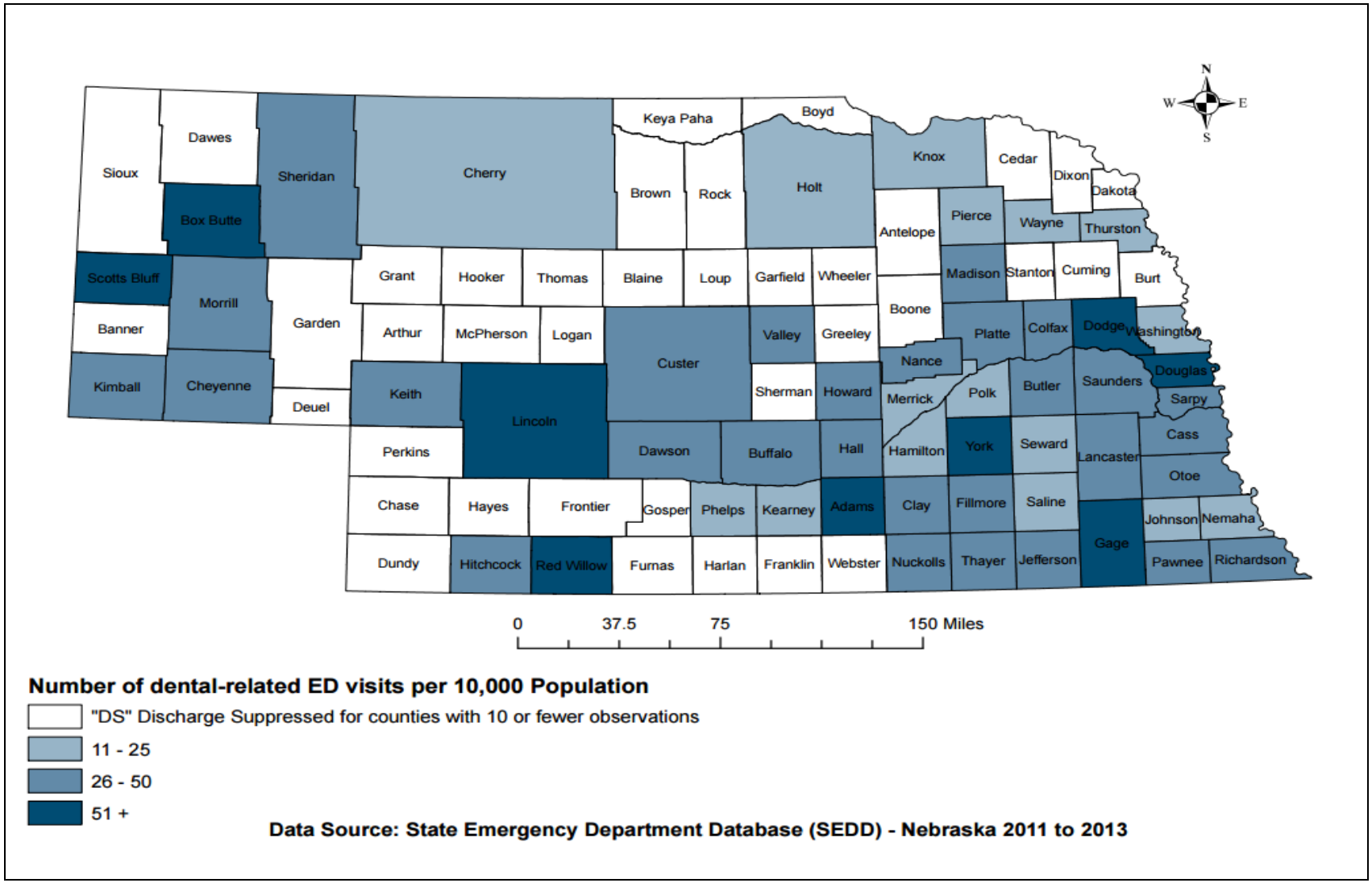
Predictor variables	Estimate (95% CI)	P-value
Sex		
Male	**Reference**	
Female	-4.929 (-77.901 - 68.044)	0.895
Age group		
0 to 17	**Reference**	
18 to 24	101.694 (-68.223 - 271.612)	0.241
25 to 44	203.906 (49.581 - 358.232)	<.01
45 to 64	560.148 (390.719 - 729.577)	<.01
65 and over	1316.175 (1043.276- 1589.073)	<.01
Primary payer		
Private Insurance	**Reference**	
Medicare	-224.746 (-382.436 - -67.056)	<.01
Medicaid	-226.441 (-336.456 - -116.425)	<.01
Other insurance	-55.017 (-340.815 - 230.781)	0.706
Uninsured	-170.302 (-256.381 - -84.223)	<.01
Patient Location		
Urban	**Reference**	
Large rural town	-229.070 (-332.992 - -125.148)	<.01
Small rural town	-402.088 (-542.149 - -262.028)	<.01
Isolated rural	-220.357 (-370.219 - -70.496)	<.01
Median household income national quartile for patient ZIP code[**]		
Fourth quartile	**Reference**	
First quartile	23.637 (-132.169 - 179.443)	0.766
Second quartile	-85.000 (-248.177 - 78.177)	0.307
Third quartile	-48.184 (-218.219 - 121.850)	0.579
Patient's Charlson Comorbidity Severity Index score		
0	**Reference**	
1	919.220 (754.854 - 1083.587)	<.01
2	1518.139 (1001.712 - 2034.566)	<.01
=> 3	1936.103 (994.192 - 2878.014)	<.01
ED visit year		
2011	**Reference**	
2012	-24.156 (-112.539 - 64.226)	0.592
2013	73.140 (-13.771- 160.051)	0.099

[**] Median household income quartiles of residents in the patient's ZIP code vary by year. For 2011, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4). For 2012, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $62,999 (quartile 3) and $63,000 or higher (quartile 4). For 2013, the levels were $1 to $37,999 (quartile 1), $38,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4).

Map 4.1: Distribution of Non-Federal Dentists in Nebraska by county: 2013



Map 4.2: Number of dental-related emergency department visits in Nebraska by county: 2013



APPENDIX

Appendix 4.1: Number (percent) of patients with dental-related ED visits in Nebraska stratified by patient characteristics, SEDD 2011 -2013*

Sex	**2011**	**2012**	**2013**
Male	1547 (47.8)	1571 (49.0)	1732 (49.6)
Female	1690 (52.2)	1634 (51.0)	1759 (50.4)
Age group			
0 to 17	218 (6.7)	209 (6.5)	184 (5.3)
18 to 24	570 (17.6)	551 (17.2)	542 (15.5)
25 to 44	1759 (54.2)	1735 (54.1)	2026 (58.0)
45 to 64	585 (18.0)	600 (18.7)	624 (17.8)
65 and over	111 (3.4)	110 (3.4)	119 (3.4)
Primary payer			
Medicare	242 (7.5)	277 (8.6)	312 (8.9)
Medicaid	566 (17.5)	454 (14.2)	499 (14.3)
Private Insurance	1033 (31.8)	1080 (33.7)	1444 (41.3)
Other insurance	59 (1.8)	58 (1.8)	45 (1.3)
Uninsured	1343 (41.4)	1336 (41.7)	1195 (34.2)
Disposition status			
Routine	2931 (98.8)	3088 (99.2)	3398 (99.2)
Transfer to short-term hospital	23 (0.8)	14 (0.5)	14 (0.4)
Transfer Other: Includes SNF, ICF, Another Type of Facility	DS	DS	DS
Home Health Care (HHC)	DS	DS	DS
Against Medical Advice (AMA)	DS	DS	DS

ED, emergency department; SEDD, State Emergency Department Database; DS, HCUP-AHRQ data user agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. These numbers were denoted by "DS" (Discharge Suppressed).

* The sum of individual counts may not add up to the total number of visits because of missing information for certain variables.

Appendix 4.2: Multivariable linear regression analysis for hospital-based emergency department charges (log transformed ED charges).

Predictor variables	Estimate (95% CI)	P-value
Sex		
Male	**Reference**	
Female	0.032 (0.001 - 0.065)	0.051
Age group		
0 to 17	**Reference**	
18 to 24	0.107 (0.030- 0.184)	0.241
25 to 44	0.158 (0.089- 0.228)	<.01
45 to 64	0.372 (0.296- 0.449)	<.01
65 and over	0.704 (0.581 - 0.827)	<.01
Primary payer		
Private Insurance	**Reference**	
Medicare	-0.047 (-0.118 - 0.024)	0.195
Medicaid	-0.067 (-0.116 - -0.017)	<.01
Other insurance	0.028 (-0.101 - 0.157)	0.6713
Uninsured	-0.025 (-0.064 - 0.013)	0.1975
Patient Location		
Urban	**Reference**	
Large rural town	-0.214 (-0.261 - -0.168)	<.01
Small rural town	-0.482(-0.546 - -0.419)	<.01
Isolated rural	0.289 (-0.357 - -0.221)	<.01
Median household income national quartile for patient ZIP code**		
Fourth quartile	**Reference**	
First quartile	0.113 (0.043- 0.183)	<.01
Second quartile	0.035 (-0.038 - 0.109)	0.345
Third quartile	-0.026 (-0.103 - 0.051)	0.504
Patient's Charlson Comorbidity Severity Index score		
0	**Reference**	
1	0.417 (0.343- 0.492)	<.01
2	0.625 (0.392- 0.858)	<.01
=> 3	1.220 (0.795- 1.646)	<.01
ED visit year		
2011	**Reference**	
2012	-0.017 (-0.023 - 0.057)	0.411
2013	0.062 (0.023 - 0.101)	<.01

Appendix 4.3: Number of ED visits with dental condition and distribution of dentists by county, NE.

