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Madhavi Golakoti, Date

APPLYING INFORMATICS TO BRIDGE THE DENTAL HEALTH DIVIDE : AN ANALYTICAL REVIEW

BY

Madhavi Golakoti, M.S. Computer Applications

Degree to be awarded- M.P.H.

Mark Conde, Committee Chair, Associate Dean IS,
Assistant Director, Executive MPH Program Date

Charles Moore, M.D., Field Advisor Date

Laura M.Gaydos, PhD. Associate Chair for Academic Affairs,
Executive MPH Program Date

Kathleen R. Miner, MEd, MPH, PhD, Track Associate Director
Date

Melissa Alperin, MPH, CHES, EdD, Chair,
Chair, Executive MPH Program Date

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BY
Madhavi Golakoti,
M.P.H., Emory University, 2016
M.S. Computer Applications, Andhra University, 1999
B.S., Computer Science and Statistics, Andhra University 1996

Thesis Committee Chair: Mark Conde

An abstract of a Thesis
submitted to the Faculty of the
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Abstract

APPLYING INFORMATICS TO BRIDGE THE DENTAL HEALTH DIVIDE: AN ANALYTICAL REVIEW

BY
Madhavi Golakoti

Background: To reduce the burden of non-emergent dental visits to hospital emergency rooms, a coordinate effort to implement across-the-border informatics solutions that bring ease-of-access and affordability are vital in promoting overall health and wellbeing of communities in need of dental healthcare.

Purpose: The purpose of this study is to assess emergency room usage patterns pertaining to dental complaints at a major Atlanta area hospital. Better insight into the communities-of-need will aid in increasing access to dental care and to reduce the burden of non-emergency visits to the emergency room(ER). Increasing overcrowding at the ER with people seeking urgent dental care magnifies the profound financial burden on the system and further taxes the emergency room (ER) staff by diverting the focus away from true emergency cases.

Methods: Data analyses of unique emergency room(ER) visits for dental care were performed using the hospital electronic health records (EHR) data. Data for a one year period were analyzed and only unique visits to the ER for dental issues were considered for research.

International classification of disease (ICD 9) dental diagnosis codes were used as the basis to analyze EMR data for dental services. Demographics of the patients that present at the ER with dental complaints were also evaluated to identify other relevant patient characteristics.

Results: Total of 3753 unique cases that visited the ER for dental care were identified. Analysis of ER data identified the top five diagnosis codes (Dx) that are used to code dental encounters at the hospital emergency room.

- Unspecified disorder of the teeth and supporting structures Dx 525.9
- Other and unspecified diseases of the oral soft tissues Dx 528.9
- Periapical abscess without sinus Dx 522.5
- Inflammatory conditions of jaw Dx 526.4 and
- Cellulitis and abscess of oral soft tissues Dx 528.3

Thirteen zip codes were identified contributing to the highest traffic (over 100 cases each) to the ER.

Conclusions: Electronic medical record data have a wealth of knowledge that can be leveraged to understand ER usage patterns, patient chief complaint and demographic details. This study enabled visibility into who is using the emergency room for non-emergency dental care, providing evidence that could insight into programs designed to divert individuals away from the ER and into community dental clinics for accessible, affordable and continuing dental care.

A program, designed to reduce dental disparity requires a multi-level approach to achieve success and be sustainable. Innovative approaches that support viable cost and delivery models are essential in providing continuing dental-health services in underserved areas.

The increasing and alarming trend of increased emergency room usage for urgent dental care is fueled by the lack of affordable and accessible dental coverage, the increasing cost of dental care and the lack of infrastructure and workforce to cater to the needs of low-income, underserved populations. Failure to act could result in costly, undesirable outcomes and declining dental health of our communities.

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This work is dedicated to my family who has always been a source of strength, inspiration and encouragement. To my grandfather, Mr. Satyanarayana Golakoti, who instilled in us the strong values of honesty, simplicity, hard work and individual achievement. He taught us that nothing comes easy and one needs to strive towards one's goal. To my father who is the epitome of positive energy and never-ending enthusiasm and my mother who has been the inspiration behind the pursuit of my career and personal goals. One day I hope to be at least a little bit of what you both are. To my wonderful husband, my friend and partner who is my source of strength and one who always makes life exciting. And finally this is dedicated to my daughters. Sanjna and Aditi everything I do is so I can set an example for you hoping you can look back one day and be proud of your mom, just as I am proud of mine.

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Chapter 1: Introduction

Examination of Context and Background

U.S. Surgeon General David Sacher's landmark report in 2000 cited "*an epidemic of oral diseases … affecting our most vulnerable citizens — poor children, the elderly, and many members of racial and ethnic minority groups*." The report aimed to draw national attention to a much neglected area of health: dental health. The report raised controversial questions related to equity and access to oral health from a population health perspective (1).

Centers for disease control's department of Health and Human services also recognized the importance of oral health as a leading health indicator, as a part of its Healthy People 2020 initiative (2). HHS proposed goals to reduce caries in children and increase dental visits by adults and minority groups. With increasingly compelling data linking oral health to overall health, the perception that oral health is purely cosmetic and, non-essential is changing gradually. The U.S. Surgeon General's report noted the importance of oral

examinations for detecting early signs of nutritional deficiencies and systemic disease (1).

The old and ingrained perception that dental health is separate and less critical than general health is growing obsolete. Based on several ground-breaking studies, better dental health has been linked to improved overall health (3) (4), reduced risk of cardiovascular disease, increased lifespan and improved quality of life (5). Even with the increasing knowledge base and research data, government, healthcare networks and providers are unprepared and unable to meet the growing dental care needs of our population (6). A majority of Americans continue to face unmet dental care needs. There are significant barriers to access and no preventive interventions available today. There continue to be stark issues and complex challenges faced in certain communities and populations related to affordable dental health. Access to dental care is largely based on ability to pay and the significant increase in dental care costs is a major issue for a majority of low-income Americans. Low-income populations are especially susceptible to disparities in receiving dental care (7). Socioeconomic conditions are a strong predictor of oral and overall health (8). There are

several factors contributing to reduced access to poor and minority groups: costs of care, access to after-hour care, inability to find suitable care in an out-patient setting are just a few of them.

Oral health disparity is an increasing epidemic with inadequate changes in policy and workforce enhancement initiatives to address the need (9). While there is no significant increase in the capacity of the oral health workforce that provides care, there is a significant decrease in utilization of on-going, preventive dental care across America (10). According to the American Dental Association's 2013 study shown in 1 there is a widening dental health divide and escalating dental health crisis in America (11). There is an incremental increase in the use of the emergency room (ER) for dental care (12). More and more individuals are turning to the ER to get dental care thus increasing the financial and health burden on our society (13).

1:

Figure 1: ADA Dental Divide in America, Reference: http://www.ada.org/~/media/ADA/Public%20Programs/Files/ADH%20PDFs/ADA_Dental-Divide-in-America-Infographic.ashx, Accessed December 12 2015

Ever increasing numbers of adults and children in America have no access to affordable and convenient preventive dental care which results in minor dental issues snow balling into serious dental disease (14). The result is a lot of people seeking high-priced care at inappropriate and often inadequate settings like the emergency room (15). In the United States, as of 2013, as many as 18% of lower-income adults and 7% of high-income (over 30K annually) adults are reported to have sought dental care at the emergency department. Dental emergency room visits rose from 1.1 million in 2000 to 2.1 million in 2010 (13). This is a grave indicator of the unmet dental care needs of our population.

Specifically in the state of Georgia, poor oral health is an increasing problem among children as well as adults, specifically those that are on Medicaid or are uninsured (16). Georgia's Medicaid does not offer dental coverage for adults. Even for those populations that do have limited dental coverage, the usage levels are below average. Several barriers are cited for low usage of preventive dental services: lack of after-hour or weekend availability, fear associated with dental procedure and lack of knowledge on benefit of good oral health (17). As such the number of children and adults with untreated

dental disease has steadily increased and the cost of dental visits at the ER has also increased. Based on a statistical brief produced by the Agency for Healthcare research and Quality's Healthcare cost and utilization project, dental visits to the ER totaled $23 million in Georgia in 2007 alone (18).

It is reported that 18% of low-income and 7% of high-income American adults sought treatment at an emergency room for dental pain, out of which only 6% reported that their dental issue was solved by their visit to the ER (11). These numbers signal the current inadequacy of ER care for dental disease. In addition, one must acknowledge that there is a significant dental health divide in USA and access to oral health services is out of reach to the majority of low-income, uninsured and minority populations.

The World Health Organization (WHO) has published its priorities and strategic goals as a part of its Global Oral Health Program (19). The broad framework provided by WHO includes four cornerstones- reducing the burden of oral disease, reducing risk factors and promoting oral health,

developing oral health systems that provide equitable care and better outcomes and finally developing effective oral health policy.

The Institute of medicine (IOM) also published a report augmenting the HHS Healthy People 2020 goals to improve the oral health of the nation. IOM proposed a set of recommendations and organizing principles called the New Oral Health Initiative (NIOH). These recommendations provided structure and built upon the HHS initiative. To maintain oral health as a priority three key focus areas were identified- leadership, sustained focus and the involvement of all stakeholders (20).

In 2013 the American dental association launched the “Action for Dental Health” program nationwide to improve the oral health of America’s underserved populations. Dentists across the nation have since collaborated to create partnerships and design community events that serve people seeking dental care (21). There is still a lot to be done and a long way to go before America as a nation can stake its position in providing equitable dental care to all Americans.

Oral health reflects on overall health and offers a window of opportunity to detect and prevent future invasive or catastrophic events (8). Thus the Public health community must focus on promoting oral health in communities by educating the public, applying research-based interventions, and enabling administration of preventive programs that serve whole communities, based on need. Public health initiatives must aim to address the gaps in access to dental healthcare services. Public health informatics can serve this purpose by steering the creation and delivery of such programs in an efficient and effective manner. It is essential that new programs also support evaluation mechanisms to measure progress and fine tune delivery methods to achieve and excel targets.

Problem statement, Purpose and Research Question

Problem

Hospital emergency departments (ED) pose a significant financial disadvantage to the healthcare system (22). According to a Bloomberg Business report, one in 4 hospital emergency departments have been closed in the past two decades (23). As a country we stand witness to the closing of EDs and creation of fewer and fewer new EDs as they are viewed by hospitals as the source of lost revenue. This trend in healthcare systems choosing not to have emergency departments is displacing patients and overcrowding the remaining EDs. In a study conducted on ED closures at all general, non-rural, acute, short-stay hospitals between 1990-2009 in the US, it was found that while hospital EDs declined 3.3%, ED visits increased by 30% in the same time period (24).

Considering there are laws requiring EDs to provide care to anyone seeking care irrespective of ability to pay, it is important to note that there is no federal law ensuring the availability of hospital EDs. This is a definite cause for concern. A trend like this could potentially lead to fewer emergency rooms and service

shortages to address the needs of the community and country as a whole. The key to a sustainable solution is to create viable economic models that can supply dental care needs and also be profitable to the care givers and institutions providing care.

The ever-increasing trend of overcrowding at the ER with people seeking dental care magnifies the profound financial burden on the healthcare system and further taxes the emergency room (ER) staff by diverting their focus away from true emergency cases. Costly use of sparse acute care ER resources for basic, non-emergency dental care is an increasing problem (25). Medicaid offers limited coverage of dental services. Further, low reimbursement rates along with excessive paperwork and administrative complexities deter dentists from participating in public dental programs(26).

There are several glaring issues feeding into the problem of ED usage for non-emergency dental care. Some of them are:

- Lack of infrastructure and preset process to deal with dental issues at the ED
- Lack of ED staff training to deal with dental complaints

- Lack of community clinics that work weekend and after hours to increase access
- Lack of patient follow-up and inadequate care resulting in repeat visits
- Lack of policies to support the financial cost associated with dental care and
- Lack of a central interoperable information system to capture cases and coordinate care

It is important to note that at the ER it is routine procedure to not provide dental care due to limitations such as- the ER staff is not trained in dental procedures and it is uncommon for ERs to have an on-site dentist to offer appropriate care. ED providers commonly prescribe antibiotics and pain medication to people presenting with dental complaints. This practice enables prescription drug abusers that seek the ED for opioids under the pretense of dental pain (27). The issue of drug abuse and how the ED is a convenient source for people to receive medications is a topic that needs a separate discussion of its own.

The statistics on Americans that lack dental insurance are morbid. An estimated 8.5% of Americans lack access to dental care (9). This is an increasing number and one that is bound to affect the overall health of the nation over the long run. At the national level about 44.3% of people lack dental insurance and specifically in the state of Georgia it is 36.4% (6). Georgia has a heavily increasing burden of oral disease and there is substantial data backing this claim for children and youth (17). Unfortunately limited research is available on Georgia adults aged 18 years and older. In Georgia there were 71, 075 emergency department visits, in 2010 alone, for non-traumatic oral health care. Most of the patients visiting the ER for oral health problems were adults 19 years and older (88%). The costs of these visits equaled $37,237,318 in 2010, a $5 million increase when compared to the previous year (17). Patients seeking dental care at the ED increased by 16% and rose from 874,000 visits in the year 2006 to 936,432 visits in the year 2009 (28).

