2012

Exploring Health Disparities for Children in the City of Milwaukee

Mark Edwin Anderson
University of Alabama at Birmingham

EXPLORING ORAL HEALTH DISPARITIES FOR CHILDREN IN THE CITY OF MILWAUKEE

by

MARK E. ANDERSON

S. ROBERT HERNANDEZ, COMMITTEE CHAIR
ROBERT WEECH-MALDONADO
CHRISTOPHER OKUNSERI
BISAKHA SEN
EARNISTINE WILLIS

A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham
in partial fulfillment of the requirements for the degree of
Executive Doctor of Science in Administration – Health Services

Birmingham, Alabama

2012

EXPLORING ORAL HEALTH DISPARITIES
FOR CHILDREN IN THE CITY OF MILWAUKEE

MARK E. ANDERSON

EXECUTIVE DOCTOR OF SCIENCE IN ADMINISTRATION-HEALTH SERVICES

ABSTRACT

This study investigated whether school-based oral health programs as a public policy intervention increased dental sealant applications among children from low-income families and minorities in public schools in inner city Milwaukee. By using a difference-in-differences analysis, we examined pre-post time frames, 2001-2003 and 2008-2009, to determine sealant application usage in public schools in nine inner city Milwaukee zip codes after the intervention of a public policy initiative to expand school-based oral health programs with the expressed intent of increasing placement of dental sealants in children at high risk for dental decay and disease.

Results of a binary logistic regression revealed that at a .05 criterion of significance, the study's difference-in-differences estimator variable was significant at $p < .02$, indicative that the policy intervention significantly and positively impacted the delivery of sealants to children attending public schools within the zip codes examined by the study. The study also assessed the demographic characteristics of the school children within the study, reporting that children aged 7, 8 and 9 were most likely to receive sealants, and that while Blacks received the largest percentage of sealants within the study (the study revealed that among racial/ethnic lines, Blacks were disproportionately represented among the school-based population), when sealant numbers were adjusted to numbers of sealants per 1,000 person years, the numbers of sealants for the racial/ethnic

categories as well as age and numbers of sealants delivered within zip codes were relatively similar.

Efforts to analyze the cost effectiveness of sealants and their predictive value in estimating future cost savings from reduced dental caries and restorative care were largely inconclusive due to the absence and inconsistency of accurate and standardized sealant cost and expenditure data. However, a limited examination of billings for sealants compared against billings for specific restorative procedures reveals that the relative percentage of billings for sealants versus restorative billings increased, suggesting an increased emphasis on sealant placements as a preventive measure and suggesting the possibility of some reduction in dental caries and restorative procedures and costs. Further research is specifically encouraged relative to the financial impact of the delivery of sealants on future savings due to reductions in tooth decay, disease and restorative services.

Keywords: dental sealants, school-based oral health programs, dental caries, oral health disparities, difference-in-differences, binary logistic regression

DEDICATION

This dissertation is lovingly dedicated to my parents, Mary Alna Jarman Anderson and Audie Edwin Anderson, for their love, support, and encouragement throughout my life, and for instilling in me the importance of faith, hard work, higher education and service to others.

ACKNOWLEDGEMENTS

Sincere appreciation is extended to the faculty and staff of the University of Alabama at Birmingham's School of Health Professions for their assistance and direction. Particular appreciation is extended to all members of my dissertation committee, S. Robert Hernandez, Ph.D., Chair; Robert Weech-Maldonado, Ph.D., Bisakha Sen, Ph.D., Earnestine Willis, M.D., and Christopher Okunseri, D.D.S., for their willing and wise counsel and guidance. A debt of gratitude is also expressed to Nicholas Pajewski, Ph.D., for his patience and persistence in enabling me to obtain the necessary data for my study. And, special words of thanks and appreciation to Leandra Celaya and Martha Hilley for their patience, good humor, and commitment to excellence for the Executive Doctor of Science in Health Services Administration program as they shepherded me and my classmates throughout our doctoral studies.