NE County	Number of Dental related ED visits (from 2011 to 2013)	Number of Non-Federal Dentists (2013)
Adams	267	22
Antelope	DS	1
Arthur	DS	0
Banner	DS	0
Blaine	DS	0
Boone	DS	4
Box butte	65	4
Boyd	DS	1
Brown	DS	0
Buffalo	164	30
Burt	9	1
Butler	22	2
Cass	87	5
Cedar	DS	3
Chase	DS	1
Cherry	11	6
Cheyenne	44	4
Clay	31	3
Colfax	30	2
Cuming	DS	4
Custer	50	3
Dakota	11	6
Dawes	DS	8
Dawson	69	14
Deuel	DS	2
Dixon	DS	4
Dodge	246	22
Douglas	3990	363
Dundy	DS	1
Fillmore	19	1
Franklin	DS	1
Frontier	DS	0
Furnas	DS	1
Gage	143	11
Garden	DS	1
Garfield	DS	1
Gosper	DS	0
Grant	DS	0
Greeley	DS	0

Hall	277	37
Hamilton	21	4
Harlan	DS	0
Hayes	DS	0
Hitchcock	13	0
Holt	19	6
Hooker	DS	0
Howard	25	2
Jefferson	30	3
Johnson	11	1
Kearney	13	3
Keith	37	4
Keya Paha	DS	0
Kimball	18	1
Knox	11	2
Lancaster	1122	188
Lincoln	440	20
Logan	DS	0
Loup	DS	0
Madison	DS	0
McPherson	121	29
Merrick	17	3
Morrill	24	1
Nance	11	1
Nemaha	11	3
Nuckolls	18	1
Otoe	70	8
Pawnee	11	2
Perkins	DS	1
Phelps	17	5
Pierce	13	3
Platte	120	14
Polk	11	2
Red Willow	88	7
Richardson	23	3
Rock	DS	0
Saline	27	6
Sarpy	607	59
Saunders	62	6
Scotts Bluff	284	15
Seward	42	7
Sheridan	16	1
Sherman	DS	0
Sioux	DS	0
Stanton	DS	1
Thayer	15	2

Thomas	DS	0
Thurston	14	4
Valley	14	2
Washington	45	7
Wayne	16	4
Webster	DS	1
Wheeler	DS	0
York	109	6

DS, Data User Agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. These numbers were denoted by "DS" (Discharge Suppressed).

CHAPTER 5 - Hospital-Based Emergency Department Visits with Dental Conditions: Impact of the Medicaid Reimbursement Fee-for-Dental services in New York State, 2009-2013.

ABSTRACT

Objective: Hospital-based emergency department visits for dental problems have been on the rise. Objectives of this study are to provide estimates of hospital-based emergency department (ED) visits with dental conditions in New York State and to examine the impact of Medicaid reimbursement fee for dental services on the utilization of EDs with dental conditions.

Methods: New York State Emergency Department Database (SEDD) for the year 2009 to 2013 and Health Resources and Services Administration's Area Health Resource File (AHRF) were used. All ED visits with the diagnosis for dental conditions were selected for analysis.

Results: The current study found a total of 325,354 ED visits with dental conditions. The mean age of patient was 32.4 years. The majority of ED visits were made by those aged 25 to 44 years (49%). Whites comprised 52.1% of ED visits. Proportion of Medicaid increased from 22% (in 2009) to 41.3% (in 2013). For Medicaid patients, the mean ED charge and aggregated ED charges were $811.4 and $88.1 million respectively. Eleven counties had fewer than four dentists per 10,000 population in New York State.

Conclusion: High-risk groups identified from the study are those aged 25 to 44 years, uninsured, covered by Medicaid and private insurance, and residing in low-income areas.

INTRODUCTION

Dental-related emergency department (ED) visits to hospitals have increased over the past two decades in the U.S.[4-7, 58] A recent study using a national sample of ED visits reported that ED utilization for dental-related conditions has increased every year from 2006 to 2012, reaching 2.2 million visits with treatment costs of $1.6 billion in 2012.[58] Geographic location, lack of access, and low-income are factors that preclude people from seeking preventive dental care. Studies suggest that financial resources and dental insurance barriers lead to dental care access problems.[2] Unmet needs and lack of routine dental care are higher for low-income than high-income groups, or for those without dental insurance coverage.[25-27] In the U.S., the number of people without any dental insurance coverage is substantially higher than those lacking medical insurance, often resulting in individuals foregoing preventive dental care and increasingly poor oral health. Thus, many of these patients seek care for dental-related issues in emergency departments. Unfortunately, they are unlikely to receive appropriate dental treatment in hospital ED settings.[6, 58]

Access to dental care is a major concern in the current healthcare environment in the U.S.[59] For example; rural patients may be forced to travel long distances to obtain dental care. A large number of mostly rural counties are designated as dental care shortage areas throughout the U.S.[59] According to a report from the U.S. Department of Health and Human Services, the U.S. will face a shortage of approximately 15,600 dentists in 2025.[60] New York State is projected to have a shortage of 1,024 full-time dentists in 2025.[60] These challenges in accessing dental care are expected to worsen oral health care as well

as geographical and race/ethnic disparities in dental care outcomes in both New York State and throughout the U.S.[32, 59]

One objective of the Affordable Care Act (ACA) of 2010 was to help make health care more affordable and increase access to care among low-income populations. Under the ACA, all state Medicaid programs are required to provide comprehensive dental benefits for children covered under Medicaid.[21, 22] However, for adult Medicaid patients, individual states are not required to provide any dental benefits. New York is among 15 states that provide extensive dental coverage for adult Medicaid patients.[61] Extensive dental coverage includes services such as preventive services, restorative services, and diagnostic services. However, in May 2011, Medicaid reimbursement rates for dentists in New York were substantially reduced.[62] For example, reimbursement rates for an adult cleaning teeth were reduced by about 19 percent from $55 to $45, which is significantly lower than what private insurance reimburses on average ($86).[63] Despite the fact that New York State provides extensive dental coverage for adults covered by Medicaid, the Medicaid fee for dentists are significantly lower than the private insurance.[62,63] Studies have shown that dentists are unsatisfied with providing care to Medicaid patients because of the low reimbursements they receive.[19, 64] Low Medicaid reimbursement is likely to further exacerbate poor preventive dental care access among low-income individuals.

The aim of this study is to examine hospital-based emergency department (ED) visits with dental conditions in New York State for the years 2009 to 2013. The objectives of the present study were to provide characteristics of dental-related hospital-based ED visits in the State of New York for the years 2011 to 2013, map the number of dental-related ED visits with the distribution of dentists in New York for each individual county,

examine the effect of patient-related factors on hospital-based emergency department charges, and examine the impact of Medicaid reimbursement fees for dental services on utilization of ED with dental-related conditions. We used a census database of all ED visits in the state of New York in addition to data on the supply of non-federal practicing dentists for each county. To our knowledge, this is the first study to examine dental-related ED utilization pre- and post-implementation of the reduced Medicaid fee schedule for dental services in New York. In addition, we compared the distribution of dentists in New York with ED utilization over time.

METHODS

Data Source

The current study is a retrospective analysis of the New York State Emergency Database (NY-SEDD) for the years 2009 to 2013. SEDD is a part of the Healthcare Cost and Utilization Project (HCUP).[39] The HCUP is sponsored by the Agency for Healthcare Research and Quality (AHRQ). NY-SEDD provides discharge information on all ED visits in New York State that have not resulted in hospitalization. NY-SEDD contains more than 100 clinical and nonclinical variables for each hospital-based ED visit, including age, sex, race/ethnicity, primary payer, median household income level, patient location, ED charges, and disposition status. For the current study, the NY-SEDD is linked to the Area Health Resource File (AHRF), which includes detailed county-level health professions data reported by the American Dental Association (ADA), the American Medical Association (AMA) and other organizations.[55] As per the HCUP-AHRQ data user agreement, cell counts less than or equal to 10 were denoted by "DS" (Discharge information suppressed) to preserve patient confidentiality.

Measures

For this retrospective study (from 2009 to 2013), all hospital-based ED visits by patients with dental conditions (including dental caries, pulp and periapical lesions, gingival disease, periodontal conditions, and mouth cellulitis) in the state of New York were selected for analysis. Different dental conditions were identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes (Table 5.1). Patient-related characteristics were examined. We used four urban-rural classifications (large metropolitan, small metropolitan, micropolitan, and not metropolitan nor micropolitan) for patient location. Large and small metropolitan areas were combined into one category ("Metropolitan areas"). Age was categorized into five groups: up to 17 years, 18 to 24 years, 25 to 44 years, 45 to 64 years and 65 and over. The Charlson comorbidity severity index was used to compute co-morbid burden.[56] A comorbidity severity index score of 0 indicates absence of co-morbid conditions.[56] "Insurance status/Primary payer" for this study specifically refers to medical insurance. SEDD does not provide information about dental insurance. The main outcome variables of interest include: number of dental-related ED visits, number of dental-related ED visits per 10,000, and Hospital ED charges. Hospital ED charges refer to the charges that the hospital levied to patients and not the cost of care provided to patients or the amount of reimbursement for services rendered. Hospital charges were adjusted to 2013 US dollars for inflation using the Bureau of Labor Statistics Consumer Price Index.

Analytical Approach

For the current study, the unit of analysis was an individual ED visit. To summarize the data, descriptive statistics were used. We generated population-based incidence rates of

dental-related ED visits and number of dentists per 10,000 county population for each of New York State's 62 counties by using US Census population data for 2013. Patient county FIPS (Federal Information Procession Standards) code from NY-SEDD and FIPS county code from AHRF were used to estimate ED visits related to dental conditions and the distribution of active non-federal dentists, respectively, for each county in the state of New York. ArcGIS software was used for mapping dental-related ED visits and distribution of dentists in New York by county. Multivariable linear regression analysis was used to examine the effects of patient-related factors on ED charges. Regression models controlled for age, sex, race/ethnicity, primary payer, admission day, median household income level, patient location, Charlson co-morbid index score and year. Generalized estimating equation methods were used to fit the multivariable regressions models and adjust for clustering. All the statistical analyses were conducted using SAS Software, version 9.3 (SAS Institute Inc., Cary, NC).

RESULTS

Dental-related ED visits from 2009-2013

During the years 2009 to 2013, a total of 325,354 hospital-based ED visits related to dental conditions were reported in New York State. Over the study period, the number of dental-related ED visits increased from 64,195 in the year 2009 to 66,568 in 2011 and then decreased from the year 2012 onwards (Figure 5.1). The number of ED visits related to dental conditions was lowest in the year 2013 (62,942) and highest in 2011 (66,568). From 2009-2013, both total ED charges and average ED charges with dental-related ED visits showed a significant increase after inflation adjusted to 2013 US dollars. Average

ED charges increased from $724.5 in year 2009 to $982.2 in year 2013 (Figure 5.1). During the study period, the total dental-related ED charges showed an approximate 32% increase from year 2009 to 2013 ($46.3 million in year 2009 to $61.5 million in year 2013). Those aged between 25 years and 44 years were the most frequent ED users for dental conditions. The proportion of dental ED visits made by age group (age 18 to 24 years) decreased over the five-year period (Figure 5.2). Over the study period, the proportion of dental-related ED visits decreased among Whites (54.2% in year 2009 to 49.8% in year 2013), while the proportion increased for Hispanics (11.8% in year 2009 to 14.1% in year 2013) and other races (7.3% in year 2009 to 10.7% in year 2013) (Figure 5.3).