While EDs are ill-equipped to address dental complaints, many patients view them as the primary point of care due to their 24-hour availability and the provision of guaranteed service. Also with the increasing cost of dental care, EDs are an attractive option for many care seekers. Most of these patients are from

the lower socioeconomic strata, working poor, federally-assisted, uninsured, underinsured, or in some cases even homeless. The challenge in coordinating such a population and ensuring adequate care is enormous. Coordinating patient care is in itself a highly complex activity; this accompanied with the added issues of providing dental care at the ED with no staff to address dental care is even more challenging. While the ED is not the right place for a patient to get dental care it could be a good location to capture dental ED users and refer them to more appropriate care settings with the ultimate goal of avoiding readmission at the ED.

Purpose

This thesis endeavors to address the issue of ER overcrowding from an applied informatics perspective and proposes a multi-pronged approach to design a simple and viable solution. The purpose of this thesis is to demonstrate how Public Health Informatics can evaluate a supportive infrastructure to reduce the burden of visits to the emergency rooms for dental care, thereby improving access. A systematic review of available literature is conducted to gain understanding of existing research and dialogue.

Informaticians are trained in all disciplines that are in the realm of healthcare-research, policy making, strategy, system architecture, exchange standards, project management, system requirement analysis, capacity planning, monitoring and evaluation tools. As such, informaticians can apply their knowledge and skills to conceive infrastructural component that support a multifaceted healthcare solution that addresses diverse needs (29). Informaticians are well equipped to contribute to and lead the conceptualization, design, development, implementation, evaluation and maintenance of health information systems. The proposed informatics framework, public health interventions and informatics solution aim to address improved access to care. This project documents the current project scenario, state of communications and issues that impede data exchange between the ER and available community dental homes. The objective is to identify a solution that can divert people from the ER to dental homes which provide comprehensive, accessible, low-cost healthcare services. The ultimate goal is to accomplish the public health mission of providing equitable care to all Americans and improve overall health and wellbeing.

Primary research Questions

- What is the current consensus, state of affairs, open discussions on dental care in America?
- How can informatics build a conceptual framework for increased access and interoperability?
- How can outcomes be improved?
- How can informatics provide a value to impact access to dental care?

This thesis is focused on exploring the issue based on published knowledge and available data and proposing an informatics framework that could help alleviate the problem of overcrowding and misuse of limited ED resources. After reviewing available literature and understanding the scope and pervasiveness of the issue, a possible informatics solution is conceptualized.

Theoretical and Conceptual Framework

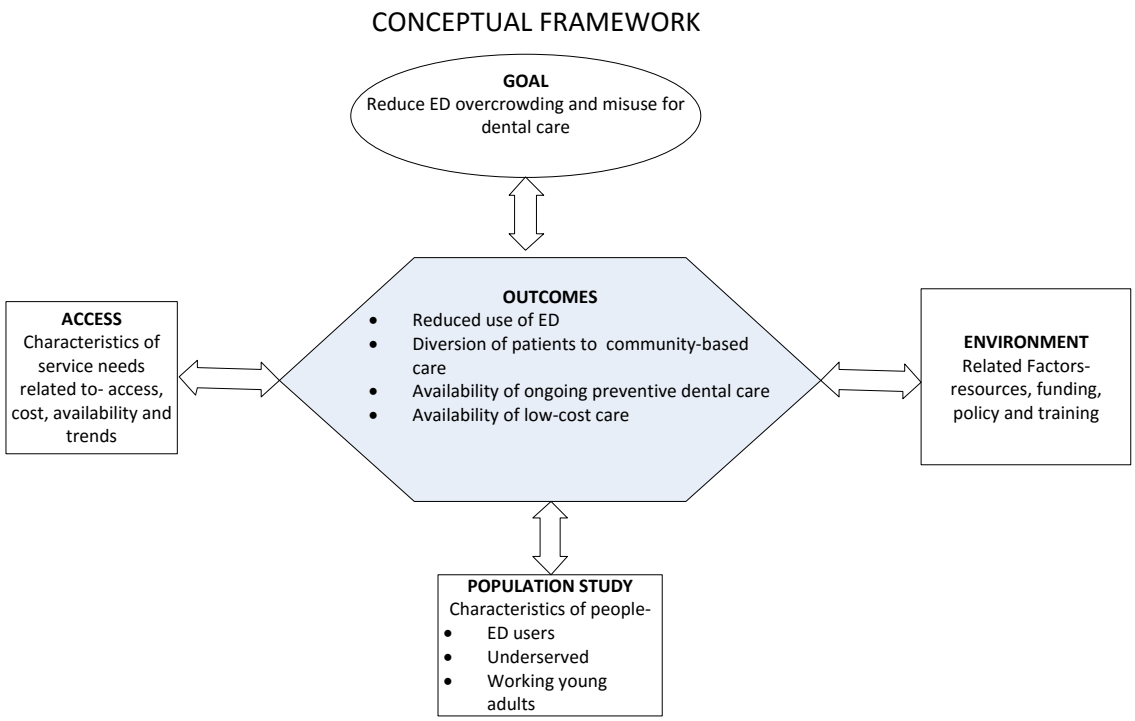
For this study an urban safety net hospital in Georgia was analyzed. This hospital faces a growing issue with the community members using their ED for dental care. The ED currently uses a manual process of logging patients with dental complaints into a spreadsheet. This spreadsheet is used to track usage data. The same is used to report to the hospital management at a monthly review session. This highly manual and time-taking process is neither conducive to identify trends in ED usage and patterns of use nor to create a better solution to divert patients.

Using a computerized patient tracking and referral management system in conjunction with current processes will accomplish the triple aim of controlling cost, delivering quality dental care and improving outcomes. The goal is to identify the communities of need and reduce and eventually eliminate their misuse of the ED for dental care. There are several community and faith-based health clinics and NGO organizations in Georgia that are involved in providing free or low-cost care to the underserved. The plan is to divert patients from the ED to

local community dental clinics and other dental offices providing charitable care. While this solution is technically and theoretically plausible, the major issue however is with data sharing, patient routing and follow up between the diverse health care systems delivering care.

In the current workflow, patients that seek care at the ED get a paper list of available dental service locations. However it is up to the patient to make an appointment. Most often the patients either do not get an appointment or the appointment they do get has wait times ranging from weeks to sometimes even months for charity care. A person suffering from dental distress just cannot afford to wait that long. Hence they end up back at the ED if their situation worsens.

A better, more efficient process must be in place to provide timely and affordable care to those in need. The following conceptual framework presents a preferred approach and possible courses of action.



2: **Figure 2: Conceptual Framework**

Through the conceptual framework depicted in 2: **Figure** 2 an attempt is made to methodically understand the current environment, identify level of access and study the population characteristics of care seekers. Specific outcomes that achieve the goals of this project are identified so that progress is measured quantitatively and qualitatively.

There is a strong interrelationship between ED users and population demographic identifiers that point to specific groups of people that have dental care needs but not enough resources at their disposal (12). Across the nation, people seeking

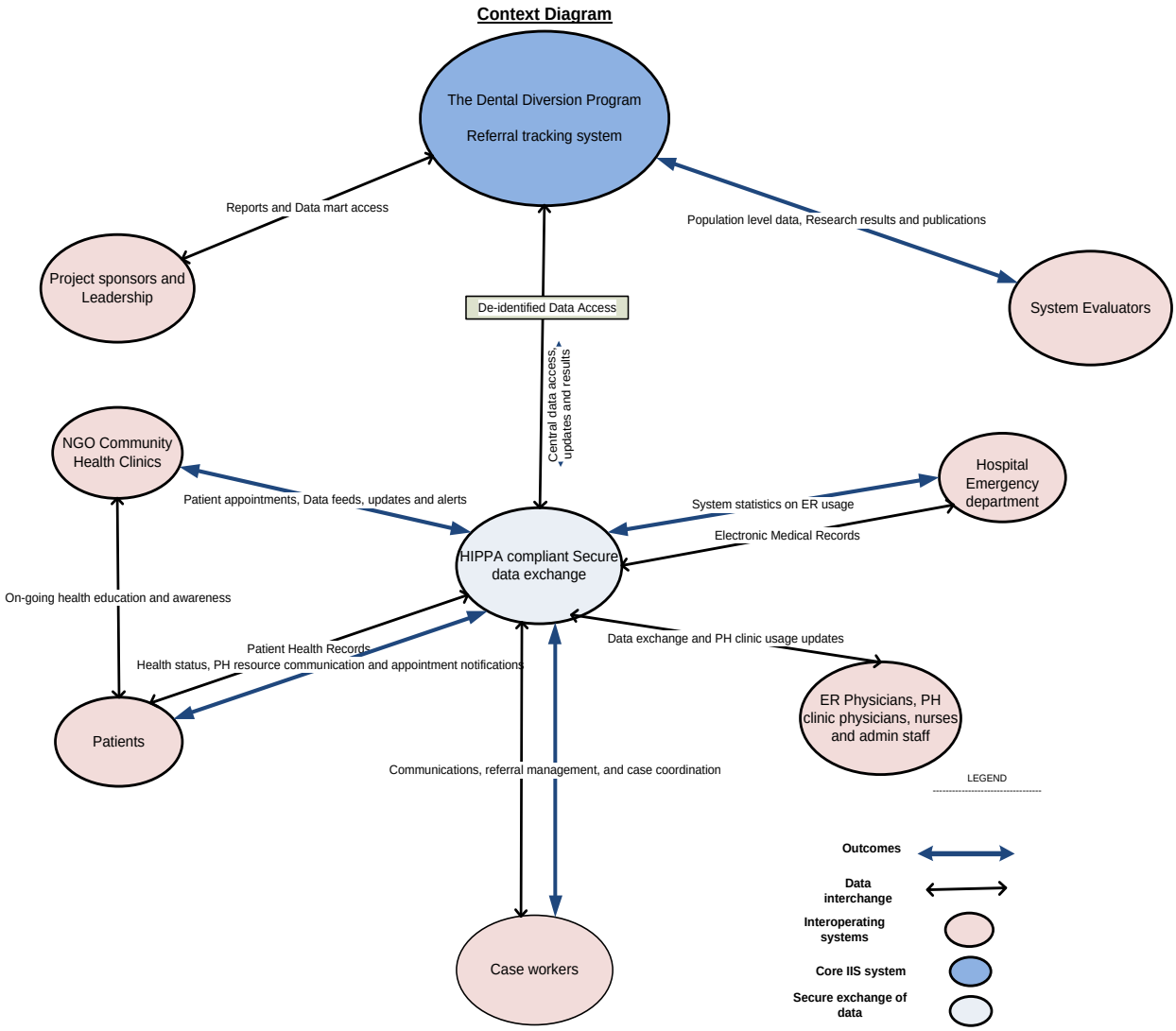
care at the ED usually come from low-income, minority, uninsured, underinsured and underserved communities (25).

While dental care is protected and required by law for children and certain special populations like pregnant women and people with disability, the same rights to care are not extended to adults. As such, there is a strong predisposition for an adult from one of the underserved groups to use the ED for dental care. Characteristics such as being African American, Hispanic or from other minority groups, receiving Medicaid, being a low-income working adult etc. all put you at an increased risk towards unmet dental care (30). Individuals in these groups that end up with severe dental disease due to neglect and lack of ongoing preventive dental care contribute to the phenomena of inappropriate ED use. This is a last resort option for these people as they lack the resources or knowledge to make a more informed decision (15).

The proposed informatics framework theorizes that ED frequent fliers can be rerouted to more traditional, accessible and optimal dental care locations with a better understanding of patient demographics, a new electronic referral tracking

system and better follow-up using a dedicated social case worker. The context diagram in **3**: depicts the stakeholders involved, the core information system, data exchange mechanisms and the context in which these entities interact. The idea is for case workers to be engaged with the communities in need and educate them on all the resources available to them so that they do not seek care at the ED. The case worker is tasked with coordinating patient care, setting up dental appointments and ensuring accessible, preventive and emergency care for the community in focus. Conceptually the dental diversion program works with the hospital, community dental clinics, NGOs and all other stakeholders working together to create a supportive and sustainable infrastructure to share patient data, track progress and keep members from seeking care at the ED.

Context Diagram for the proposed dental diversion program:



3: **Figure 3: Dental Diversion program Context Diagram**

Significance

There is no existing literature on care coordinate models, especially dental care. Transferring patients from ED to a community/primary care setting, maintaining patient engagement and ensuring appropriate ongoing care are all essential aspects of a care coordination model. There is a gap in knowledge and this thesis study discusses how clinical systems can use informatics frameworks to build comprehensive clinical information solutions that improve coordination of care.

This study brings to light the issues related to ED overcrowding and lack of proper care for dental patients. The data analytics helps identify the demographic of the population that is most needy of care. The informatics framework is a blueprint of what a future central, coordinated system could look like. Others can benefit from this study by learning how a simple BI solution could be used to evaluate a sample data set to describe population healthcare needs. Different approaches to create a system architecture design that aptly addresses project requirements are also discussed here.

Collaborative efforts by stakeholders as well as federal and state-level initiatives that support equitable dental care are all essential for long-term success. National Oral Health Surveillance System (NOHSS) –National Oral Health Surveillance System (NOHSS) is a collaborative effort between CDC's Division of Oral Health and the Association of State and Territorial Dental Directors (ASTDD). NOHSS is designed to monitor the burden of oral disease, use of the oral health care delivery system, and the status of community water fluoridation on both a national and state level (31). Such systems that capture national and state trends in burden of disease and levels of usage can ideally feed these critical metrics to local public health officials and policy makers.