A sincere and abiding indebtedness is also felt towards professional colleagues and friends who, throughout the years, have provided mentorship, encouragement, support and friendship as I have pursued professional and personal goals and opportunities. A specific acknowledgement is made to Jon E. Vice, President Emeritus of Children's Hospital and Health System of Wisconsin, for his mentorship, encouragement and above all, friendship over the years.

A special word of thanks and deepest gratitude as well to Kathy Melser for her constant support. She has been a special point of happiness as I have moved through this journey.

Finally, enduring appreciation and respect is expressed to Tee Hiatt, Ph.D., Howard W. Houser, Ph.D., and S. Robert Hernandez, Ph.D., University of Alabama at Birmingham faculty extraordinaire, who have creatively, enthusiastically and passionately provided wisdom, guidance, support and friendship not only to me, but to hundreds of health professionals whose professional lives they have helped shape in the United States and in countries around the world. Their pursuit of academic excellence and desire to raise the standard of health care for all is inspiration and example for us all.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Background of the Problem

In May, 2000, the landmark report, "Oral Health in America: A Report of the Surgeon General" was released. The report, which focused exclusively on oral, dental, and craniofacial health, was the first such report ever issued by the Surgeon General of the United States, and its findings made it abundantly clear that profound and consequential disparities exist with respect to the oral health of America's citizens. The report claims that what amounts to a silent epidemic of dental and oral diseases is affecting significant portions of the population (U.S. Department of Health and Human Services [HHS] National Institutes of Health [NIH], 2000).

Particularly glaring are the reported disparities in children's oral health and access to dental care. Specifically, the report notes that dental care is the most prevalent unmet health need in U.S. children, and that those from in low-income families, those from racial/ethnic minorities, and those with special health care needs are at the greatest risk of inadequate access and poor oral health. Though numerous advances in oral health over the previous 50 years have led to safe and effective means of maintaining oral health and in preventing dental caries and periodontal disease, dental caries remains the most common chronic disease among children (HHS, NIH, 2000). Children suffering from oral health disease often experience serious social and health issues such as chronic pain, difficulty in eating and speaking, deterioration of school performance, withdrawal from

social and family interactions and diminished self-image and self-esteem (Holt & Kraft, 2003).

Among children, unmet need for oral and dental care is concentrated within certain demographic groups. Studies have shown that approximately 80% of untreated cavities in permanent teeth are found in roughly 25% of children aged 5 to 17 years of age, with most of these children coming from low-income families and from racial/ethnic minorities. Children in families with incomes below the poverty level have two times more cavities than those from higher income families and are less likely to obtain treatment. Children from low-income families and from racial/ethnic minorities are less likely to receive preventive services such as dental sealants applied to molar teeth to prevent decay (HHS, NIH, 2000). While Medicaid programs and most State Children's Health Insurance Programs offer children's dental benefits, numerous barriers to access exist, including low reimbursement rates and a lack of providers willing to participate in the programs (Centers for Medicare and Medicaid Services [CMS] & HHS, 2004). One study estimated that less than one-fifth of Medicaid covered children received even one dental preventive visit per year (Association of State and Territorial Health Officials [ASTHO], 2012; HHS, Centers for Disease Control and Prevention [CDC], 2005).

To address these issues, the Surgeon General's report, as well as other federal initiatives, including Healthy People 2010 and Healthy People 2020, has recommended national objectives for increasing the number of children and adolescents who receive preventive oral health services. A particular focus has been an emphasis on increasing the number of children receiving dental sealants on their permanent teeth. As a consequence of these national objectives, numerous school-based oral health programs which provide

dental sealants have been implemented in communities around the country. This has been true of the city of Milwaukee, which implemented school-based oral health programs in select inner city public schools after both State of Wisconsin and City of Milwaukee oral health screening data revealed trends slightly worse than the national average relative to children's oral health issues. The existing literature supports the effectiveness of dental sealants in reducing the risk of tooth decay (Gooch et al., 2009; Association of State and Territorial Health Officials [ASTDD], 2012).