Dental-related ED visits by primary payer

Figure 5.4 presents the percentage of dental-related ED visits by the primary payer for each study year. For each study year, Medicaid and private Insurance were the most frequently reported primary payer. The proportion of Medicaid increased (22% in 2009 to 41.3% in 2013) while the proportion of private insurance decreased (38.4% in 2009 to 21.1 in 2013). Over the study period, the proportion of uninsured decreased from 32.7% in 2009 to 27.2% in 2013. The distribution of different dental conditions by primary payer is summarized in Table 5.3. Among the different dental conditions, the most frequently reported dental conditions were dental caries (50.4% of all dental-related ED visits) and pulp & periapical lesions (47.0% of all dental-related ED visits). For the current study, the least frequently reported dental condition was mouth cellulitis (2.7% of all dental-related ED visits). For those covered by Medicaid (53.7%) and self-pay/uninsured (54.4%), dental caries was the most frequently reported dental condition.

Pulp & periapical lesions were the frequently reported dental condition for those covered by Medicare, private and other insurance plans. Table 5.4 provides the summary of ED visits with dental conditions by patient characteristics and primary payer. Proportion of females visiting ED with dental problems were seen more in those patients covered by Medicaid, private insurance and other insurance plans. The mean age per dental ED visit for the entire study period (years 2009 to 2013) was 32.4 years. A majority of all dental-related ED visits occurred among those aged between 25 years and 44 years (49%) and by those aged between 18 years and 24 years (21%). Whites comprised majority of dental ED visits for all the primary payer categories. Following an ED visit with dental conditions, 98.8% were discharged routinely for those covered by Medicaid. Most ED visits with dental conditions occurred on weekdays (close to 69%). Following an ED visits with dental conditions, around 98% were routinely discharged. About 63% of all dental ED visits occurred among those residing in the geographical areas with median household income below the second quartile. Using Charlson comorbid severity index, the current study found around 94% of dental-related ED visits made by across all ages had zero comorbid index score and only less than 6% had one comorbid condition. About 84% of dental ED visits made by Medicare patients did not have a comorbid condition. For Medicaid, close to 94% did not have any comorbid condition. Most of dental ED visits consisted of patients residing in metropolitan areas for those patients covered by Medicaid (81.8%), Medicare (82.1%), and private insurance (83.1%) and uninsured (85.8%) (Table 5.5). Among the different primary payer categories, patients with Medicare had highest average ED charges ($1041.7), followed by private insurance ($874.4), Medicaid ($811.4), uninsured ($796.2) and other insurance plans ($744.5)

[Table 5.6]. For the entire study period, aggregated ED charges were highest for Medicaid patients ($88.1 million). Figure 5.5 shows the average ED charges for dental conditions stratified by primary payer. Average ED charges for Medicare, Private insurance, Medicaid and Other insurance plans source and uninsured (self pay) have increased for the past five years. Average ED charges for those covered by Medicaid insurance have surpassed those uninsured in 2013.

Characteristics associated with hospital-based ED charges

Results from the multivariable linear regression analysis examining the effect of patient-related factors on hospital-based emergency department charges are summarized in Table 5.7. After adjusting for all other patient-related factors, patients with mouth cellulitis had $371.0 ($p<0.01$) higher ED charges than patient with pulp & periapical lesions. Those with dental caries ($162.4, $p<0.01$) and gingival conditions ($117.4, $p<0.01$) were significantly associated with lower ED charges. Blacks ($37.2, $p <0.01$) and Native Americans ($60.8, $p <0.01$) had lower ED charges compared with whites. Those covered by Medicare ($28.7, $p<0.05$) and Other insurance plans ($50.8, $p<0.05$) had higher ED charges compared to private insurance, whereas those uninsured had lower ED charges ($52.3, $p<0.01$). Dental ED visits during the weekend had $24.7 lower ED charges than weekday. Patient residing in areas where the median household income were second, third and fourth quartile had $14.7 ($p<0.01$), $34.6 ($p<0.01$) and $44.3 ($p<0.01$) higher ED charges respectively than those in the first quartile. Those residing in micropolitan ($41.8, $p<0.05$) and not metropolitan or micropolitan ($67.7, $p<0.01$) areas were associated with higher ED charges. ED charges increase with increasing comorbid index

score. Each year increase in age was associated with increasing ED charges ($4.5, p <0.01).

Distribution of dentists and dental-related ED visits by County

Map 5.1 shows the distribution of non-federal dentists in the state of New York by county for the year 2013. In 2013, there were 14,654 Non-Federal dentists in New York State. Counties that had less than 4 dentists per 10,000 population included Allegany, Cortland, Delaware, Hamilton, Lewis, Orleans, Schoharie, Schuyler, Tioga, Washington, and Yates. Counties that had the highest dentist per 10,000 population were Nassau, New York, Rockland, and Westchester. The distribution of population-based estimates of ED visits with dental conditions in New York by county is presented in Map 5.2. From Map 5.2, 26 counties had more than 50 dental-related ED visits per 10,000 population.

DISCUSSION

The present study provides estimates of hospital-based ED visits with dental conditions in New York State. To our knowledge, this study is the first to examine hospital-based ED visits with dental conditions in the state of New York after Medicaid reimbursement fees for dental coverage were lowered in 2011. Our study indicates that a total of 325,354 dental ED visits occurred during the study period resulting in total ED charges of close to $272 million. A substantial amount of resources is spent in ED to treat dental conditions considering the fact that EDs may not provide adequate care for dental conditions. For example, most patients are treated symptomatically using prescription medications and are not provided a definitive dental examination in the ED. There are unlikely to be trained dentists among ED staff. Our results suggest that a greater proportion of dental

ED visits occurred among those aged between 25-44 years, uninsured, covered by Medicaid and private insurance, and residing in metropolitan areas. The most frequently reported type of dental conditions in the current study were dental caries and pulp and lesions. These findings are consistent with prior studies.[2, 6, 65] High-risk cohorts who are likely to visit an ED with dental conditions in the state of New York are identified in the current study. Preventive oral health programs tailoring these individuals should be considered by policymakers and health care providers.

The current study demonstrates that close to 64% of the dental-related ED visits occurred in patients living in zip codes with first and second quartile median household income. These results suggest that more dental problems are in low-income areas. Studies have suggested that unmet needs and lack of routine dental care are higher for the low-income groups compared to high-income groups and even higher for dentally uninsured groups. [5, 12, 20] Effective community outreach and dental-related education program should be implemented in the low-income quartile areas.

Consistent with prior studies, our study results also indicated that the majority of ED visits with dental conditions were made by patients who did not have a comorbid condition. [2,6,65] Results from the maps showed that counties (Allegany, Delaware, Lewis, Schuyler, Washington and Yates) with fewer number of dentists per 10,000 population had higher dental ED visits per 10,000 population. An uneven distribution of dentists by county in the State of New York is evident from the distribution of dentist mapping. These results seem to suggest that lack of access to dentists could be the reason for patients seeking dental care in EDs. Also, prior studies have suggested access to dental care is the primary reason for seeking ED with dental problems.[2, 6] According to a report

by U.S. Department of Health and Human Services, New York State is projected to have a shortage of dentists in 2025.[60] This could further contribute to worsening oral health care and perpetuating the disparities in dental care access in New York state. Improving access to dental care could result in a reduction in dental-related ED visits.

Consistent with previous studies, our study also documented that a large proportion of ED visits with dental conditions were made by those covered by Medicaid, private insurance and the uninsured.[2,6,65] An interesting finding from the current study was that the proportion of Medicaid ED visits with dental conditions almost doubled from the year 2011 onwards. The reason for the increase in dental-related ED visits covered by Medicaid may be attributed to the decrease in Medicaid reimbursement rates for dentists in New York State. New York decreased Medicaid dental fees by 10 to 33 percent in 2011.[62,63] Figure 5.4 provides evidence that decreased Medicaid reimbursement rates (after the year 2010) might have led to significant increase in dental-related ED visits by Medicaid patients. A study conducted by Nasseh et al examined the impact of Medicaid reform on children's dental care utilization in Connecticut, Maryland, and Texas.[66] Using data from National Survey of Children's Health, this study suggested that increasing Medicaid dental fees led to lower unmet dental need. Other previous studies have also suggested that changes to reimbursement rates have affected dentist participation.[67-69] Most dentists are unwilling to accept and treat Medicaid patients because of low reimbursement rates. [67-69] In addition to shortages and uneven distribution of dentists, low Medicaid reimbursement for dentists has further contributed to poor access to dental care. As indicated by the current study, a major portion of the patients who visit an ED with a dental condition were those covered by Medicaid. We could potentially consider

increasing Medicaid reimbursement for dentists. This action could decrease the number of ED visits related to dental conditions and also improve the overall oral health.