There is a push to include Oral Health Indicators in the National Public Health Surveillance System (NPHSS). Some of the proposed indicators include-

- Number of States with an Oral Health Surveillance System
- Number of dentists participating in Medicaid
- Jurisdictions with 250,000 or more persons and Indian Health Service Regions with 30,000 or more persons with an oral health program directed by a dental professional and

Few states like Arkansas, Illinois, Nevada, New York and Michigan have invested heavily in developing a State oral health surveillance system to align with CDC's Healthy people 2010 goal of having more states with a state-based oral health surveillance system. These programs have been quiet successfully with the synergistic efforts of local and state government organizations (32).

The Centers for Disease Control and Prevention (CDC) provides substantial support to states in their efforts to reduce dental disease and improve oral health through identified effective interventions. Cooperative agreements ranging from $230,000 to $310,000 per year are available to states that want to improve their dental health infrastructure and services. As many as 21 states have been awarded funding under the State Oral Disease Prevention Program Cooperative Agreement. The list includes Colorado, Connecticut, Georgia, Hawaii, Idaho, Iowa, Kansas, Louisiana, Maryland, Michigan, Minnesota, Mississippi, New Hampshire, New York, North Dakota, Rhode Island, South Carolina, Vermont, Virginia, West Virginia and Wisconsin. Grant funding resources such as these can kick start state programs to reduce the burden of oral disease among their citizens.

Method and Rationale for Target Journal Selection

The target journal for publication of this work is the Journal of the American Dental Association (JADA). This decision is based on the American Dental Association's role as a stakeholder. JADA is the most popular journal on topics related to dental health and care issues in America.

Journal of Public Health Dentistry is another possible target for Article submission due to the heavy public health involvement in the proposed solution.

Chapter 2: Review of the Literature

The literature review involved researching existing published and unpublished data, articles and reports that related to the topic of interest. The search terms used in PubMed were- Emergency department, ED, Emergency dental, Dental complaints, Dental visit, Dental service, Dental pain, Dental health, Dental safety net, Access to dental, ER usage, Toothache, Non-emergent dental, Oral health, Oral disease, Dental care Dental Service, Hospital, Dental Socioeconomic Factors and combinations of these words.

In addition, web searches were conducted to identify existing literature and to seek out other unpublished material. Several websites were researched for online content- American Dental association; Centers for disease control, American Dental association, Agency for Healthcare Research & Quality etc. are some of the top ones used.

Inclusion and exclusion criteria: All articles that matched the search criteria and focused on adult populations were considered. Children's dental care articles were left out to focus solely on adults in our analysis. There is a large body of research that discusses children's dental disease and access to care. This requires a separate research track due to the nature of children's insurance and government social policies for children. Focus was primarily on the adult population so as not to detract from the topic.

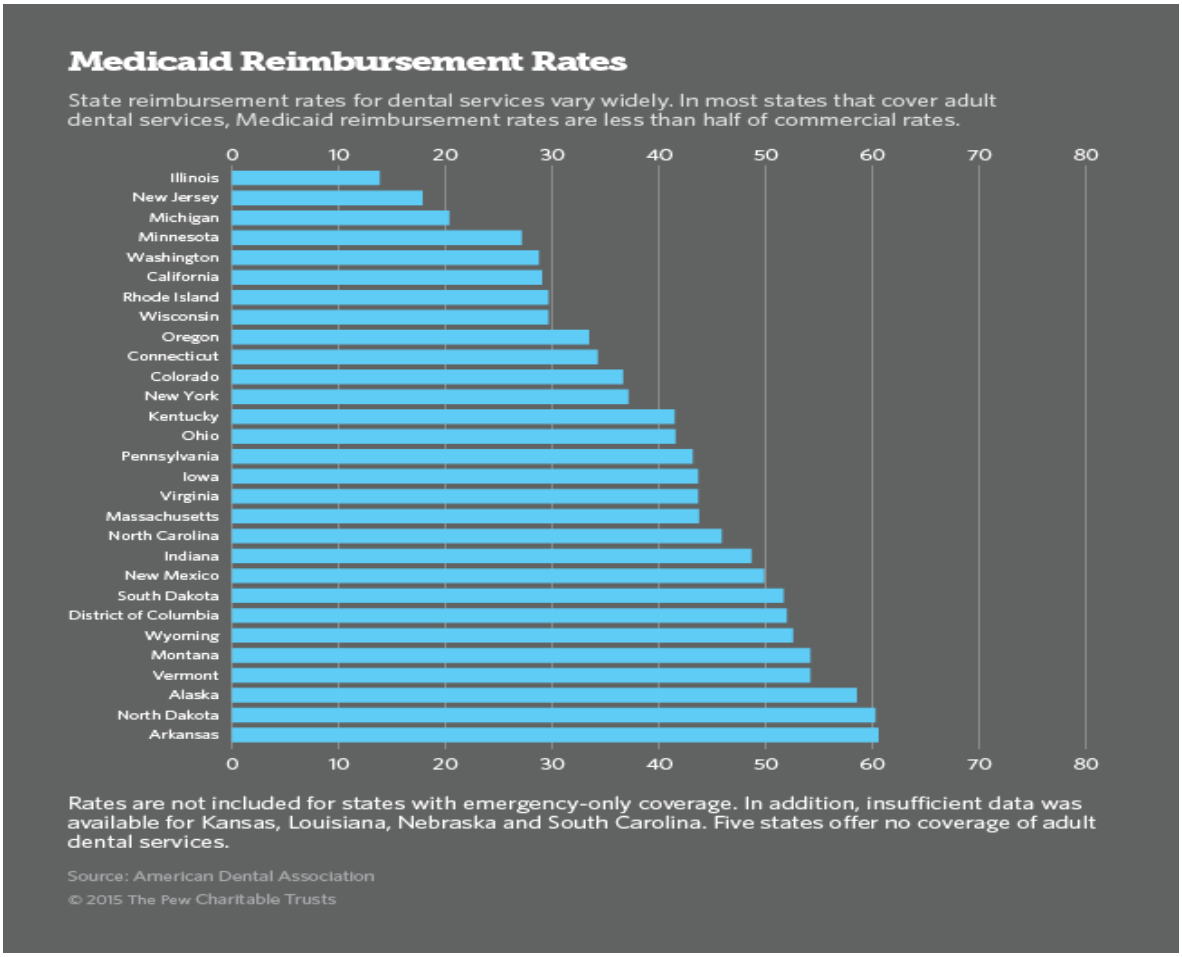
There were a large number of published papers and articles regarding dental care and the use of ED from other countries. Some of these countries have publicly-funded healthcare and so cannot be compared to the for-profit healthcare model in USA. Due to this reason articles outside the USA were excluded.

The Descriptive Epidemiology

The CDC published a national strategic oral health plan, sharing their vision and public health priorities. The goal is to prevent dental caries, eliminate disparities in oral health, improve the oral health program infrastructure and capacity and assure effective delivery (33). The CDC's Division of Oral Health (DOH) is focused on reducing inequality and improving oral health of the nation. CDC funds and supports several state-based oral health programs and open-data tools such as a National Oral Health Surveillance System (NOHSS) and water fluoridation programs (34). But even with this level of federal support, the country as a whole continues to face a stark need to improve dental health coverage, especially for its adult population.

According to a PEW report adult dental coverage in America has remained stagnant and seen no significant improvement over the last decade (35). Although there is great emphasis on improving oral health services for all Americans, federal rules do not yet require states to cover dental services under Medicaid. Dental insurance coverage is thus found to be less prevalent than medical insurance coverage. An estimated 85 million Americans carry no form of dental insurance coverage, that is three times more than the number of people who do

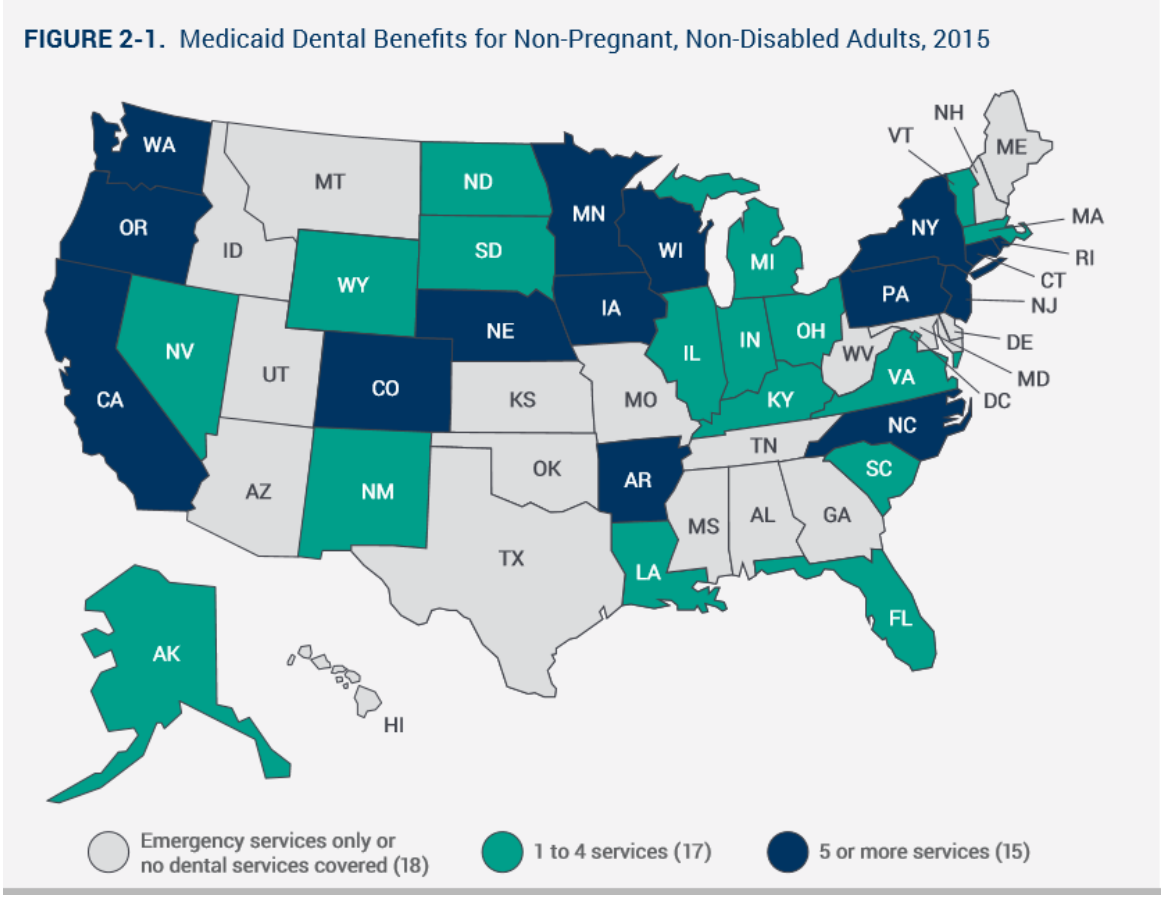
not have medical insurance(36). Even those with dental insurance under public or private insurance schemes face severe limitations on covered services and reimbursement rates. Medicaid dental reimbursement rates vary by state and are either not covered at all or less than adequately covered in most cases. Inadequate reimbursement rates act as a disincentive for dentists serving members under Medicaid programs as seen in **4**_Figure 4.



4 Figure 4: Medicaid reimbursement rates (35)

In these circumstances patients needing preventive as well as emergency dental care are left untended. The situation has led an increasing number of people to seek care at the emergency room (12). The use of ER services leads to many issues- one it is a costly alternative, two EDs are usually not equipped to attend to dental issues leading to repeat cases and, three it takes time away from true emergency cases and strains the ED staff.

Dental pain affects the quality of life and wellbeing of America's most needy communities. Most of the people seeking care at the emergency room are in the minority, lower economic strata (37). International, national and local markers are all showing corroborating data to support this phenomenon (12). Overall, very few states offer comprehensive coverage of dental services for its underserved populations. Moreover the state of California that previously had a dental coverage program but decided to end it due to financial issues, has seen a 68% increase in the use of ED for dental care (38).



5- Figure 5: Medicaid Dental Benefits by State, PEW report(35) Reference : Accessed on January 10 2016

Data in Figure 5- Figure shows the state of Medicaid dental coverage across the nation. Based on this information a large number of state Medicaid programs only provide emergency dental services and a few states provide no dental services at all.

Observing an increasing trend in utilization of the ED for dental care, the healthcare and public health community is engaged in analyzing new and innovative approaches to address the issue. Considering the statistics on private

dental insurance, it is observed that dental insurance through employers covers only a portion of the working adult population. Most low-wage workers do not have any dental coverage or simple cannot afford to pay for such coverage. An estimated 46% of workers do not have access to dental coverage and of those that do have access, only 36% participate (39). The numbers on Medicaid dental coverage for adult, non-pregnant,
non-disabled adults; are even more disparaging (14). As of February 2015:

- 19 states provided emergency-only
- 27 states covered preventive services;
- 26 states covered restorative services;
- 19 states covered periodontal services;
- 25 states covered dentures;
- 25 states covered oral surgery;
- 2 states covered orthodontia; and
- 9 states placed an annual dollar limit on covered dental services

Dental service coverage under Medicaid is optional and hence waived by most states and it is shocking to note that for elderly Americans Medicare also does not

cover on-going dental care. Medicare, which is the federal insurance program for elders over 65, only covers very limited hospital-based oral surgeries when combined with other treatments. This leaves our most vulnerable elderly population(over 65 years) at risk with almost 70% of elderly Americans left without adequate dental coverage (39).