Existing literature also reveals that Systems Theory, with its focus on relationships among the parts of systems and behaviors within systems provides a useful structure for evaluating system processes and facilitating change. It is a highly utilized theoretical framework for examining public health practices and systems such as the oral health issues described above. The purpose of this study is to evaluate the impact of an oral health system's intervention – the introduction and implementation of school-based oral health programs into inner city Milwaukee Public Schools on increasing the utilization of dental sealants among low-income and minority children.

Significance of Study

The significance of this study is several fold. Numerous studies have evaluated the effectiveness of sealant programs in various settings such as multidisciplinary clinics, community centers, schools, dental practices and other settings. However, an area of inquiry missing is an evaluation of existing dental programs in a manner that will allow improvement in dental care delivery. This study, by examining the effectiveness of sealant programs in increasing sealant prevalence among Medicaid recipients in the city

of Milwaukee from the context of school-based oral health programs, will lend generalizability to the existing literature, as well as support city and state strategies to promote and implement managerial and operational initiatives which respond to an identified public health problem for Wisconsin's children.

Though school-based dental sealant programs have been implemented successfully around the country in response to children's and adolescents' needs for prevention against dental caries, utilization of sealants as a prevention strategy remains underused, particularly among children from low-income families and from racial/ethnic minority groups. A System's Theory framework, which permits systems to evaluate, adapt and change behaviors and processes through self-corrective strategies based upon system feedback, will be utilized to address the study's research questions and hypotheses.

The evidence-based information obtained through this framework will enable city of Milwaukee and state of Wisconsin policy makers and healthcare administrators to more effectively and efficiently allocate resources to increase sealant prevalence among high-risk children, build effective infrastructures to improve the oral health of children who still suffer disproportionately from oral diseases, and pursue programs designed to reduce future oral health expenditures. In sum, this study will make contributions toward both the research literature, as well as toward both policy and dental care delivery decisions which will help launch programs to help children and adolescents from low-income populations attain a greater level of preventive oral health services.

Research Questions

Based upon a number of state and local surveys dealing with oral health services for children, which reflect nationwide trends relating to disparities, it is evident that children in the City of Milwaukee experience significant disparities in access and utilization of oral health services. To address these disparities, the City of Milwaukee, in collaboration with a number of community-based partners, has, in recent years, implemented school-based oral health programs in designated public schools in inner city of Milwaukee. Primary objectives of these school-based programs are to increase the number of children receiving dental sealants and to identify oral health diseases for appropriate referral for early and urgent oral health treatment. This study seeks to determine the impact of this school-based intervention on increasing the prevalence of dental sealant utilization among Milwaukee public school children. Specifically, this study explores the following two questions.

1. How effective have school-based oral health programs been in increasing dental sealant utilization in public school children?
2. What demographic characteristics of the participating students might drive dental sealant usage?

A third question, "What is the financial impact of using dental sealants as an oral health intervention upon children who received sealants within the study", is raised, and though recognized as beyond the scope of this project, is briefly examined and presented as a logical extension for future research in association with the two prior questions.

Plan of Work

Chapter 2 reviews the literature on access to and utilization of oral health care services by children. It specifically focuses on issues associated with disparities in access and utilization by children from low-income families and ethnic minorities, as well as strategies for reducing these disparities, including the application of dental sealants. Existing literature on national, State of Wisconsin and City of Milwaukee data as it relates to access to children's oral health will also be presented, as will literature relating to Systems Theory, the theoretical framework used within the study.

Chapter 3 presents the study's hypotheses, which were derived from the literature review, and a description of the methods, through which the goals of the study were achieved. Chapter 4 presents the results of the study, including variable characteristics, prevalence rates, difference-in-differences coefficients, and analysis of hypotheses. Finally, Chapter 5 provides a summary of research results, explanations for these results, practical suggestions, study limitations, and future research implications.