LIMITATIONS

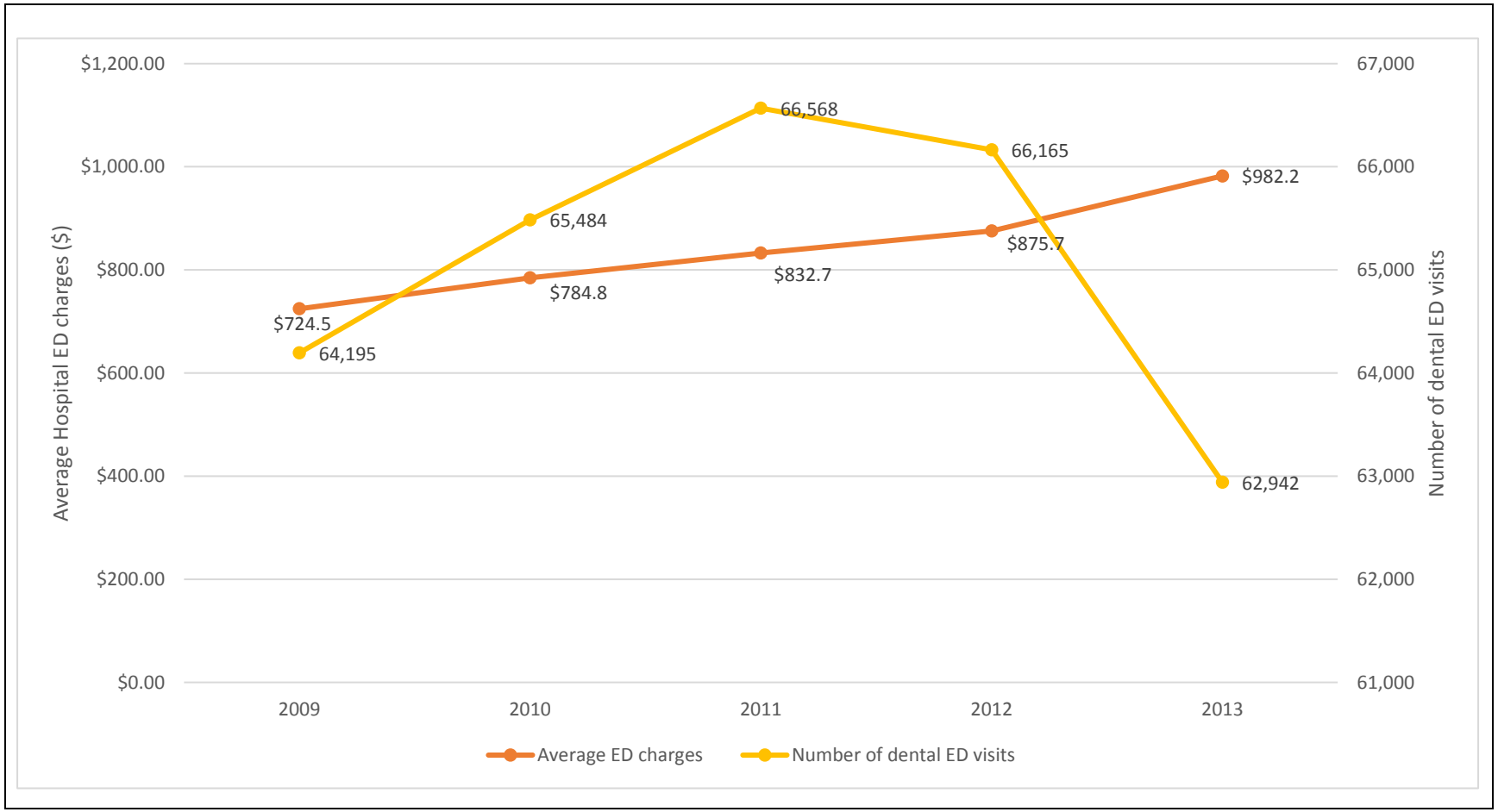
The results presented in the current study are subject to certain limitations due to the retrospective study design and use of secondary hospital ED data sets. It should be noted that the current study provides information only on ED visits not resulting in hospitalization. Subsequently, the current study may underestimate the total ED charges that result in ED. The data used for the present study do not provide information on post-discharge outcomes, which precludes us from further examination of outcomes. Also, SEDD datasets do not provide actual reason or cause for an ED. Future research should focus on emergency visits made to dental clinics and community clinics.

CONCLUSION

The current study provides estimates of characteristics of patients across all ages visiting hospital-based EDs with dental conditions in the state of New York. Additionally, this study examined the impact of Medicaid reimbursement for dentist on dental-related ED utilization. In the state of New York, a total of 325,354 ED visits with dental conditions occurred during the study period which resulted in total ED charges of around $272 million. High-risk groups visiting ED with dental problems identified from the study are those aged 25 to 44 years, uninsured, covered by Medicaid and private insurance, and residing in low-income areas. The proportion of dental ED visits made by patients on Medicaid increased drastically in the year 2011 and remained almost steady from then onwards.

FIGURES

Figure 5.1: Number of dental ED visits and Average dental-related ED charges, 2009 – 2013



Note: Hospital ED charges – Inflation adjusted to 2013 US dollar value. ED, Emergency Department

Figure 5.2: Dental-related emergency department visits by age group, NY 2009-2013

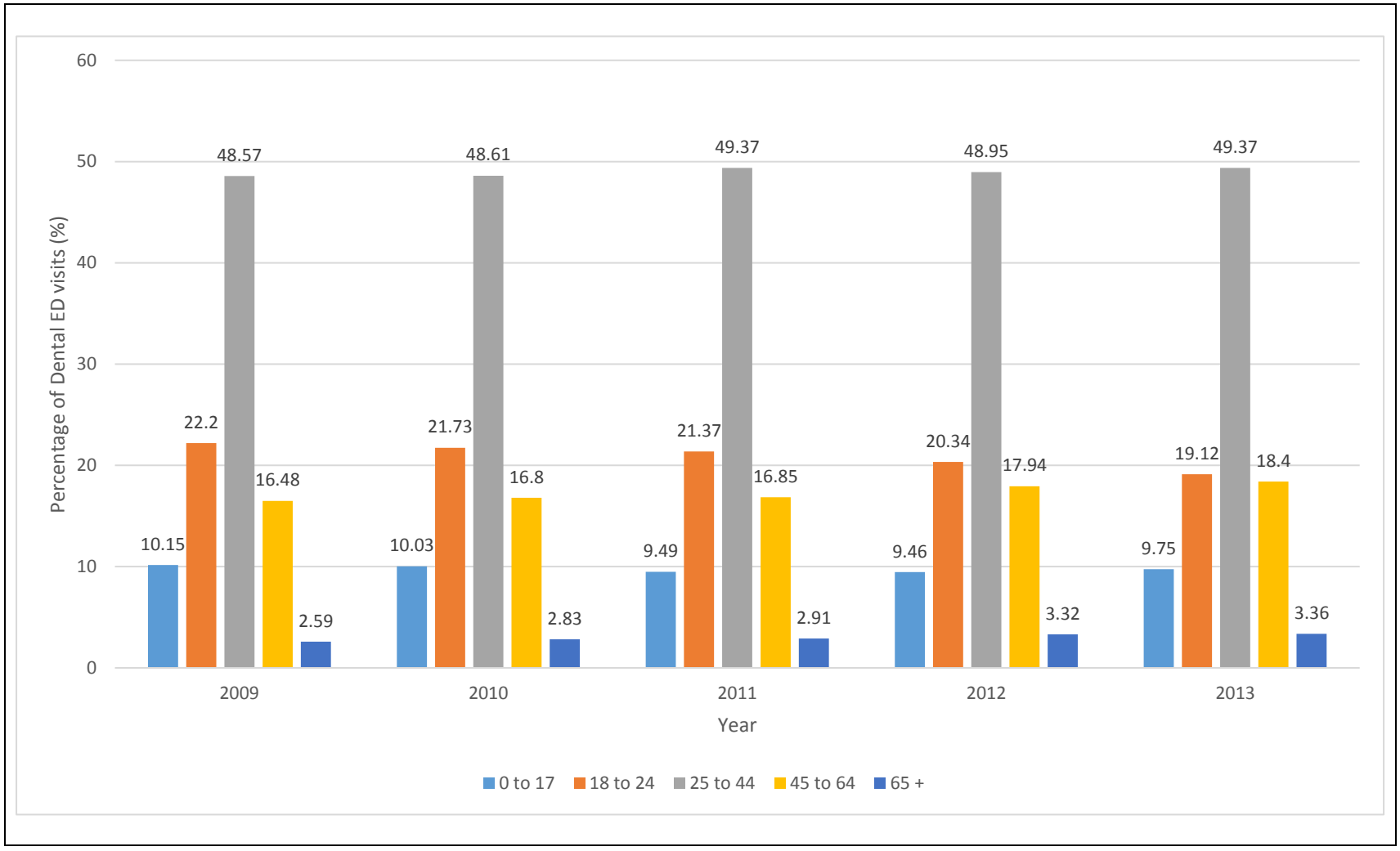


Figure 5.3: Dental-related emergency department visits by Race/Ethnicity, NY 2009 - 2013

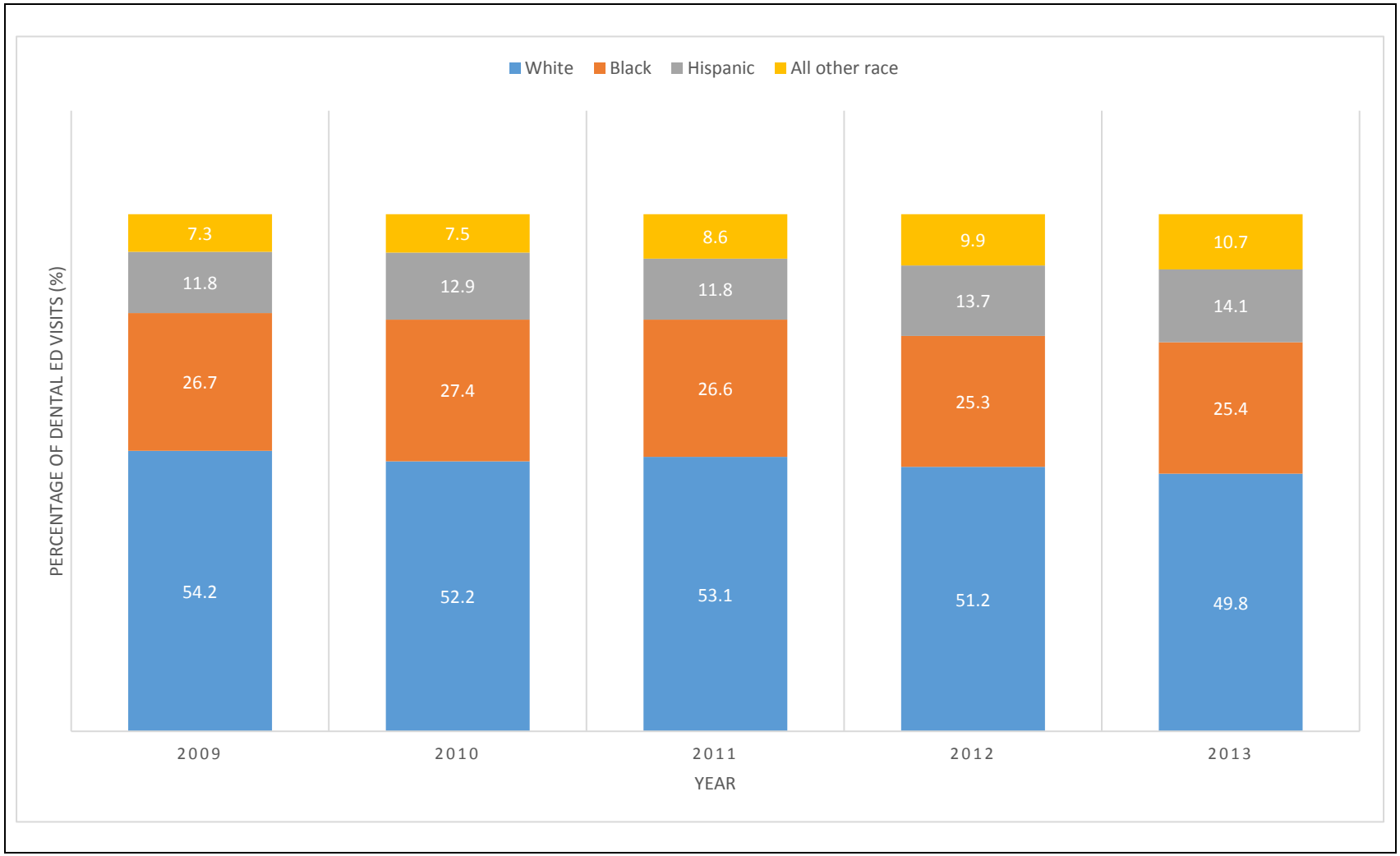


Figure 5.4: Dental-related emergency department visits by primary payer, 2009 – 2013