The major issues and debates on the topic

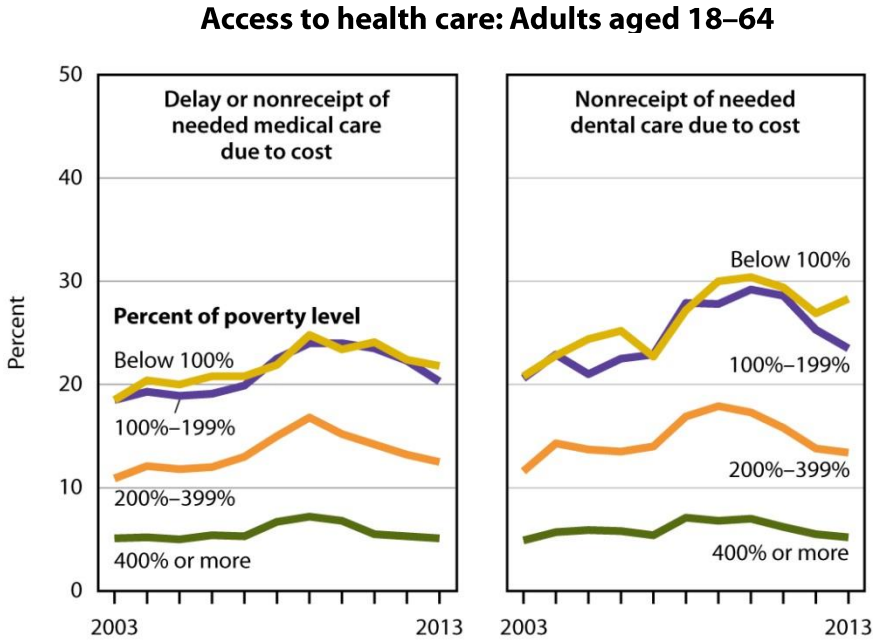
Several major issues contribute to this problem with dental health care-

- Cost of care
- Lack of trained resources and infrastructure to divert dental ED patients
- Lack of access to weekend and after-hour dental care
- Disjointed efforts that fail to serve the community as a whole. (organizational effectiveness and workforce development)
- Lack of coordinated routing and centrally accessible referral mechanism available to disjointed healthcare systems
- Inadequate coverage of dental care by Medicaid and Medicare programs

According to the Center for Financing, access and cost trends, Agency for Healthcare Cost Research and Quality, there is a national trend of increasing dental service costs(40). These costs account for 7% of overall health expenditures nationally, according to the Medical Expenditure Panel Survey (40). This is a significant indicator of the financial barriers facing low-income populations today.

In a survey done by the CDC's National Center for Health Statistics identified 6 Figure 6, 'cost of care' was the reason, cited by most, for not using preventive dental services (36) . Affordable dental care must be made available to all irrespective of social class. New and innovative payment solutions must be identified to replace the current all-or-nothing scenario. Patients must be able to choose partial payment or staggered payment schemes based on their individual financial situation.

Non-receipt of needed dental care due to cost



6 Figure 6: Access to Dental Care, Reference: CDC/NCHS, Health, United States, 2014, Figure 18 and Table 69. Data from the National Health Interview Survey

The dental workforce also needs training and education to face the unique challenges that come with providing dental care to underserved communities. In an exploratory study done by Anderson et.al the researchers evaluated the effect of recruiting underrepresented, minority and low-income dental students and promoting community-based dental education programs to feed the dental pipeline. They found that minority dental students were more likely to serve in underserved communities and showed better retention rates (41).

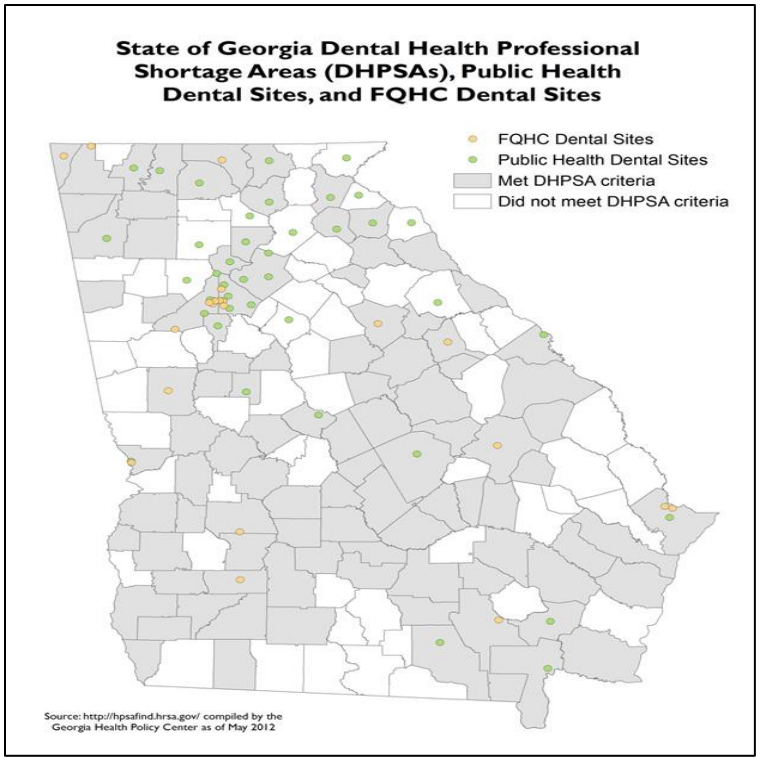
In the article “At the Intersection of Health, Healthcare and policy”, Fingare et.al discusses the need to revamp the existing Medicaid and Medicare programs to address the growing dental health disparities. However, it is seen that Medicaid dental expansion alone cannot address the issue of ED usage (42). A more effective strategy is to improve financial support along with community education and advocacy efforts to increase the knowledge of citizens on the importance of continued dental care. Resources that identify affordable dental care clinics and transportation services to reach these locations can address some of the travel challenges most commonly faced by the elderly, low-income, underserved communities. Lastly an electronic referral and care management system, which can track ongoing care and coordination of patients within the dental care network and can monitor status, could suitably support a successful dental diversion program.

The Magnitude of the problem

In a retrospective study conducted on patients presenting with dental complaints at an urban hospital in the US, it was found that year over year there were increasing instances of people presenting at the ED with dental problems. More

than 50% of these patients had dental complaints that could more appropriately be treated at a primary care dental clinic and did not need emergency care (43). Increased use of the urban ED is a national uptrend that is at a risk of further amplifying due to the shrinking of Medicaid and Medicare budgets and the non-availability of after hour dental care.

Georgia is one of the poorest states in the country with over 14% of Georgia residents living in poverty (44). There is a heavy burden of oral disease in Georgia due to a large minority population that is in the low socioeconomic strata (17). Georgia Medicaid does not cover any dental benefits except for emergency care. These factors predispose Georgia residents in seeking care at the ED. Dental schools in Georgia have been producing increasing number of dentists each year, about 4.2 dentists per 10,000 residents. However, there are still noted shortages for dentists in rural and even some urban areas as depicted in Figure 7: GA Dental Shortage areas. Georgia is ranked 49th in the country on dentist-to-population ratio (45).



7 **Figure 7: GA Dental Shortage areas**

Inadequate dental ED services resulting in treatment failure cause patients to return to the ED for unresolved dental issues (46). Common treatment approaches used by the ED staff include prescribing antibiotics and analgesics. For severe dental problems, these are not optimal or adequate care practices. Unfortunately for patients who have no access to community dental care they cannot but seek repeat care at the ED. This leads to unnecessary cost and burden on the ED due to untreated dental pain. Policy, political and economic barriers plague our society from providing equitable and definitive dental care to all segments of the population (47).

Low-income and minority populations have a disproportionate burden of dental disease as per the GAO report (7). While all American children are covered either by Medicaid or other government sponsored children's insurance programs, adult dental services are optional under Medicaid. Only two thirds of states cover adult dental care under Medicaid and, there are severe restrictions on what is covered. Also, not all low-income members have Medicaid, which has selection criteria based on income limitations, age, disability status or blindness.

Dental disparity is further aggravated due to workforce shortages (48). Rethinking who can provide care and allowing hygienists and other non-dentist members to provide initial dental services like cleanings and basic dental care is suggested as a possible solution to quickly expand the dental workforce (49). Training dental public health therapists to work in coordination with dentists and act as level one support to ease the burden on dentists and the ED staff is a possible strategy (50). Expanding the role of general physicians in identifying early dental disease and helping the patient navigate the dental network and finding dental care is also suggested as an effective intervention (51). One in five Medicaid enrollees returned to the ED for dental care after initially using the ED for non-emergent

dental care. The reason cited most for returning to the ED is the lack of providers in local communities and lack of knowledge on where to get care (52).

Georgia follows the rank of states that face a severe dental workforce crisis leading to challenges in providing dental care, especially to rural Georgia residents(45). Recruiting and training students from underrepresented, minority and low-income communities to become dentists and hygienists has shown potential in increasing access. Researchers observed an increased interest and intent to serve from such graduates. Student dentists that themselves come out of underrepresented communities are more interested in public service and giving back to their communities when compared to students from other demographics (41).

Currently known and accepted standpoints

Americans do not carry enough dental insurance coverage either private or public. Nearly half the adults participating in CDC's BRFSS survey reported having no dental insurance coverage at all(6). Increasing dental insurance coverage for

preventive services can improve usage of preventive dental care thereby reducing the economic burden of treating critical dental disease.

There is a trend of increased dental ED visits specifically in the Medicaid population. These visits are costly and end up in hospital admissions is around 2% of the cases. Better mechanisms need to be developed to catch the dental issues early and avoid hospital admission. It is ideal to keep patients from seeking care at the ED and diverting them to primary, community-based dental clinics (53). Dental professionals should work in conjunction with primary care physicians and mental health professional to ensure an individual's dental, mental and physical health is delivered cohesively to improve the individual's overall health and wellbeing (54).

Expansion of Medicaid to cover preventive dental care can improve usage of local dental care and reduce the burden on the ED. Dental care providers and practitioners engaged in a coordinated effort to provide care to the underprivileged can make a significant difference in the dental delivery system (55). The Government and healthcare community needs to invest time in

investigating better strategies to coordination between hospitals ED, dental, preventive, primary, and non-profit care organizations. These type of strategies have shown to be effective (14).

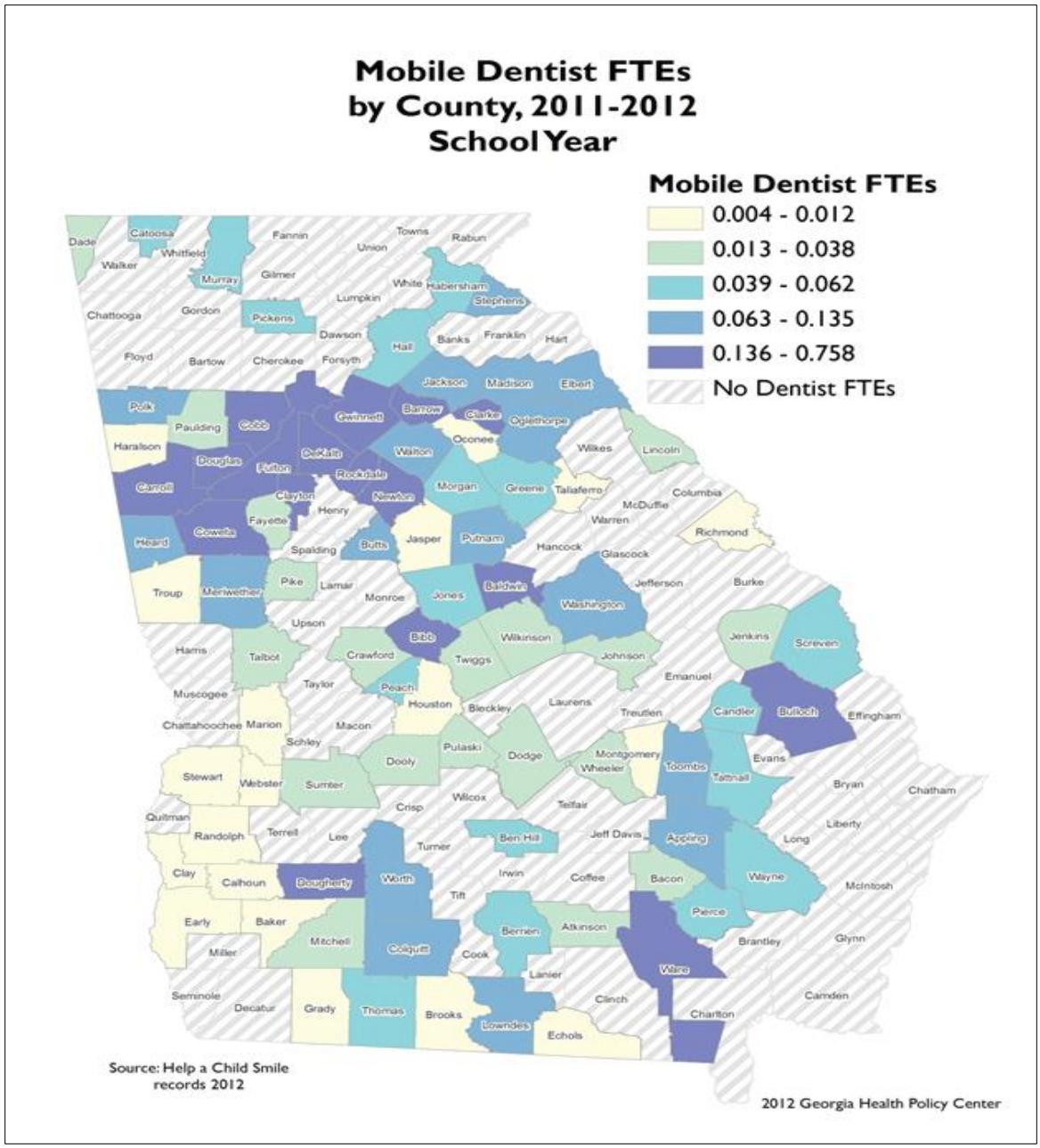
In addition, innovative economic models are needed to support the increased cost of care and government policymakers should drive the agenda to make a change in current policy. According to a study performed on the National Emergency Department Sample Database (NEDS) dataset, there were more than 1.3 million ED visits during 2008-2010, for non-traumatic dental conditions which resulted in charges of $1 billion to the institutions. Out of a total sample size of 4,049,361 ED visits, approximately 1% were for dental issues (22). This is a drain on our already burdened medical economic system. Moreover some of these ED visits resulted in hospitalization and even death in some patients with extreme dental disease along and other comorbidities. These adverse outcomes are unacceptable and preventable. Early and ongoing preventive dental care is a recommended and highly effective solution to avoid these types of issues.