CHAPTER 2

LITERATURE REVIEW

To set the stage for this inquiry, a review of the literature in the following areas is provided: 1) the factors associated with dental care access and utilization for children and the disparities which characterize the oral health care system for children, particularly those in low-income families and from racial/ethnic minorities; 2) the framework of Systems Theory and with it, an understanding that systems, in this case oral health delivery systems, both determine and are determined by their components, and the processes for system evaluation and change.

Oral Health Care Access and Utilization by Children

In recent years there has been a growing body of research examining disparities in children's access and utilization of oral health services, particularly as these disparities relate to poor and near poor children and children from racial and ethnic minorities. This section presents a historical review of children's oral health access and outcomes research findings as well as specific references to research conducted relative to the context of the research questions cited in Chapter 1. As children's oral health services are rendered within the context of a health care delivery systems model, a Systems Theory framework will be discussed in subsequent sections of this Chapter, as well as how an understanding of Systems Theory can assist in evaluating health delivery systems effectiveness and facilitate corrective actions as required and necessary.

The Issue of Health Care Disparities and Unmet Care Needs

"Health disparities" is a term that describes disproportionate burden or risk of death, disease, disability, and ill health on a particular population or group (Patrick et al., 2006). Many studies have been conducted to identify the characteristics of disparities in healthcare access and health outcomes. Findings of these studies indicate that while most Americans have high quality healthcare available, gaps or disparities in healthcare access and health outcomes continue to exist. These disparities are associated with age, education, race and ethnicity, gender, income and socioeconomic status, place of residence, and location of healthcare services (Graves, 2009).

However, it is noteworthy to mention that the number of studies examining unmet need among children is limited. Those studies that do exist suggest unmet need for care among children is significant in this country (Simpson, Bloom, Cohan, & Parsons, 1997). In these studies, oral health care ranks as the greatest unmet children's health need in the United States, and is much more common than unmet need for medical care (Hughes, Duderstadt, Soobader, & Newacheck, 2005). A study examining access to care for children with special care needs noted that "failure to obtain routine medical care for children may be a risk factor for failure to obtain dental care" (Kane, Mosca, Zotti, & Schwalberg, 2008).

Oral Health in America

Oral health is an integral component of general health, contributes to overall well-being, and is a marker for overall health status. Oral health means much more than having healthy teeth. It means being free of chronic oral-facial pain, oral and pharyngeal

(throat) cancers, oral soft-tissue lesions, birth defects such as cleft lip and palate, and scores of other diseases and disorders. Research indicates that many systemic diseases may initially start with and be identified through oral symptoms. For example, people who have conditions that affect their immune system, including people with HIV/AIDS, are more likely to experience oral infections. Research also suggests an association between gum and tissue disease and diabetes, heart disease, stroke and adverse pregnancy outcomes (HHS, NIH, 2000; Patrick et al., 2006).

Over the past 50 years, advances in oral health have led to safe and effective means of maintaining oral health and preventing dental caries and periodontal disease. However, there are profound and far-reaching oral health disparities within the population. Disparities in various oral conditions may relate to age, sex, race/ethnicity, geography, income, education, or medical status. Children from low-income families suffer dental decay twice as much as children from higher-income families and are more likely to let disease go untreated due to a lack of resources (Dietrich, Culler, Garcia, & Henshaw, 2008; CMS & HHS, 2004).

The Surgeon General cites lack of dental insurance (public or private) as one of the major barriers to obtaining care. In addition, the level of reimbursement for services, particularly for state-funded insurance programs, is a barrier for providers to participate in these programs because of insufficient financial incentives and reimbursements (HHS, NIH, 2000). The Surgeon General also asserts that safe and effective disease prevention measures need to be readily available so that everyone can adopt prevention measures to improve oral health and prevent disease. These measures include daily oral hygiene procedures and other lifestyle behaviors, community-based programs such as water

fluoridation and tobacco cessation programs, and provider-based interventions such as dental sealants, fluoride varnish, and examinations for common oral and throat cancers.