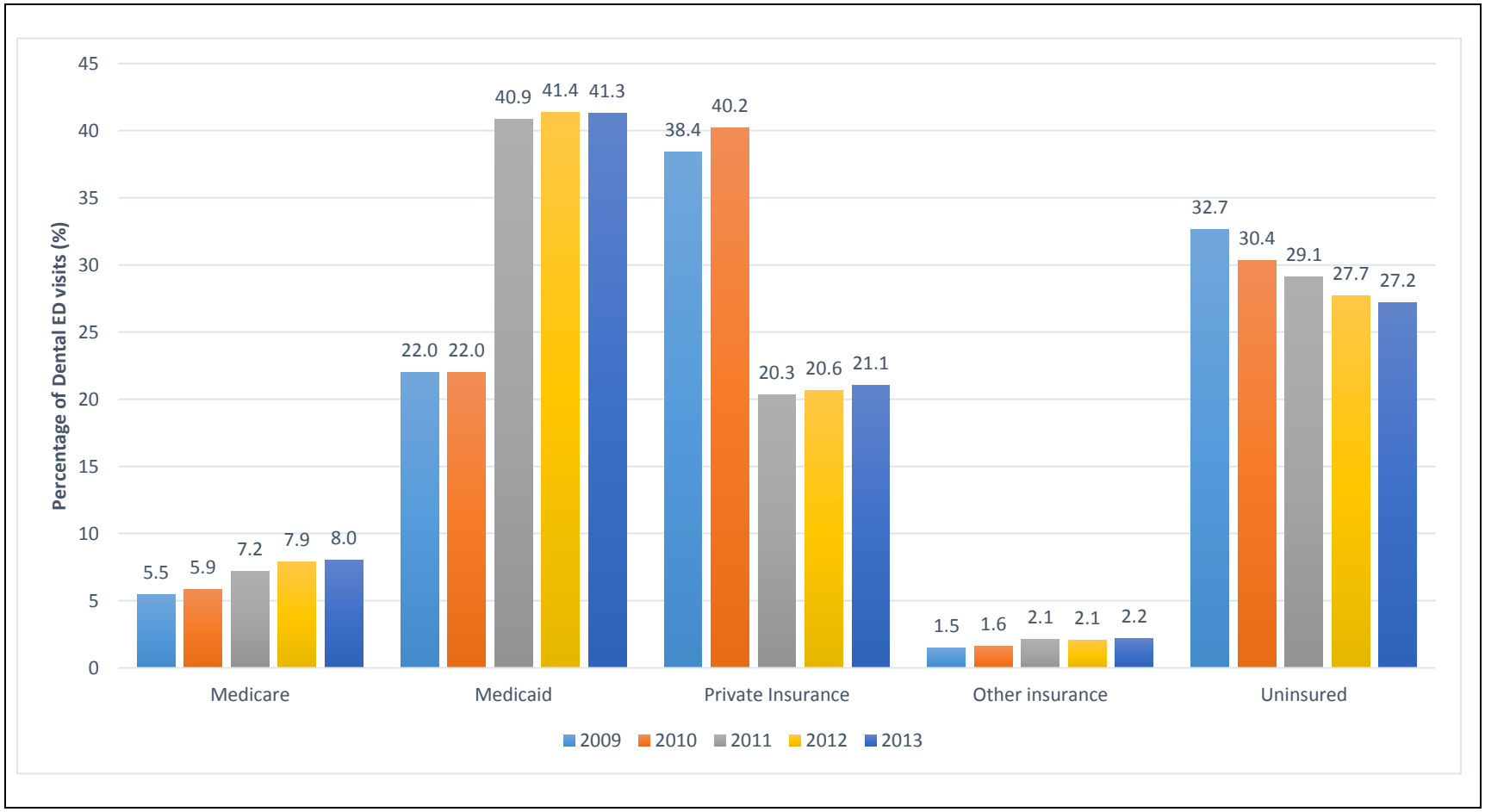
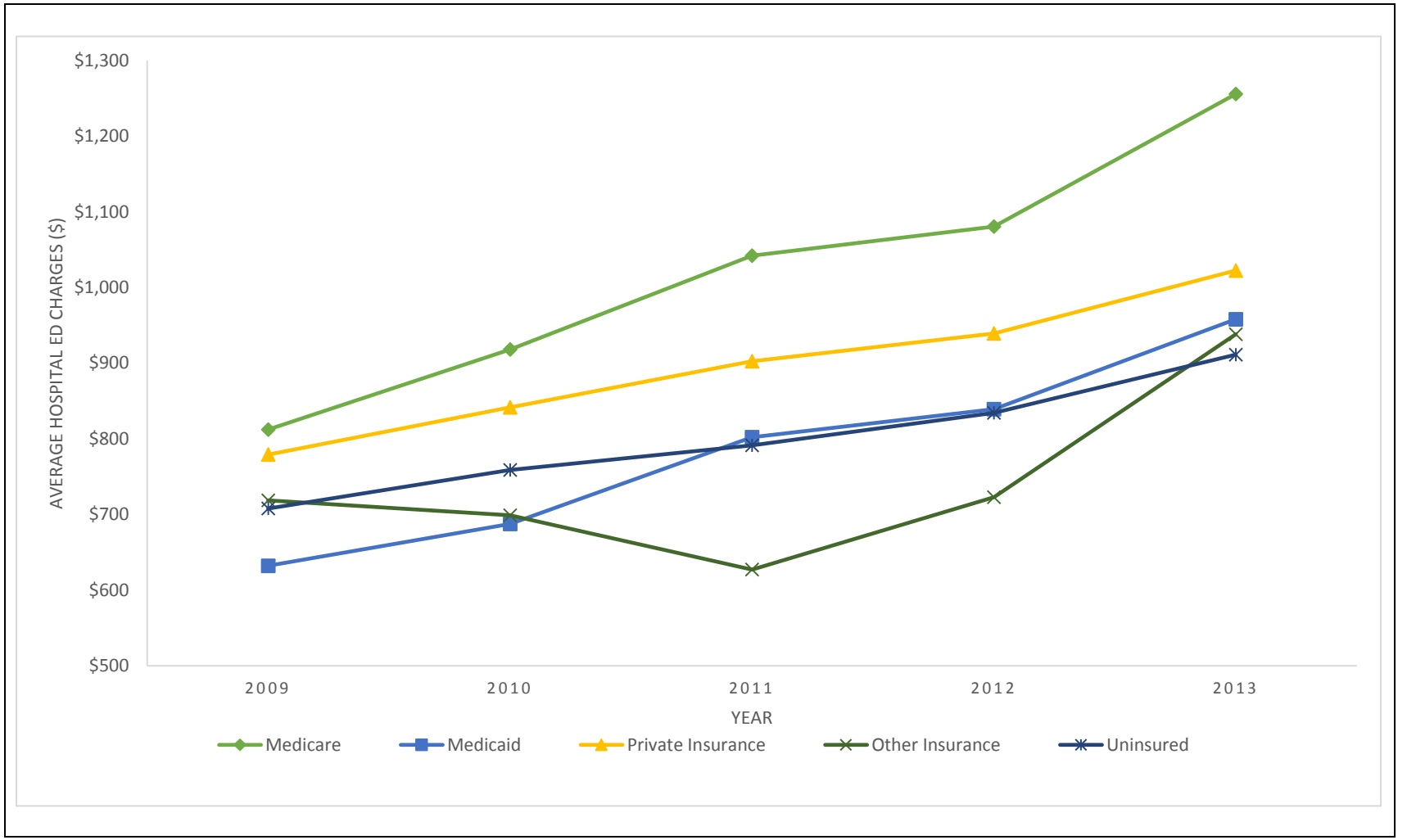


Figure 5.5: Average hospital-based emergency department charges with dental conditions by primary payer, NY 2009-2013



Note: Hospital ED charges - Inflation adjusted to 2013 US dollar value

TABLES

Table 5.1: ICD-9-CM codes used to define different dental conditions.

Dental Conditions	ICD-9-CM codes
Dental caries	521.00, 521.01, 521.02, 521.03, 521.04, 521.05, 521.06, 521.07, 521.08 & 521.09
Pulpal or Periapical lesions	522.0, 522.1, 522.2, 522.3, 522.4, 522.5, 522.6, 522.7, 522.8 & 522.9
Gingival or Periodontal conditions	523.00, 523.01, 523.10, 523.11, 523.20, 523.21, 523.22, 523.23, 523.24, 523.25, 523.3, 523.30, 523.31, 523.32, 523.33, 523.40, 523.41, 523.42, 523.5, 523.6, 523.8 & 523.9
Mouth cellulitis or Abscess	528.3

ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification

Table 5.2: Number of dental-related ED visits per 10,000 population in New York: SEDD 2009-2013.

Characteristics	2009	2010	2011	2012	2013
Total ED visits related to dental conditions	64,195	65,484	66,568	66,165	62,942
Population Estimates	19,541,453	19,402,920	19,523,202	19,606,981	19,691,032
Dental related ED visits per 10,000 population	32.9	33.8	34.1	33.8	32.0

ED, emergency department; SEDD, State Emergency Department Database.