Dental ED usage models

Emergency room diversion programs have been touted as one of the effective strategies to address the problem of ED usage. Patients are diverted from the ED to local community health clinics where affordable quality dental care is provided. Several organizations have effectively implemented ED diversion programs reducing the burden on the ED staff, saving cost and reducing repeat patients to ED with the same complaint.

In a research study done at the Medical college of Virginia hospital/Virginia commonwealth University health system emergency department, patients were given the opportunity to get care at an out-patient dental care clinic instead of at the ED. The ED staff was cautious and adhered to the guidelines prescribed in the Emergency medical treatment and labor act and provided stabilizing care before moving the patient to seek appropriate care at a dental clinic affiliated with the hospital. The patients were also given a list of resources at discharge identifying other clinics offering free or reduced-fee dental services. This program was very successful and reduced the use of the emergency room for dental pain by 52% and successfully provided suitable care to ED care seekers at outpatient dental clinics (56).

Similarly, deploying mobile clinics offering dental care can be a very effective strategy in delivering dental care to rural, underserved communities. In several states, even Georgia, children are served at their school using such mobile dental clinics. Dental care professionals in mobile clinics routinely offer several services including, but not limited to, primary dental care, caries treatment, sealants and dental cleanings. The dental care is subsidized, supported by government funding or free in some cases. This is a model that is effective and efficient in addressing many of the barriers to care discussed on this topic (57). **8** Figure 8 shows the number of mobile dentists operating in different counties in Georgia and serving school children.



8 Figure 8: GA Mobile Dental Services by county

The American Dental Association proposed several other models of care that provide the blueprints to create customized dental programs, taking several important aspects into consideration such as administrative processes,

organizational structure, collaborative partnerships, financial models, outreach and participation rates (26). The proposed models include one- a public-private partnership between commercial dentists and state Medicaid programs, two- a Medicaid managed care program that includes, dental services as an integral part of its ongoing care, and uses a dental plan administrator on a fee-for-service basis, three- a State-operated dental Medicaid program with targeted case management, four- individual contracts between private sector dentists and federally qualified health centers (FQHCs) and other health centers and five-a community-driven model where a freestanding, private dental center offers fee-for-service, for-profit dental care in the community. Each of these models presents its own unique set of challenges but innovative strategies, created by a coalition of engaged partner organizations and the government, can definitely help overcome any challenge.

Discussion

There is ample data and research validating the issue of ED utilization for dental care services however; there is still a lot of work to be done to analyze a nationally applicable, feasible solution. The research community has done its part

and identified the issue, now it's the healthcare community, informaticians and policy maker's turn to come together and create a comprehensive, financially viable proposal to address this issue.

Advances in business intelligence tools now offer easier, faster ways to analyze one's data and make workable recommendations. This project identifies the use of freely available, off-the shelf tools to perform data analyses. There is no longer a need for exhaustive planning, intensive resource allocation and extended time periods to handle research and information gathering projects. This project demonstrates the power of BI tools and simple data analytics to delve into data and capture information. While such data analysis may not be statistically representative of the population under study, the result are pretty accurate and in line with the results of traditional research. Information technology solutions can use BI tools and support healthcare delivery models by bringing insight to create better systems and processes. Health informatics brings innovative approaches to health service delivery, management and planning. Information technology enables better system design and service delivery models. The

collective aim is to improve oral health and reduce the burden of dental disease, consequently improving the overall health and wellbeing of all Americans.

Chapter 3: Methodology, Approach, and Solution

Methodology and Approach

A workflow analysis of the hospital ED was performed and interviews conducted to describe current process and identify opportunities for improvement. Business process analysis reflected a need to update the patient triage process. Existing processes lack patient follow up and referral management. To address the current drawbacks, newly proposed processes include updated patient work flow, dental diversion task flow, and patient follow up processes.

Workflow Analysis

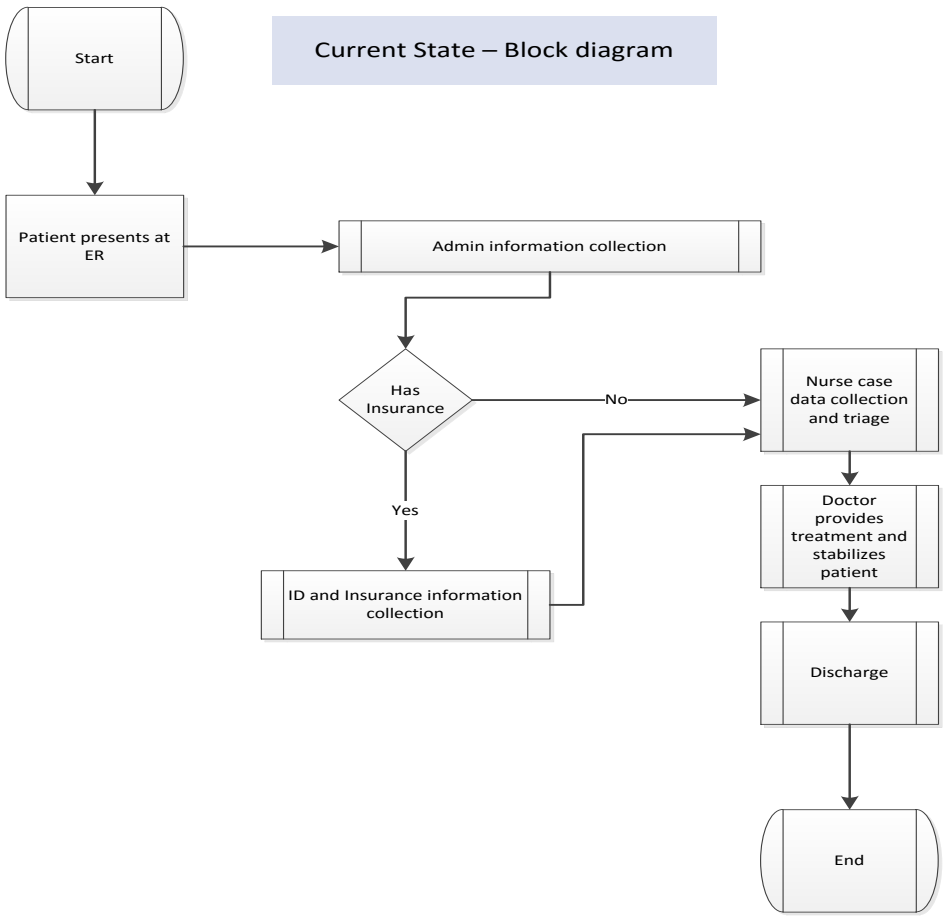
The exiting processes followed by the ED staff do not include referral creation, case management and follow up care. This is primarily due to lack of dedicated social workers and case managers that can focus on such tasks. The lack of preparation and planning to address dental patients at the ED puts the hospital at financial risk and stresses the ED staff as they tend to new and repeat visitors to the ED.

Hospital management needs to be educated on the value of adding dedicated staff to support an ED dental diversion program. Although management understands the issue of inappropriate ED usage, they are already financially challenged and recruiting new staff is considered an additional burden. As always in public health, it is a challenge to assign monetary value to a healthy person that is not using the emergency healthcare system. Making a case to keep people healthy and out of the hospital is difficult. But one relevant metric could be ED usage statistics. One can monitor and measure ED usage before and after the dental diversion program is implemented. This metric could be used to attribute the saved time and costs to address other true emergency cases, and be

measured as profit. Hence, it is vital to have an evaluation mechanism in place for any new program, not only to gauge success and measure value but also to gain buy in from the management and stakeholders.

As a part of workflow analysis for this project the current workflow was charted and more efficient way to triage dental patients was identified. Due to the lack of dedicated resources to handle dental care in the ED, the hospital had no separate workflow for dental patients. An improved workflow is proposed in 9 **Figure** 9, to triage ED care seekers; the new workflow assumes the allocation of a social worker or case management nurse to coordinate care.

Current State Workflow



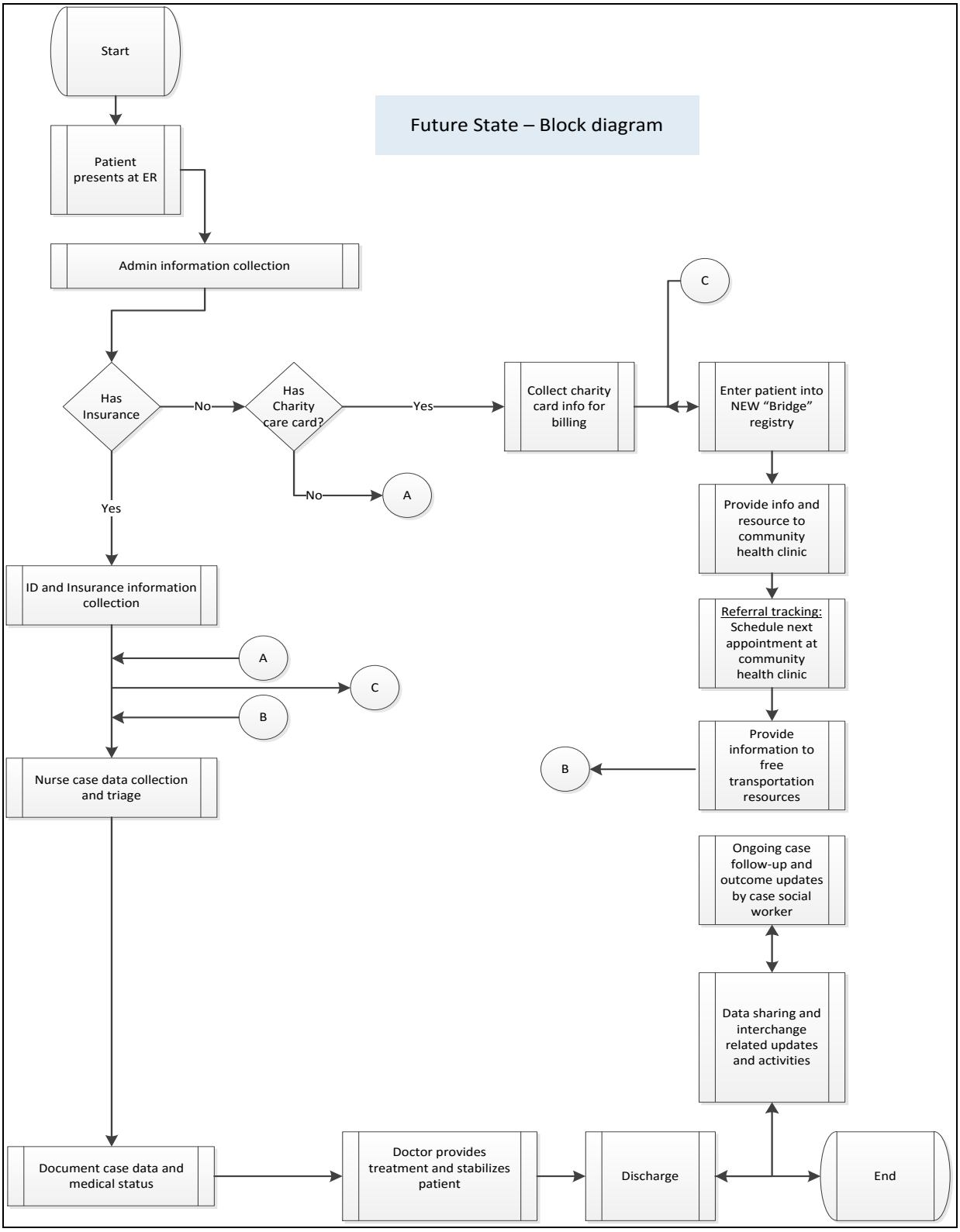
9 Figure 9: Current State workflow diagram

Future State Proposed Workflow

The proposed future-state workflow **10** Figure includes steps to not only provide resources to the patient, but to track the patient in a registry, using a referral tracking tool to create appointments for the patient and provide information on transportation resource to those that need it. This new process includes a new operational model to maintain the patient registry that continually informs the case manager of the burden of dental disease in the community and the level of

need. The registry and electronic referral system are also great tools for stakeholder reporting and evaluation purposes.