Many states provide statewide sealant programs that offer grants to local school-based programs. Typically, these programs target low-income, uninsured children who attend schools with high rates of free and reduced-price school meals eligibility. In addition to sealants, these children also receive oral health education and fluoride varnish applications. Community water fluoridation is a cost-effective, safe, broad-based approach that helps people of all ages and income levels and is considered one of the great public health achievements of the 20th century (HHS, NIH, 2000; Mouradian, Wehr, & Crall, 2000).

Oral Health and America's Children

With respect to children, utilization of oral health and dental services is a complex phenomenon that involves insurance coverage and affordability; geographic accessibility of providers, provider availability and participation with various types of insurance; provider interest in treating children of various ages and subpopulations; valuation of health services by parents, community and culture; and perceived need for health services (Edelstein, 2002). America's children are far less likely to have dental insurance than medical insurance. An unpublished Centers for Disease Control report revealed that there were 2.6 times as many children with no dental insurance as children with no health insurance. This equates to approximately 26 million children and adolescents (Bloom, Gift, & Jack, 1992).

The issue of unmet oral health care for children, as well as inequity of access, has been a long standing concern. In a study of historical epidemiological data, Brown, Wall & Lazar compared the oral health of children in the early 1970s with that of their counterparts in the late 1980s and early 1990s. He reported that:

> "Although oral health differences based on poverty and race still exist, absolute differences between poverty and racial categories (for the period 1988-94) were much smaller than those of 20 years earlier. However, children living in poverty during the period (1988-94) still exhibited more untreated caries in their permanent dentition than did children living above the poverty level" (1999).

Advances in biomedical, behavioral, and health services research and their practical application to communities over the past 50 years have led to safer and more effective means of maintaining oral health and preventing dental caries and periodontal disease. However, significant disparities in children's oral health among low-income and minority communities continues. Numerous studies reveal that access to dental care is still problematic for poor and near poor children. Children in lower socioeconomic levels are more likely to have untreated dental caries, and poor children suffer 12 times the number of restricted activity days caused by dental disease as compared to more affluent children (U.S. General Accounting Office [GAO], 2000; HHS, CDC, 2005).

In 2000, the Surgeon General reported that 80% of dental caries occur in 25% of the pediatric population, especially in low-income populations (HHS, NIH, 2000; HHS, CDC, 2005). Similarly, in 2002, Newacheck, Hughes, Yun, Wong, & Stoddard noted that children from poor and near-poor families with incomes below 199% of the Federal Poverty Level (FPL) are three times as likely to have an unmet dental care need as children from families at or above 200% of the FPL (2000).

National Surveys on Children's Oral Health

Using survey data obtained from the National Health and Nutritional Examination Survey (NHANES), which was a data source used by the federal government to establish the goals for Healthy People 2000 and Healthy People 2010, authors representing key federal agencies the Centers for Disease Control and Prevention (CDC), the Centers for Medicare and Medicaid Services (CMS), and the Agency for Healthcare Research and Quality (AHRQ) made the following policy observations:

> "Despite significant improvements in prevalence of dental caries over the past 3 decades … the vast majority of children are adversely affected to some degree by the time they reach adulthood. Perhaps, more importantly, these data indicate that children from lower-income households are more likely to experience caries and have levels of untreated caries compared with their more economically advantaged counterparts. Findings concerning the high levels of untreated caries in children indicate that children entering new programs (such as SCHIP) or enrolling in Medicaid will bring a burden of untreated illness that will need to be addressed in terms of access to dental providers. Fiscal resources for comprehensive dental treatment (as opposed to just screening and preventive services) also will need to be addressed. Collectively, children from low income households who might become enrolled in Medicaid and SCHIP programs are at a higher risk of developing dental caries and may require a more intensive mix of services to meet their dental needs compared with their more economically advantaged counterparts" (Vargas, Crall, & Schneider, 1998; Edelstein, 2002).