Table 5.3: Types of dental conditions stratified by primary payer, NY SEDD 2009-2013

Types of dental conditions	Number (Percent)	Primary Payer – Number (Percent)				
		Medicare	Medicaid	Private Insurance	Other Insurance	Uninsured
Dental caries	163,817 (50.4)	10,098 (45.0)	58,553 (53.7)	39,693 (43.4)	3115 (50.6)	52,329 (54.4)
Pulp & Periapical lesions	152,991 (47.0)	10,541 (47.0)	48,453 (44.4)	46,003 (50.4)	3245 (52.7)	44,720 (46.4)
Gingival	22,419 (6.9)	1580 (7.0)	8184 (7.5)	6862 (7.5)	278 (4.5)	5514 (5.7)
Periodontal	15,638 (4.8)	2149 (9.6)	4427 (4.1)	4756 (5.2)	203 (3.3)	4103 (4.3)
Mouth cellulitis	8747 (2.7)	686 (3.1)	2104 (1.9)	3930 (4.3)	158 (2.6)	1867 (1.9)

ED, emergency department; SEDD, State Emergency Department Database

Table 5.4: Patient characteristics visiting ED with a dental condition in New York stratified by primary payer, NY SEDD 2009 -2013*[*]

Characteristics	Number (Percent)	Primary Payer – Number (Percent)				
		Medicaid	Medicare	Private Insurance	Other Insurance	Uninsured
Sex						
Male	164,402 (50.5)	46,872(43.0)	11,469 (51.1)	43,752 (47.9)	2845 (46.2)	59,434 (61.7)
Female	160,946 (49.5)	62,181(57.0)	10,965 (48.9)	47,621 (52.1)	3309 (53.8)	36,844 (38.3)
Race/Ethnicity						
White	168,627 (52.1)	52,836 (48.7)	13,641 (61.1)	49,758 (54.7)	4017 (65.6)	48,343 (50.5)
Black	84,996 (26.3)	30,272 (27.9)	4880 (21.8)	22,826 (25.1)	1218 (19.9)	25,785 (26.9)
Hispanic	41,626 (12.9)	15,457 (14.2)	2285 (10.2)	11,068 (12.2)	542 (8.9)	12,271 (12.8)
Asian	4523(1.4)	1824 (1.7)	305 (1.4)	1420 (1.6)	49 (0.8)	925 (1.0)
Native American	1142 (0.4)	351 (0.3)	44 (0.2)	412 (0.4)	93 (1.5)	242 (0.3)
Other race	22,726 (7.0)	7784 (7.2)	1176 (5.3)	5416 (6.0)	204 (3.3)	8140 (8.5)
Admission Day						
Weekday	221,979 (68.7)	75,052 (69.3)	15,124 (68.3)	59,425 (65.5)	4116 (67.2)	68,219 (71.1)
Weekend	101,369 (31.3)	33,255 (30.7)	7037 (31.7)	31,341 (34.5)	2011 (32.8)	27,712 (28.9)

Disposition status						
Routine	320,818 (98.6)	107,709 (98.8)	21,870 (97.5)	90,000 (98.5)	6092 (99.0)	95,147 (98.8)
Transfer to short-term hospital	1429 (0.4)	445 (0.4)	159 (0.7)	461 (0.5)	22 (0.4)	342 (0.4)
Transfer Other: Includes SNF, ICF, Another Type of Facility	444 (0.1)	131 (0.1)	171 (0.8)	71 (0.1)	DS	64 (0.1)
Home Health Care	870 (0.3)	198 (0.2)	68 (0.3)	450 (0.5)	DS	150 (0.2)
Against Medical Advice	1733 (0.5)	570 (0.5)	165 (0.7)	392 (0.4)	29 (0.5)	577 (0.6)
Died	DS	DS	DS	DS	DS	DS
Median household income national quartile for patient ZIP code[**]						
First quartile	110,198 (34.6)	42,061 (39.3)	6253 (28.7)	26,939 (30.1)	2436 (40.5)	32,487 (34.4)
Second quartile	90,991 (28.5)	31,723 (29.7)	6245 (28.7)	24,883 (27.8)	2146 (35.6)	25,978 (27.5)
Third quartile	60,475 (19.0)	18,790 (17.6)	4213 (19.3)	17,973 (20.0)	874 (14.5)	18,614 (19.7)
Fourth quartile	57,183 (17.9)	14,342 (13.4)	5065 (23.3)	19,850 (22.1)	566 (9.4)	17,353 (18.4)
Patient's Charlson Comorbidity Severity Index score						
0	304,966 (93.7)	101,964 (93.5)	18,801 (83.8)	85,941 (94.1)	5759 (93.6)	92,455 (96.0)
1	18,410 (5.7)	6482 (5.9)	2943 (13.1)	4921 (5.4)	354 (5.8)	3701 (3.8)
2	1705 (0.5)	538 (0.5)	568 (2.5)	450 (0.5)	34 (0.5)	115 (0.1)
=> 3	273 (0.1)	69 (0.1)	122 (0.5)	63 (0.1)	DS	11 (0.1)

ED, emergency department; SEDD, State Emergency Department Database; SNF, Skilled Nursing Facility; ICF, Intermediate Care Facility; DS, HCUP-AHRQ data user agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. These numbers were denoted by "DS" (Discharge Suppressed). [*] The sum of individual counts may not add up to the total number of visits because of missing information for certain variables.

[**] Median household income quartiles of residents in the patient's ZIP code vary by year. For 2009, the level levels were $1 to $39,999 (quartile 1), $40,000 to $49,999 (quartile 2), $50,000 to $65,999 (quartile 3) and $66,000 or higher (quartile 4). For 2010, the level levels were $1 to $40,999 (quartile 1), $41,000 to $50,999 (quartile 2), $51,000 to $66,999 (quartile 3) and $67,000 or higher (quartile 4). For 2011, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4). For 2012, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $62,999 (quartile 3) and $63,000 or higher (quartile 4). For 2013, the levels were $1 to $37,999 (quartile 1), $38,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4).

Table 5.5: Number (percent) of patients with dental-related ED visits by patient location and primary payer, NY SEDD 2009 - 2013[*]

Patient location	Number (percent)	Medicare	Medicaid	Private Insurance	Other Insurance	Uninsured
Metropolitan areas	266,454(82.8)	88,186 (81.8)	18,080 (82.1)	75,264 (83.1)	2977 (48.8)	81,899 (85.8)
Micropolitan areas	43,108(13.4)	15,196 (14.1)	2998 (13.6)	11,722 (12.9)	2951 (48.4)	10,240 (10.7)
Not metropolitan nor micropolitan	12,415(3.9)	4428 (4.1)	932 (4.2)	3577 (4.0)	167 (2.8)	3304 (3.5)

ED, emergency department; SEDD, State Emergency Department Database

Table 5.6: Average and aggregate emergency department charges with dental conditions by primary payer, NY SEDD 2009 - 2013[*]

ED charges	Medicare	Medicaid	Private Insurance	Other Insurance	Uninsured
Mean charges	$ 1041.7	$ 811.4	$ 874.4	$ 744.5	$ 796.2
Aggregate charges	$ 23,278,134	$ 88,113,696	$ 79,537,780	$ 4,575,457	$ 76,439097

ED, emergency department; SEDD, State Emergency Department Database
Hospital ED charges (inflation adjusted to 2013 US dollar value)

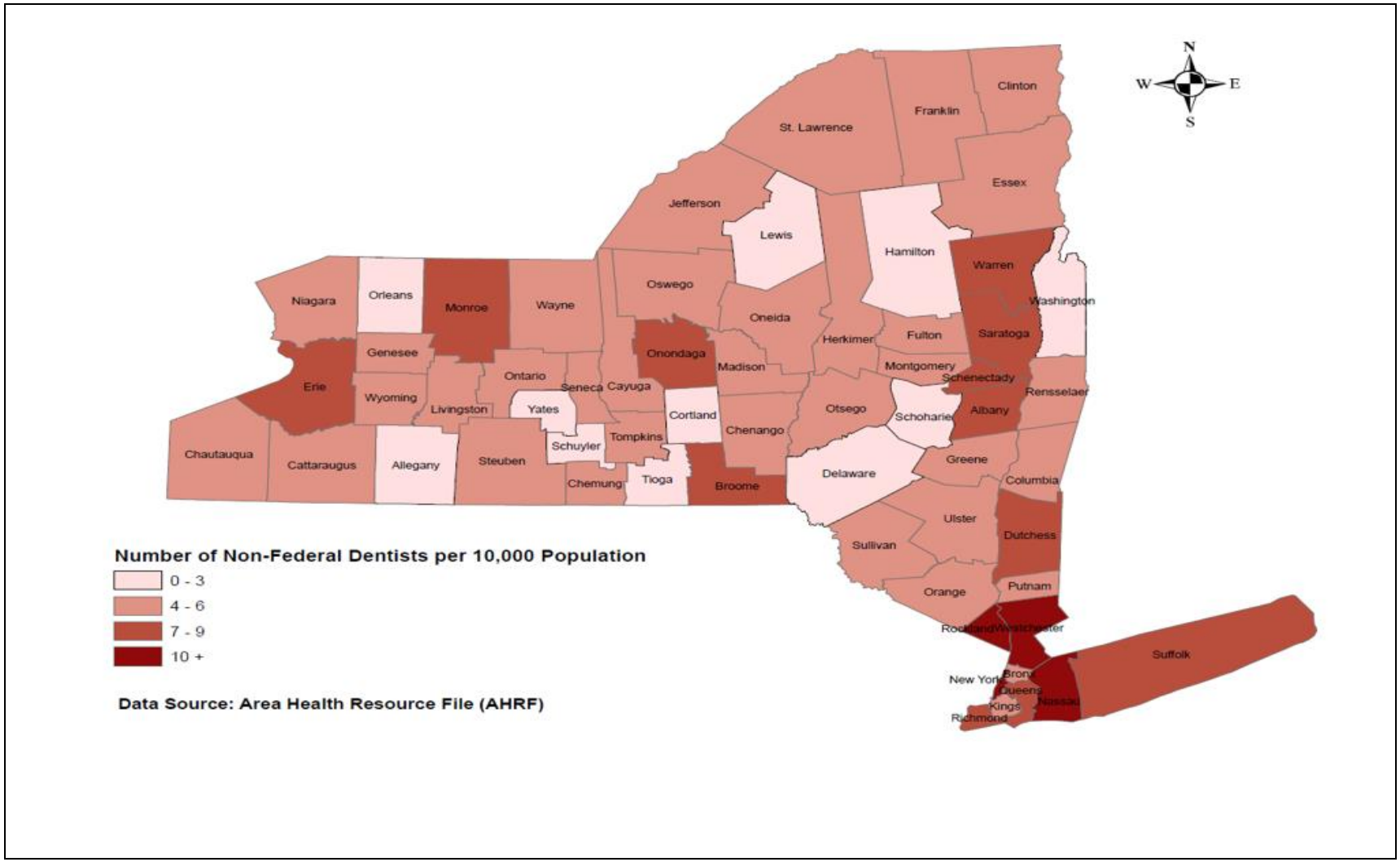
Table 5.7: Multivariable linear regression: Examining the effect of patient related factors on dental related ED charges.