Overhauling the existing process, addressing the lack of case management staff and creating new workflows are the initial steps in mending dental ED misuse. Informatics tools that track ED users and ensure they are diverted to appropriate dental care locations will not only aid the ED staff but also be pivotal in sharing data between the various stakeholders involved in providing care. The ultimate goal is to ensure the patients continue to use the dental clinics as their primary source of care and not the ED.



10 **Figure 10: Future state workflow diagram**

Stakeholder Review

The stakeholders for this program include the hospital system under review, ED staff, hospital management, community clinics, local NGO organizations, faith-based organizations, and other hospitals and clinics that can benefit from the dental diversion program. Stakeholder identification and review is an essential step in designing a new system. Translating stakeholder requirements into a functional system ensures buy-in and use. Each stakeholder comes with a unique set of constraints and process needs. Integrating the different perspectives to create a cohesive system addressing the needs of all equally is essential for the success of the project. Specifically for this project, the common requirement for all stakeholders is to divert patients from the ED to more suitable dental care locations, to reduce the burden of disease by providing quality care and to create a viable and profitable financial model for everyone.

Secondary Data Analysis

For the data analysis component a sample data set was used. The sample was de-identified and scrambled to protect PHI. The de-identified data was collected by the ED and secondary analysis was performed on a sub-set of the data for this project. The Emory Institutional review board (IRB) evaluated the project and confirmed there was no risk of re-identification. The IRB granted an exemption for

this project considering it secondary data analysis on non-human subject research (non-HSR). Suitable care was taken to ensure the privacy and protection of the sample data set.

Strategy

The project involves evaluating unique emergency room(ER) visits for dental care using the hospital electronic health records (EHR) data from a major urban Atlanta hospital. Data are used to understand ER usage patterns pertaining to dental complaints. Using the International Classification of Disease (ICD9) codes from medical records, ER visits related to toothache or any other tooth-related complaints are determined, and the discharge diagnosis are analyzed. Factors relating to the use of emergency room services for dental complaints are evaluated to answer some of the following pertinent questions-

- What are the characteristics of people seeking dental care at the ER?
- What are the geographical areas needing better dental services?
- What types of services are needed?

The focus is on identifying the diagnosis, condition, and treatment codes related to dental care from the EHR data. The top zip codes where patients originate from are identified so as to narrow down the areas of need, and pinpoint the populations facing dental health disparity. The list of diagnosis codes used in the EHR data identifies the general dental care needs of the people seeking care at the ER.

The objective of the sample data analyses is to create a data visualization using geocoding to identifying the communities in need of dental care. The aim is to identify factors associated with increased use of ER services for dental care and propose recommended actions, interventions and outreach activities to reduce ER congestion.

Data analysis methods include-

- Analysis of diagnosis codes from electronic health records
- Demographic data analysis
- Geographic data analysis

Tableau is the chosen BI tool for its ease of use and stunning visual analytic features. Tableau conveniently offers a free version for students and researchers to explore the full feature range of the tool. This tool adequately addressed the BI needs for this project.

Methodology includes reviewing-

- Patient Demographics details captured in the electronic medical records are used to evaluate the patients who present at the ER with dental complaints.
- Zip codes captured in the medical records identify the areas in need of improved dental services.
- International Classification of Disease codes (ICD 9) are used to find encounters specific to dental diagnosis and dental services provided in the ER.

The sample was n=3754 records and included data for a one year period representing only unique visits to the ER for dental issues. The data cleanup and transformation phase preceded the data analysis phase. Data were analyzed, inclusion and exclusion criteria applied, non-essential data removed and available

data formatted to make data consistent and usable. On most data analysis projects, this phase is the more arduous and resource-intensive.

Defining the data

- Data sources – ED data from the hospital
- Date range – The data are sporadic for 2010. Regular monthly data is available from Nov 2010 through Jan 2013
- Cost analysis – Data were not available in the dataset reviewed
- Data dictionary – The EMR data contained the 33 columns of data covering patient demographics, clinical data and demographic data
- Dental conditions – EMR used the International Classification of Diseases (ICD) to define dental conditions that are used at the ED.

The following diagnosis codes were included for analysis:

UNIQUE DX_NAME	DX_CODE
UNSPECIFIED DISORDER OF THE TEETH AND SUPPORTING STRUCTURES -	525.9
OTHER & UNSPECIFIED DISEASES OF THE ORAL TISSUES	528.9
PERIAPICAL ABSCESS WITHOUT SINUS -	522.5

UNIQUE DX_NAME	DX_CODE
CELLULITIS AND ABSCESS OF ORAL SOFT TISSUES -	528.3
INFLAMMATORY CONDITIONS OF JAW -	526.4
UNSPECIFIED DENTAL CARIES -	521
OTHER SPECIFIED CONDITIONS OF THE TONGUE -	529.8
DISEASES OF LIPS -	528.5
UNSPECIFIED DISEASE OF THE JAWS -	526.9
SIALOADENITIS -	527.2
OTHER SPECIFIED DISORDERS OF THE TEETH AND SUPPORTING STRUCTURES -	525.8
UNSPECIFIED CONDITION OF THE TONGUE -	529.9
OTHER SPECIFIED PERIODONTAL DISEASES -	523.8
OTHER CYSTS OF JAWS -	526.2
GLOSSODYNIA -	529.6
DISTURBANCE OF SALIVARY SECRETION -	527.7
CRACKED TOOTH -	521.81
ARTHRALGIA OF TEMPOROMANDIBULAR JOINT -	524.62
AGGRESSIVE PERIODONTITIS UNSPECIFIED -	523.3
OTHER DISTURBANCES OF ORAL EPITHELIUM INCLUDING TONGUE -	528.79
ORAL APHTHAE -	528.2
GLOSSITIS -	529
UNSPECIFIED DISEASE OF THE SALIVARY GLANDS -	527.9
STOMATITIS AND MUCOSITIS UNSPECIFIED -	528
SIALOLITHIASIS -	527.5
CHRONIC GINGIVITIS PLAQUE INDUCED -	523.1
ACUTE APICAL PERIODONTITIS OF PULPAL ORIGIN -	522.4
OTHER SPECIFIED TEMPOROMANDIBULAR JOINT DISORDERS -	524.69
OTHER SPECIFIED DISEASE OF THE JAWS -	526.89
CYSTS OF ORAL SOFT TISSUES -	528.4
UNSPECIFIED GINGIVAL AND PERIODONTAL DISEASE -	523.9
OTHER SPECIFIED DENTOFACIAL ANOMALIES -	524.89

UNIQUE DX_NAME	DX_CODE
OTHER & UNSPECIFIED DISEASES OF PULP & PERIAPICAL TISSUES -	522.9
OSSEOINTEGRATION FAILURE OF DENTAL IMPLANT -	525.71
DEVELOPMENTAL ODONTOGENIC CYSTS -	526
ADHESIONS AND ANKYLOSIS (BONY OR FIBROUS) OF TEMPOROMANDIBULAR JOINT -	524.61
ACUTE PERIODONTITIS -	523.33

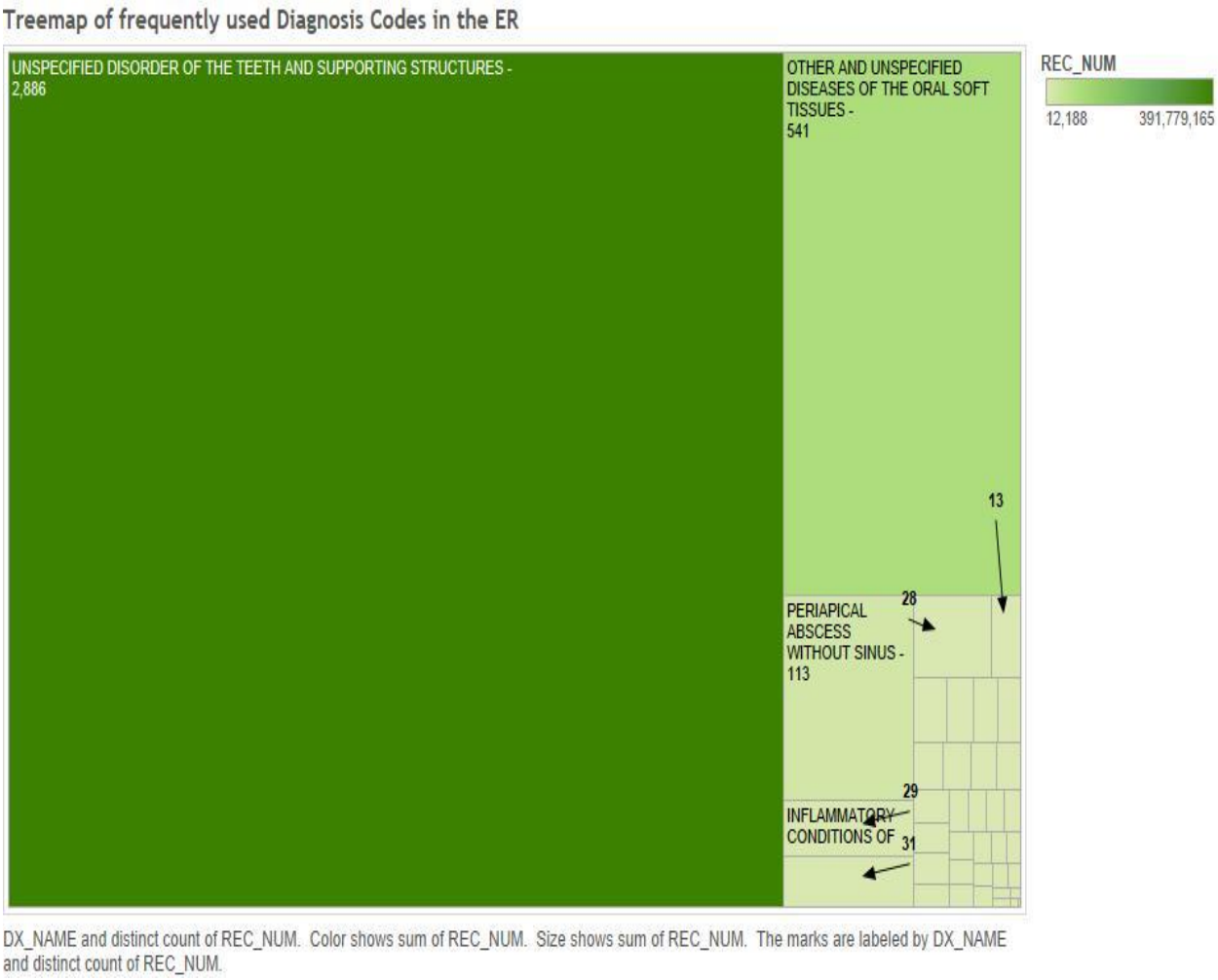
Results

- Total of 3753 unique cases visited the ER for dental care

- The top 5 diagnosis codes(Dx) that were used by the ED staff to code dental encounters were :

    1. Unspecified disorder of the teeth and supporting structures Dx 525.9
    2. Other and unspecified diseases of the oral soft tissues Dx 528.9
    3. Periapical abscess without sinus Dx 522.5 and
    4. Cellulitis, Inflammatory conditions of jaw Dx 526.4 and
    5. Abscess of oral soft tissues Dx 528.3