Low-income children have the highest rates of dental coverage because of Medicaid eligibility and State Children's Health Insurance Program (SCHIP) programs. African-Americans have the highest rates of coverage at 72%, whites with 62%, and Hispanics at 61%. Despite this, there are significant disparities in the availability of care, primarily due the absence of dentists participating in state Medicaid programs. And children with no dental insurance are three times more likely to have unmet dental need than their counterparts with either private or public insurance (HHS, CDC, 2005).

National surveys on access to oral health also report that socially disadvantaged children are not only less likely to access care, but older children tend to have fewer dental visits when they do receive care. In terms of service mix, the literature reveals that the types of services children obtain when they access care do not vary significantly between population social and ethnic subgroups. However, for each category of service, service frequency increases with increasing income. Preschool children obtain the least care in all categories, school-aged children the most, adolescents have the highest rates of disease yet service rates decline as children move into adolescence. Children from middle- and high- income families experience twice as many preventive visits, including cleanings, fluoride treatments, or sealants, as do poor or near poor children. Sealants, a notably effective treatment preventing biting surface cavities in the most susceptible teeth, are evident on about 1 in 4 children but are generally evident in less than one in ten black and Hispanic children (Edelstein, 2002).

Disparities in Oral Disease and Dental Care for Children

Oral disease in children and inadequate access to oral health care are system-wide problems in the U.S., but they are not distributed evenly in the population. Poor children – those in families with income below the federal poverty level (FPL) – have twice the prevalence of dental caries (tooth decay). The extent and severity of their decay are more extreme, and their disease is more likely to be untreated. Roughly one-third of low-income children age 6-19 have untreated tooth decay, compared with 15% of children at or above twice the poverty level. The burden of oral disease is highly concentrated: 80%

of tooth decay is found in 25% of children age 5 to 17, mostly from low-income and other vulnerable groups (Edelstein, 2002; HHS, NIH, 2000; HHS, CDC, 2005).

In a 2006 Medical Expenditure Panel Survey (MEPS) analysis on Medicaid and the uninsured, the Kaiser Commission documented oral health disparities among low-income children and minorities, reporting that in addition to having more oral disease than other children, poor and near-poor children are also less likely to obtain dental care. The Commission further reported that, in 2006, about 60% of low-income children had no dental visits in the previous year, compared with 40% of children who were not from low-income families. Further reflecting the consequences of income-related disparities in the burden of oral disease by low-income children, the Commission cited research which demonstrated that poor children experience 12 times as many restricted activity days due to dental disease as children in higher-income families. In addition to the disparities in oral health which affect low-income children, racial and ethnic disparities in children's oral health and access also exist. The Commission reported that African-American and Hispanic children are both more likely to have untreated caries than White children, and are less likely to have had a dental visit in the previous year (Kaiser Commission on Medicaid and the Uninsured [KCMU], 2006).

Governmental Support Programs

The burden of oral disease can be effectively reduced through preventive measures. Publicly funded health programs have great potential to provide necessary preventive dental care for children, yet have largely not been able to do so. Medicaid and SCHIP, the nation's safety-net health insurance programs, are a major source of coverage

for children in the United States. Over the past 20 years, federal and state initiatives have significantly expanded health insurance for low-income children through a series of Medicaid eligibility expansions in the 1980s and 1990s, and through the enactment of the SCHIP in 1997. The goal of these initiatives was increasing access to care, including dental care, and ultimately improving the health status of low-income, previously uninsured children. Substantial evidence has demonstrated that the availability of Medicaid has improved access to care among low-income children, and early evidence suggests that the SCHIP program is producing similar results (KCMU, 2009; CMS & HHS, 2004).