Characteristics	Categories	Estimate (95% CI)	P-value
Types of dental conditions	Pulp & Periapical lesions	Reference	
	Dental Caries	-162.380 (-189.290 - -135.470)	<.01
	Gingival	-117.361 (-143.561 - -91.1618)	<.01
	Periodontal	-26.8567 (-70.0838 - 16.3703)	0.2233
	Mouth Cellulitis	371.0317(318.6955 - 423.3679)	<.01
Sex	Male	Reference	
	Female	7.9477 (-0.8915 - 16.7869)	0.0780
Race/Ethnicity	White	Reference	
	Black	-37.1720 (-50.9980 - -23.3461)	<.01
	Hispanic	-15.1074 (-38.1437 - 7.9290)	0.1987
	Asian	-11.2865 (-37.4988 - 14.9258)	0.3987
	Native American	-60.8008 (-97.4433 - -24.1582)	<.01
	Other race	-18.5543 (-39.7153 - 2.6066)	0.0857
Primary payer	Private Insurance	Reference	
	Medicare	28.6600 (5.3833 - 51.9366)	<.05
	Medicaid	-21.7987 (-66.8034 - 23.2060)	0.3424
	Other Insurance	50.8094 (5.0099 - 96.6090)	0.0297
	Uninsured	-52.3484 (-76.0707 - -28.6262)	<.01
Admission Day	Weekday (0)	Reference	
	Weekend (1)	-24.6789 (-38.2205 - -11.1374)	<.01
Median household income national quartile	First quartile	Reference	
	Second quartile	14.7232 (3.5459 - 25.9005)	<.01
	Third quartile	34.6437 (16.8208 - 52.4667)	<.01
	Fourth quartile	44.2656 (18.7634 - 69.7677)	<.01
Patient location	Metropolitan areas	Reference	
	Micropolitan areas	41.8433 (3.4728 - 80.2139)	<.05
	Not metropolitan or micropolitan	67.6920 (18.4934 - 116.8905)	<.01
Charlson comorbid index	0	Reference	
	1	194.1717 (148.6676 - 239.6758)	<.01

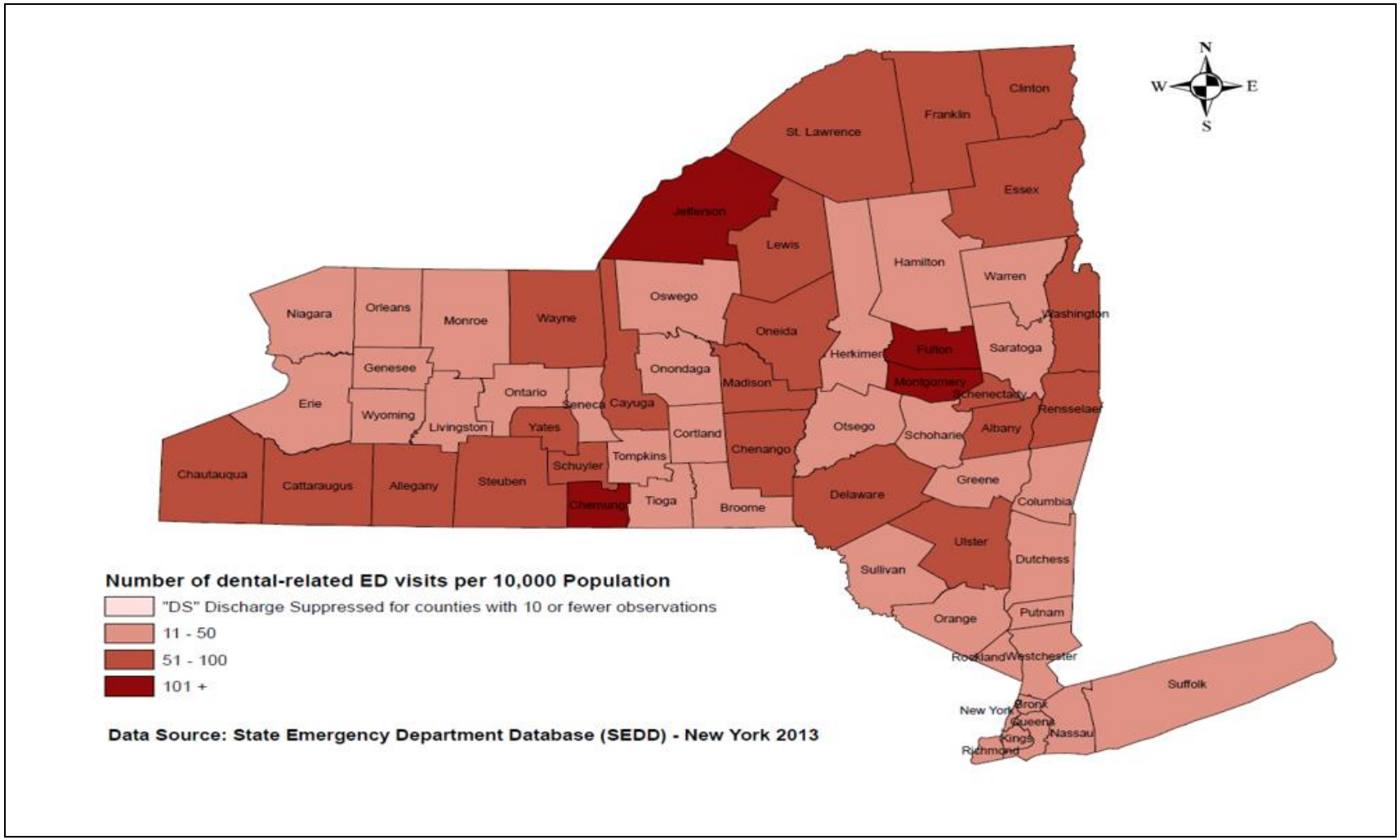
	2	639.2763 (458.0784 - 820.4742)	<.01
	3	1290.853 (858.3139 - 1723.391)	<.01
Year	2009	Reference	
	2010	51.6880 (12.1026 – 91.2734)	<.05
	2011	96.1067 (40.2346 - 151.9787)	<.01
	2012	136.7770 (79.3290 - 194.2250)	<.01
	2013	222.5429 (150.9557 - 294.1301)	<.01
Age		4.4504 (3.7226 - 5.1783)	<.01

* Median household income quartiles of residents in the patient's ZIP code vary by year. For 2009, the level levels were $1 to $39,999 (quartile 1), $40,000 to $49,999 (quartile 2), $50,000 to $65,999 (quartile 3) and $66,000 or higher (quartile 4). For 2010, the level levels were $1 to $40,999 (quartile 1), $41,000 to $50,999 (quartile 2), $51,000 to $66,999 (quartile 3) and $67,000 or higher (quartile 4). For 2011, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4). For 2012, the levels were $1 to $38,999 (quartile 1), $39,000 to $47,999 (quartile 2), $48,000 to $62,999 (quartile 3) and $63,000 or higher (quartile 4). For 2013, the levels were $1 to $37,999 (quartile 1), $38,000 to $47,999 (quartile 2), $48,000 to $63,999 (quartile 3) and $64,000 or higher (quartile 4).

Map 5.1: Distribution of Non-Federal Dentists in New York by County: 2013



Map 5.2: Number of dental-related emergency department (ED) visits in New York by County: 2013



APPENDIX

Appendix 5.1: Number (percent) of patients with dental-related ED visits in New York stratified by patient characteristics, SEDD 2009-2013

Characteristics	2009	2010	2011	2012	2013
Sex					
Male	32,339(50.38)	32,793(50.08)	33,500(50.32)	33,634(50.83)	32,136(51.06)
Female	31,852(49.62)	32,689(49.92)	33,068(49.68)	32,531(49.17)	30,806(48.94)
Age group					
0 to 17	6518(10.15)	6566(10.03)	6318(9.49)	6259(9.46)	6139(9.75)
18 to 24	14,252(22.20)	14,227(21.73)	14,227(21.37)	13,455(20.34)	12,033(19.12)
25 to 44	31,182(48.57)	31,832(48.61)	32,866(49.37)	32,387(48.95)	31,074(49.37)
45 to 64	10,581(16.48)	11,004(16.80)	11,219(16.85)	11,868(17.94)	11,580(18.40)
65 and over	1661(2.59)	1855(2.83)	1938(2.91)	2196(3.32)	2116(3.36)
Race/Ethnicity					
White	34,544(54.24)	33,917(52.22)	35,045(53.05)	33,767(51.16)	31,354(49.82)
Black	16,981(26.66)	17799(27.41)	17,538(26.55)	16,679(25.27)	15,999(25.42)
Hispanic	7540(11.84)	8392(12.92)	7810(11.82)	9020(13.67)	8864(14.08)
Asian	794(1.25)	817(1.26)	952(1.44)	1045(1.58)	915(1.45)
Native American	252(0.40)	232(0.36)	266(0.40)	235(0.36)	157(0.25)
Other race	3580(5.62)	3791(5.84)	4451(6.74)	5254(7.96)	5650(8.98)
Mean Age (year)	31.87	32.07	32.33	32.79	33.06
Primary payer					
Medicare	3517(5.48)	3844(5.87)	4789(7.19)	5228(7.91)	5056(8.04)
Medicaid	14,108(21.98)	14,410(22.01)	27,198(40.86)	27,356(41.37)	25,981(41.29)
Private Insurance	24,646(38.39)	26,311(40.18)	13,517(20.31)	13,648(20.64)	13,253(21.06)
Other Insurance	966(1.50)	1041(1.59)	1405(2.11)	1364(2.06)	1378(2.19)
Uninsured	20,958(32.65)	19,878(30.36)	19,369(29.10)	18,308(27.69)	17,122(27.21)
Admission Day					
Weekday	43,129(68.26)	44,335(68.74)	45,838(68.86)	45,576(68.88)	43,101(68.48)
Weekend	20,051(31.74)	20,158(31.26)	20,730(31.14)	20,589(31.12)	19,841(31.52)