Data visualization is depicted in Figure 11 Figure



11 Figure 11: Top Diagnosis codes used to code dental ED visits

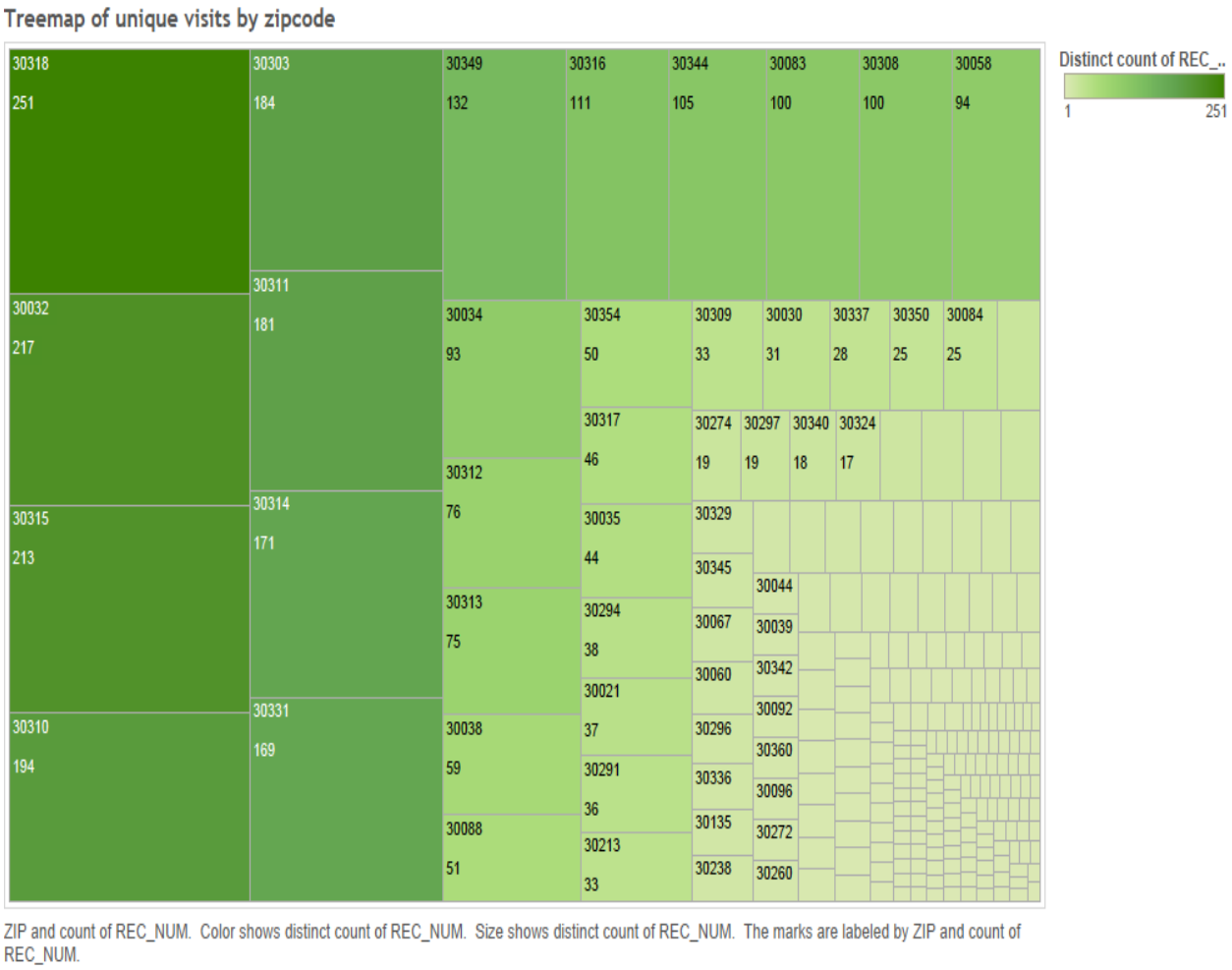
The use of broad diagnosis code categories like- “unspecified disorder of the teeth” potentially points to a lack of knowledge and training on triage procedures for dental care. EMR data are coded for medical billing and reimbursement and not to capture accurate clinical diagnosis. Training the ED staff could improve the sensitivity of data captured at the ED, which then identifies specific dental issues faced by the community. This knowledge can guide targeted interventions.

Sensitivity, specificity of the EMR data is essential in to narrow the focus of health interventions.

Results Continued

- 13 zip codes were identified contributing to the highest traffic (over 100 cases each) to the ER

Data visualization is depicted in Figure 12 Figure.

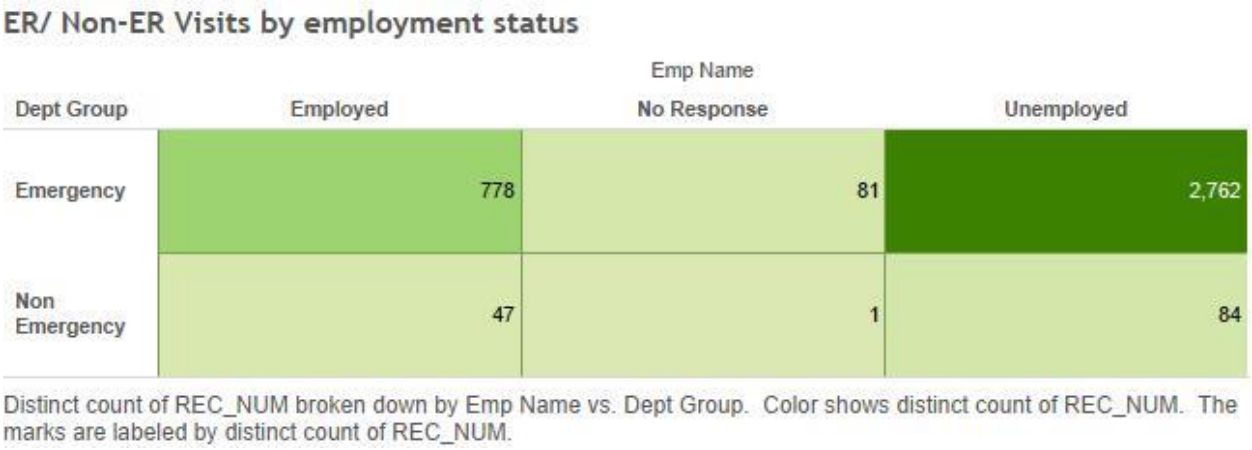


12 Figure 12: Zip codes' representing the most dental ED visits

Although the dataset used is not representative of a generalized population, the visual pointers to areas where most patients come from are clear. A similar approach when used with real data can identify pockets of communities that represent the highest ED usage rates. Misuse of the ED for dental care could stem from a systemic problem involving lack of education, lack of access and financial barriers to appropriate local care. Public health plays a vital role in such situations by leading grass roots projects that are culturally appropriate and applicable to the community and involve the community itself to address its problems. A community could be defined as people within shared geographic boundaries, race, gender, ethnic groups or a group of people with shared occupations, interests etc. The capacity for health programs to affect change depends on the depth of understanding of the acceptable ideologies, norms, and underlying factors that lead to disease causing behaviors within communities. Community approaches to health promotion programs include several tested methodologies and frameworks that each target different dimensional aspects of the community. However, special attention to refining and revising the framework and being flexible to change aspects of the program to be applicable to the particular community is essential. Frameworks that do not follow the traditional top-down,

expert driven approach, would be harder for traditionalists to embrace but are very effective in some situations.

An analysis of the employment status as reported by the patients reveals an inordinate number of unemployed populace seeking care at the ER. Data in Figure 13 Figureshows that although, a majority of dental ER visits were made by unemployed people, a substantial number (778 o of 3753) of employed folks are also seeking dental services at the ER. This is could possibly be due to unavailability of dental care after work hours and on weekends. Some of these populations may not have the liberty or the financial freedom to miss work and get dental care.

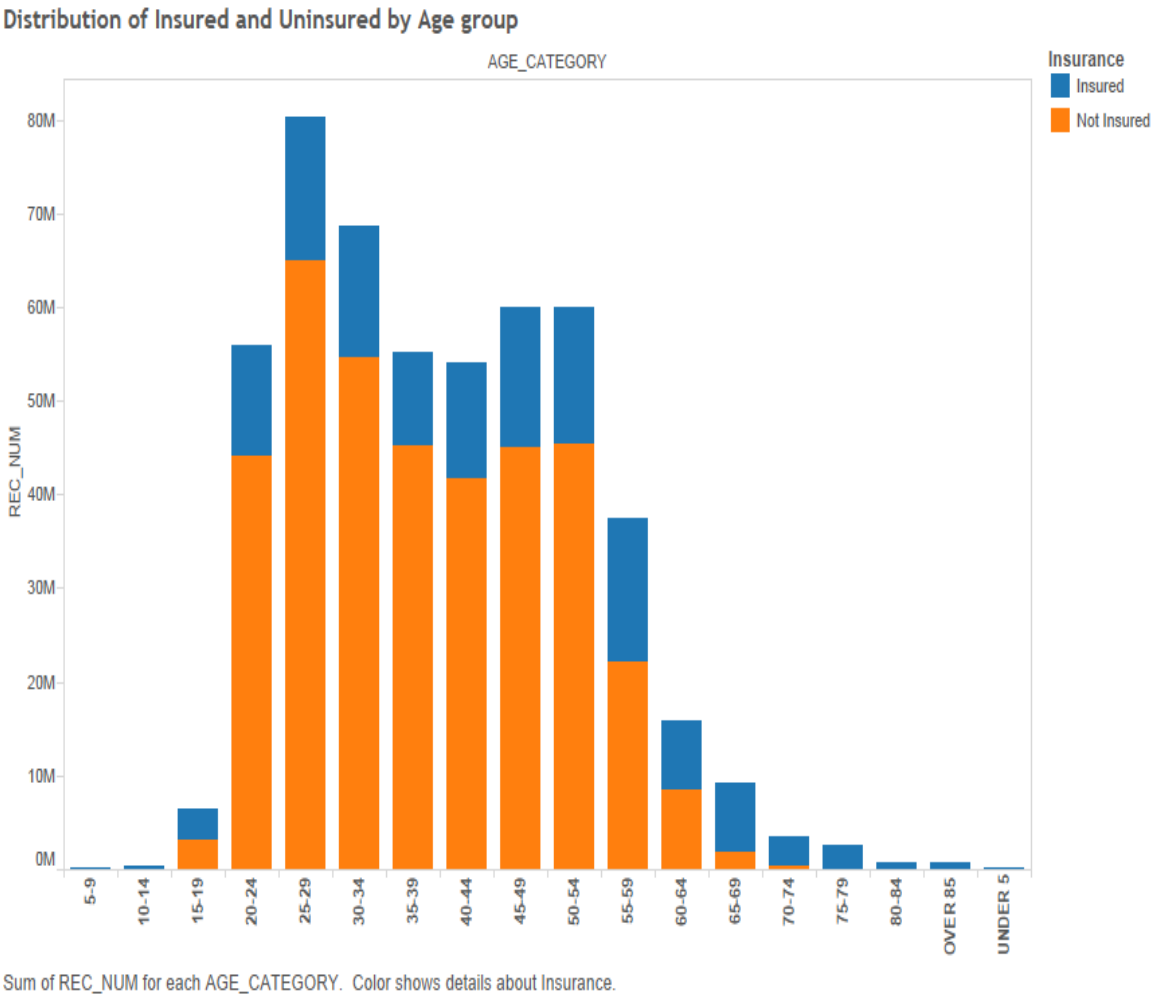


13 Figure 13: Employment status of ED users

The demographic analyses of the data sample yielded the following insights. Also shown in Figure 14 Figure-

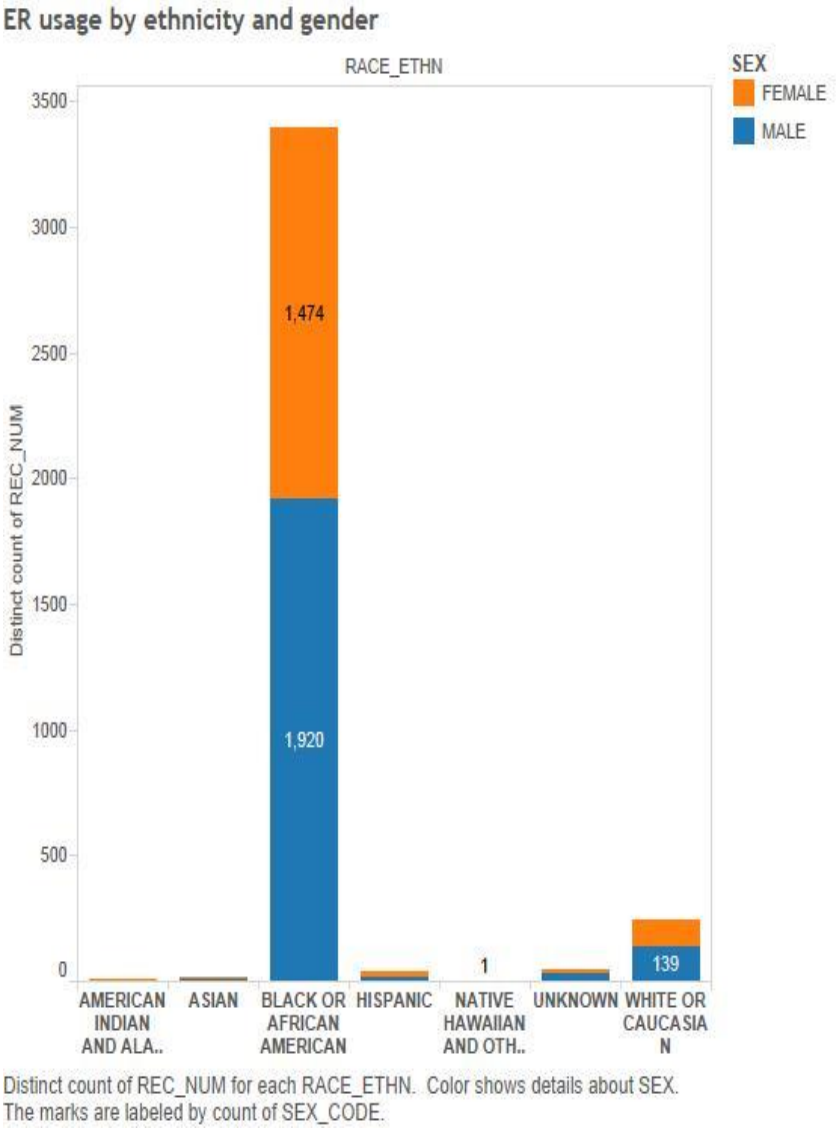
- The majority of ER users were uninsured and in the 20-55 age category
- The major ethnic group utilizing the ER for dental care were coded as “Black or African American”

Although, this sample study of secondary data does not follow traditional statistical analysis methods the findings are still in accord with other published and cited research material used on this thesis.



14 Figure 14: Distribution of insured and uninsured ED users

Most insured patients are coming from the 20-59 age groups suggesting that these are working adults that do not have other avenues of care and hence use the ED.