Disposition status					
Routine	63,384(98.74)	64597(98.65)	65,597(98.54)	65,153(98.52)	62,087(98.67)
Transfer to short-term hospital	164(0.26)	260(0.40)	350(0.53)	379(0.57)	276(0.44)
Transfer Other: Includes SNF, ICF, Another Type of Facility	54(0.08)	72(0.11)	84(0.13)	93(0.14)	141(0.22)
Home Health Care (HHC)	264(0.41)	225(0.34)	167(0.25)	124(0.19)	90(0.14)
Against Medical Advice (AMA)	328(0.51)	328(0.50)	370(0.56)	380(0.57)	327(0.52)
Died	DS	DS	DS	DS	DS
Median household income national quartile for patient ZIP code					
First quartile	22,637(36.31)	23,276(36.55)	24,009(36.59)	23,346(35.80)	16,930(27.31)
Second quartile	17,725(28.43)	17,547(27.55)	17,788(27.11)	18,066(27.70)	19,865(32.04)
Third quartile	11,091(17.79)	11,237(17.65)	12,822(19.54)	12,190(18.69)	13,135(21.19)
Fourth quartile	10,888(17.47)	11,623(18.25)	10,995(16.76)	11,608(17.80)	12,069(19.47)
Patient location					
Metropolitan areas	51,919(82.39)	53,419(83.07)	55,118(83.22)	54,442(82.69)	51,556(82.37)
Micropolitan areas	8765(13.91)	8488(13.20)	8614(13.01)	8787(13.35)	8454(13.51)
Not metropolitan or micropolitan	2329(3.70)	2402(3.74)	2498(3.77)	2607(3.96)	2579(4.12)
Patient's Charlson Comorbidity Severity Index score					
0	61,135(95.23)	61735(94.27)	62,556(93.97)	61,437(92.85)	58,103(92.31)
1	2794(4.35)	3393(5.18)	3635(5.46)	4269(6.45)	4319(6.86)
2	226(0.35)	321(0.49)	310(0.47)	404(0.61)	444(0.71)
=> 3	40(0.06)	35(0.05)	67(0.10)	55(0.08)	76(0.12)
Hospital ED charges (inflation adjusted to 2013 US dollar value)					
Mean charges	$724.4	$784.7	$832.7	$875.6	$982.1
Total charges	$46,344,316.98	$51,300,119	$55,162,623	$57,655,513	$61,517,583

DS, HCUP-AHRQ data user agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. These numbers were denoted by "DS" (Discharge Suppressed).

Appendix 5.2: Multivariable linear regression: Examining the effect of patient related factors on dental related ED charges (log transformed ED charges).

Characteristics	Categories	Estimate (95% CI)	P-value
Types of dental conditions	Pulp & Periapical lesions	Reference	
	Dental Caries	-0.1400 (-0.1646 - -0.1154)	<.01
	Gingival	-0.0947 (-0.1145 - -0.0749)	<.01
	Periodontal	-0.0304 (-0.0697 - 0.0090)	0.1306
	Mouth Cellulitis	0.2775 (0.2420 - 0.3131)	<.01
Sex	Male	Reference	
	Female	0.0088 (0.0033 - 0.0143)	<.01
Race/Ethnicity	White	Reference	
	Black	-0.0216 (-0.0320 - -0.0111)	<.01
	Hispanic	-0.0177 (-0.0440 - 0.0086)	0.1860
	Asian	0.0003 (-0.0194 - 0.0199)	0.9781
	Native American	-0.0399 (-0.0704 - -0.0094)	<.05
	Other race	-0.0139 (-0.0354 - 0.0076)	0.2058
Primary payer	Private Insurance	Reference	
	Medicare	0.0116 (-0.0031 - 0.0262)	0.1208
	Medicaid	-0.0218 (-0.0555 - 0.0119)	0.2042
	Other Insurance	0.0614 (0.0334 - 0.0895)	<.01
	Uninsured	-0.0303 (-0.0443 - -0.0162)	<.01
Admission Day	Weekday (0)	Reference	
	Weekend (1)	-0.0081 (-0.0173 - 0.0010)	0.0822
Median household income national quartile*	First quartile	Reference	
	Second quartile	0.0168 (0.0066 - 0.0269)	<.01
	Third quartile	0.0233 (0.0114 - 0.0353)	<.01
	Fourth quartile	0.0260 (0.0108 - 0.0412)	<.01
Patient location	Metropolitan areas	Reference	
	Micropolitan areas	0.0185 (-0.0074 - 0.0445)	0.1610
	Not metropolitan or micropolitan	0.0336 (0.0056 - 0.0616)	<.05
Charlson comorbid index	0	Reference	

	1	0.1281 (0.1050 - 0.1512)	<.01
	2	0.3213 (0.2649 - 0.3777)	<.01
	3	0.5652 (0.4397 - 0.6906)	<.01
Year	2009	Reference	
	2010	0.0632 (0.0200 - 0.1064)	<.01
	2011	0.1294 (0.0657 -0.1930)	<.01
	2012	0.1672 (0.1040 -0.2303)	<.01
	2013	0.2387 (0.1662 - 0.3111)	<.01
Age (year)		0.0030 (0.0026 - 0.0034)	<.01

Appendix 5.3: Number of ED visits with dental condition and distribution of Dentists by county, NY 2013.

NY County	Number of Non-Federal Dentists	Number of Dental related ED visits
Albany	240	2012
Allegany	10	345
Bronx	452	3607
Broome	122	989
Cattaraugus	27	596
Cayuga	34	408
Chautauqua	59	860
Chemung	36	1132
Chenango	15	385
Clinton	38	741
Columbia	24	245
Cortland	14	220
Delaware	11	311
Dutchess	196	745
Erie	715	3563
Essex	17	286
Franklin	19	268
Fulton	18	729
Genesee	22	252
Greene	17	107
Hamilton	0	DS
Herkimer	20	243
Jefferson	59	1239
Kings	1448	5698
Lewis	5	193
Livingston	31	144
Madison	27	543
Monroe	530	2597
Montgomery	27	552
Nassau	1647	2113
New York	2833	2353
Niagara	98	676
Oneida	112	1218
Onondaga	314	2135
Ontario	62	365

Orange	208	1395
Orleans	9	152
Oswego	43	473
Otsego	29	301
Putnam	52	124
Queens	1568	5074
Rensselaer	60	1195
Richmond	316	1110
Rockland	299	334
St. Lawrence	36	1046
Saratoga	150	602
Schenectady	99	1244
Schoharie	7	102
Schuyler	4	129
Seneca	11	139
Steuben	35	700
Suffolk	1114	4952
Sullivan	25	374
Tioga	8	96
Tompkins	52	342
Ulster	95	917
Warren	53	314
Washington	15	318
Wayne	29	535
Westchester	1020	1382
Wyoming	13	189
Yates	5	150

DS, HCUP-AHRQ data user agreement precludes reporting individual cell counts ≤ 10 to preserve patient confidentiality. These numbers were denoted by "DS" (Discharge Suppressed).

CHAPTER 6 – CONCLUSION

The three studies comprising this dissertation primarily focused on examining patient-related characteristics of emergency department visits with dental conditions in California, Nebraska, and New York. The first study, "Trends in dental-related emergency department visits in the state of California from 2005 to 2011" provided trends in hospital-based emergency department visits involving dental conditions in the State of California, and identified clinical and patient characteristics associated with these trends. Additionally, this study examined whether patient-related characteristics were associated with being discharged against medical advice and the impact of state Medicaid policy change on dental benefits for adults on dental-related ED visits. The second study, "Emergency department utilization related to dental conditions & distribution of dentists, Nebraska 2011-2013" examined hospital-based ED visits with dental conditions in the state of Nebraska and showed how the distribution of dentists is associated with hospital ED visits with dental conditions. The third study, "Hospital-based emergency department visits with dental conditions: Impact of the Medicaid reimbursement fee-for-dental services in New York State" examined the Medicaid reimbursement change for dental services on the utilization of EDs with dental conditions. The State Emergency Department Database (SEDD) for California, Nebraska and New York were used for this dissertation. The SEDD contains information on all visits to hospital-affiliated emergency departments that do not result in hospitalization. All hospital-based emergency department visits with dental conditions in the states of California, Nebraska, and New York were selected. Dental conditions (dental caries, pulp & periapical lesions, gingival,

periodontal and mouth cellulitis) were identified based on International classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes.

Summary of findings

First Study: This study found a total of 402,077 ED visits with dental conditions. The number of ED visits with dental conditions increased from 44,516 (in 2005) to 70,385 (in 2011). The proportion of Medicaid patients visiting EDs with dental condition increased following the elimination of Medicaid dental benefits for adults in 2009. Uninsured and Medicaid patients accounted for large proportion of ED visits with dental conditions. This study suggests that male patients and those lacking private insurance plans or the uninsured are most likely to be discharged against medical advice following emergency visits with dental condition.

Second Study: The study found a total of 9,943 ED visits with dental conditions resulting in total hospital ED charges of $9.3 million. Thirty-nine percent of all dental ED visits had patients who were self-financed or uninsured. Patients residing in urban areas spent significantly higher charges than those living in rural towns, small rural towns or isolated rural areas. Results from this study suggest that ED visits with dental conditions are more likely in the counties with higher number of dentist per population. Also, this study identified high-risk groups (uninsured, aged 25 to 44 years, those covered by private insurance and residing in urban areas) who are likely to visit EDs with dental conditions.

Third Study: There were 325,354 ED visits with dental conditions in New York state. For this study, the identified high-risk groups were those aged 24 to 44 years, uninsured,

those covered by private insurance, Medicaid and residing in low-income areas. The proportion of Medicaid patients increased drastically from 2010 onwards. The study highlights that the decrease in Medicaid reimbursement fees for dental services had a significant impact on emergency departments' utilization with dental problems by Medicaid patients.

Practical Implications

This dissertation attempted to characterize and examine the outcomes associated with hospital-based EDs with dental conditions using state-specific emergency department. The above studies found increasingly more patients are visiting hospital-based EDs with dental-related conditions. High-risk groups that are likely to visit hospital-based EDs include those covered by Medicaid, the uninsured, those residing in low-income areas. These studies suggest that more education and preventive programs need to be tailored to the needs of the vulnerable groups that are likely to seek hospital-based EDs for dental care. Also, this dissertation highlights the need for increased Medicaid reimbursement for dentists and improved access to preventive dental care especially for vulnerable groups. More research is also needed to explore re-admissions for dental-related conditions and to examine referrals or follow-up plans, if any, that are provided to these patients. The potential role of dentists in management of the increasing numbers of patients visiting the ED should also be examined by hospital providers.

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