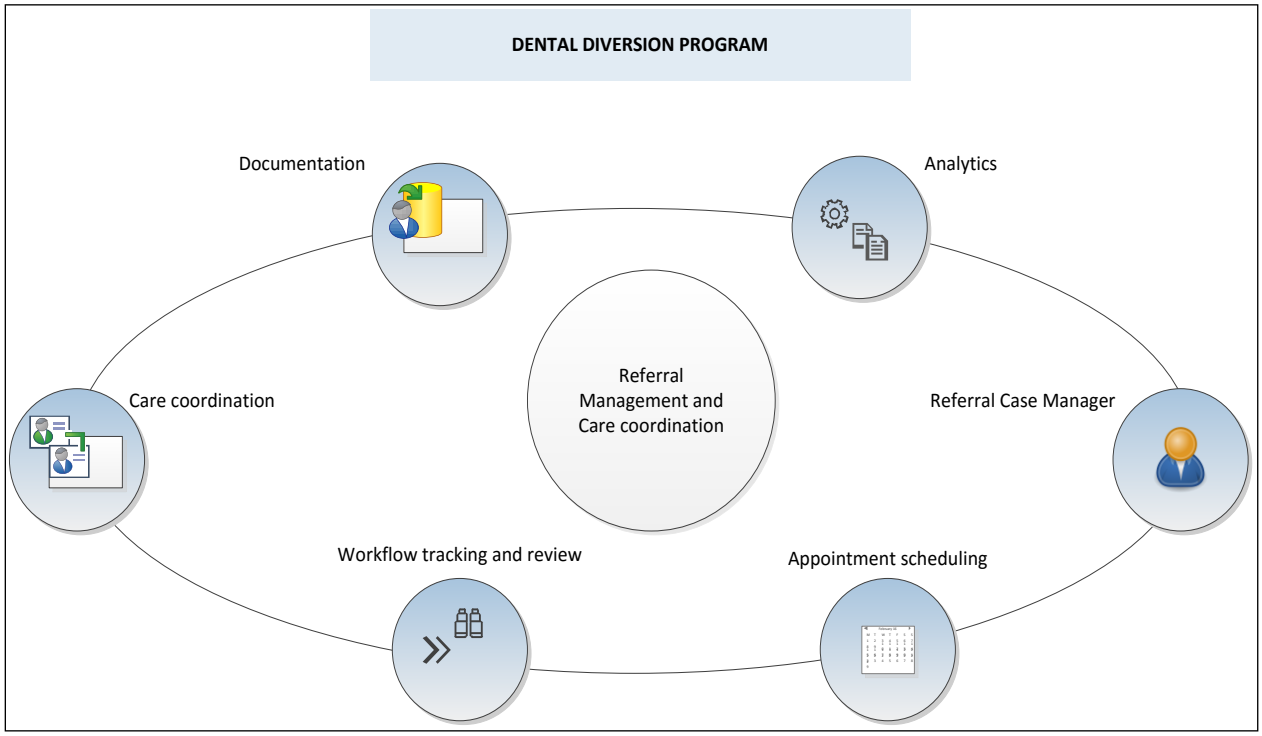


15 Figure 15: Ethnic makeup of ED users

Data in Figure 15 Figure show the ethnic markers of the ED users. Black or African Americans make up the majority of ED users but this could also be attributed to the majority black population in Atlanta. Recognizing the drivers of the ED usage trend is essential to propose appropriate and effective solutions. Increased access to dental insurance coverage, and availability of dental clinics that provide care

after hours and on weekends, could divert patient traffic away from the ER and into dental clinics.

Proposed Solution



16 Figure 16: Proposed solution

The proposed informatics solution depicted in Figure 16 Figureis a model dental diversion program. The solution has a multifaceted approach involving processes for documentation, care coordination, workflow charting and tracking, patient scheduling and follow up, referral and case management and advanced analytics.

The complex functions involved demand strong advocacy and continued support of all stakeholders. The results of such coordinated efforts are bound to reflect in reduced ED usage and improved community dental health.

Collaboration:

To support optimal overall health of individual, medical and dental providers, policy makers, public health organizations and social workgroups need to work in collaboration. Increased access can be provided to individuals by creating sustainable and comprehensive healthcare solutions. The involvement of all parties is fundamental to success.

Awareness:

Communities can seek preventive and timely dental care if targeted communication campaigns are created to encourage healthy behavior change related to oral health. Community stakeholders need to be engaged and educated about the benefits of dental health and its effects on overall health. Educating policy makers about the relationship between oral health and overall health could drive better policies. Development of surveillance indicators and identification of oral health data to effectively communicate the status of oral health in the communities of need is essential to evaluate progress.

Prevention:

Early detection and treatment of dental issues will help avoid costly procedures and the use of expensive ER services for non-emergent dental care (58). Water fluoridation, dental sealants, regular dental cleaning and continued oral health education campaigns can all prevent and reduce dental disease in the community.

Financial viability and reimbursement:

Patient financial barriers in paying for care and physician financial barriers in getting appropriately reimbursed for care have been identified as some of the reasons for the worsening status of dental health in America (59). Identification of sustainable payment models where providers are reimbursed for dental health services under state, federal program or private payment models is essential to maintain buy-in. and engagement of all stakeholders.

Workforce training:

Preparation of oral health workforce and targeted training focused on meeting the needs of previously underserved populace is recommended (48). Expanding the service that can be offered by dental hygienists and training general physicians to identify early dental disease can results in better preventive care.

On a program with this level of complexity, a multi-pronged-approach is required to reduce dental health disparity and achieve sustainability and success. Innovative approaches that support viable cost and delivery models are essential in providing continuing dental-health services in underserved areas. Information sharing frameworks that tie all the collaborating stakeholders together are a good strategy for success. Well-designed informatics frameworks can coordinate large, complex varieties and volumes of data and create a shared meaning. Informatics framework design and process integration across networks of provider, hospitals, public health and government organizations and is crucial for success.

This project involves steps to collect, review and summarizes all applicable literature and online published material. Informatics methodologies will be applied to propose solutions.

- Literature review to describe current and future trends
- Informatics framework to address usage of emergency room for dental care

Chapter 4: Discussion

Although there is increased focus on providing access to affordable healthcare to all Americans unfortunately the same focus does not extend to dental care. Vulnerable populations are still at an extreme disadvantage of receiving limited to no dental care resulting in increased chronic disease and reduced quality of life (60). Federal and local government initiatives have made significant progress in providing dental care to children but adults, even under the Medicaid program, continue to face challenges. Strong advocacy efforts at a few states like California, Colorado, Illinois, Massachusetts and South Carolina have been successful in improving state Medicaid benefits to cover dental care but the rest of the nation continues to struggles with the financial and health burden of dental disease (49).

In the current environment, healthcare systems around the nation see rising usage of ED for dental care. Government and healthcare organizations must be prepared to address this issue in order to serve their community deliver results and save costs. The current landscape of siloed systems cannot support the healthcare delivery and coordination issues of tomorrow which are increasingly

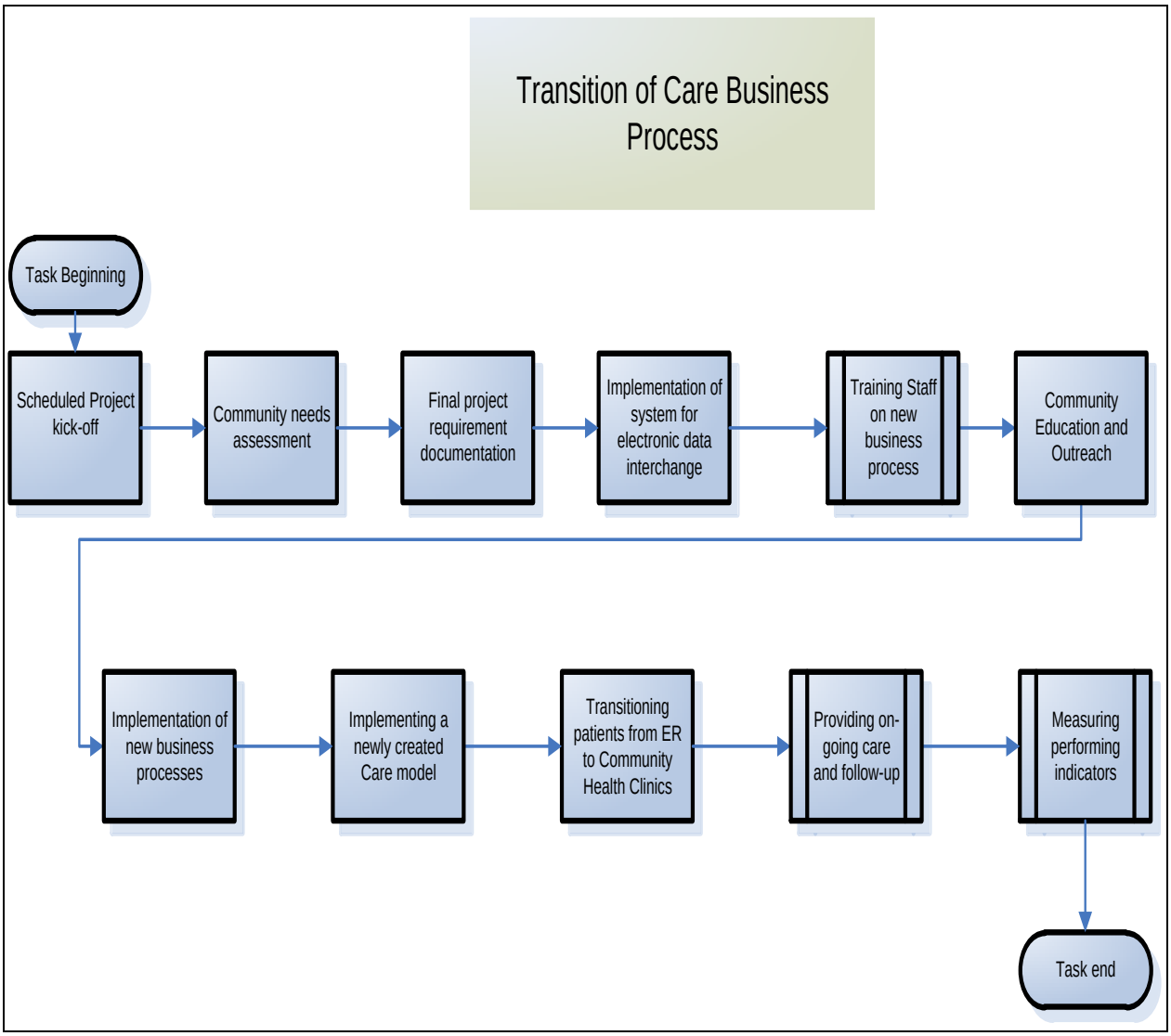
more complex and challenging. With increased incidence of dental disease, and reduced supply of affordable care, a systematic and phased plan to remove dental health disparities is essential to improve the current situation(61).

Barriers and proposed solutions

There are several barriers to implementing an enhanced solution- insufficient number of providers registered for Medicaid dental services, patient education, limited training of ED staff to address dental issues(62) and program finances are some of the major ones. Providers are not enthusiastic in participating in dental Medicaid programs due to the complexity of paperwork and insufficient reimbursement for services provided. Dental care providers, community health clinics as well as Federally Qualified Health Centers face financial barriers due to inadequate reimbursements and reduced revenue recognition (63).

Some of the barriers to care could be addressed by establishing market-value reimbursements to dentists, reducing cumbersome paperwork and billing procedures and education and outreach to families teaching them the value of timely preventive care and identifying affordable service locations.

Chapter three discusses flaws in the existing workflow and the lack of transition of care and follow-up patient coordination for patients seeking dental care at the ED. Addressing this issue can have profound impacts on providing much needed care to the underserved as well as reducing return visits to the ED. Figure 17 Figureshows a proposed transition of care process that could fill the gaps in care coordination faced by most EDs today.



17 Figure 17: Dental Diversion- Transition of care workflow

Understanding the population seeking care at the ED and designing processes and programs that serve these populations based on their specific need is tantamount to success. Every state and every healthcare system faces a unique set of challenges based on their location, demographics and financial situation, so this

study only proposes a broad set of guidelines with the understanding that these would be modified to suit individual needs.

The limitations of this thesis study include the narrow focus on one specific safety net hospital and a narrowed demographic of adults. Further the data have not been processed with advanced statistical methods and adjusted for bias, to account for accuracy in weightage given to certain race or ethnicities based on the population demographics. While it is beneficial to recognize the value of a narrowed focus for quick analysis further state and national level initiatives must be undertaken to broadly address the issue of ED dental usage. Despite the limitations of the study the findings are consistent with existing research and literature. United States faces a new age of dental disparity, especially so for patients under Medicare Medicaid and adults who cannot afford the costs of dental care.

Lastly, healthcare organizations, information technology solutions, healthcare data security and data exchange standards have improved and matured greatly and are more capable of taking on this challenge today than ever before. As these

systems and organizations continue to develop many more innovative ways to address current human healthcare needs will be presented. The tools and infrastructure are available; the challenge is in bring the government and disparate healthcare entities together to collaborate for shared benefits and for the greater good.

Public health Informatics community can lay the ground work to design a comprehensive framework of service programs that address health disparities. Successful programs need a coalition of committed stakeholders to work in tandem to develop and improve the existing dental care network. The burden of emergency department visits for dental conditions will continue as long as the ED is the most accessible and affordable source of care for underserved populations. ED dental abuse will persist unless state, federal, public health and dental workforces participate in a joint effort to lead change, develop new policy and design strategic initiatives. Strong advocacy and public health programs are required to interrupt the cycle of ED use and remove barriers to deliver quality, community-based dental care to all Americans.

Chapter 5 – Journal Article

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