For example, in 2007, the two programs covered more than one-quarter of all children and about half of low-income children. Medicaid covered about 29 million poor and near-poor children, and SCHIP built on this coverage, providing health insurance for an additional 7 million low-income children. In 2006, more than two-thirds of low income children in the U.S. (69%) received dental coverage through Medicaid and SCHIP during at least part of the past year. This is a substantial increase relative to 1999, when the rate was just about 50%. In the absence of Medicaid and SCHIP, most children covered by these programs would be uninsured. Reflecting this reality and the impact of broader public coverage among children, the share of low income children with no dental coverage during the past year fell by 10 percentage points between 1999 and 2006, from 25% to 15% (KCMU, 2006).

Medicaid covers comprehensive dental care for children through the Early and Periodic Screening, Diagnostic and Treatment (EPSDT) benefit, which federal law requires all states to provide to children enrolled in the program. A distinctive focus of

EPSDT is prevention-oriented care to maximize children's health and development and avert the health and financial costs of long-term disability. Under EPSDT, states must cover all medically necessary dental services for children, including screening and diagnostic services and needed treatment and follow-up care. States cannot limit their dental services or spending for children enrolled in Medicaid or in SCHIP programs that are Medicaid expansions (KCMU, 2009).

However, the extent to which the Medicaid/SCHIP expansions have improved the health status of low-income children has not been well documented. This is a reflection of several complex issues, including the fact that oral health programs have not traditionally been well integrated with other public health programs, and that oral health services have been greatly underfunded (ASTHO, 2012). Also, presently, reliable national statistics are not available to compare the utilization rates of dental care between children with and without Medicaid/SCHIP support. Nor are statistics available relative to other programs which support children's programs which support dental services such as Civilian Health And Medical Programs of the Uniformed Services (CHAMPUS) or Indian Health Services. However, several studies have examined the underutilization of dental services through Medicaid and have concluded that the following factors were involved:

- Rejection of patients with Medicaid by dentists due to low and inconsistent reimbursement rates;
- Frequently missed appointments by the Medicaid enrollees;
- Reluctance to treat patients with complex and time-consuming problems;

- Problem of availability of dentists serving in remote rural or undesirable urban settings;
- A culture gap between patients from varying social and ethnic classes and dentists (Patrick et al., 2006).

In sum, with respect to children who are eligible for governmental programs such as Medicaid and SCHIP, a comprehensive review of empirical evidence has revealed that dental care, particularly care for vulnerable groups, is a complex process. A whole range of factors contribute to underutilization of Medicaid services. On the patient side, cultural values, education, prior experience with dentists, perceived value of dental care, and access issues influence care seeking. On the dental professional side, practitioners' perception of poor patients, financial costs, time, and reimbursement issues can influence delivery of oral health care (Patrick et al., 2006).

Children's Oral Health Trends in Wisconsin and Milwaukee

Results from oral health studies and screenings of Wisconsin children reveal similar trends. In two recent reports, entitled *"*Healthiest Wisconsin 2020: Oral Health Profile" and "2008 – Make your Smile Count: The Oral Health of Wisconsin's Children,*"* Wisconsin's Department of Health Services (WDHS) highlighted the following trends. Results from screenings of Wisconsin children conducted among a sample of Head Start children in the 2008-09 school year, and a sample of third grade students in the 2007-08 school year, revealed that 26% of Head Start children had untreated decay, 55% of third grade students had experienced tooth decay and 20% of third grade students had untreated decay (Wisconsin Department of Health Services

[WDHS], 2008; 2010). Racial and ethnic disparities were found among children screened, particularly among the third grade children. African American and Hispanic third graders were twice as likely to have untreated decay and were less likely to have the benefit of sealants compared to White children (WDHS, 2008; 2010).

Oral health disparities between racial/ethnic groups in Wisconsin are also impacted by socioeconomic status. Eighty-seven percent of third graders in higher income schools were white non-Hispanic. Sixteen percent of the third graders in the lower income schools were white non-Hispanic (WDHS, 2008; 2010).

The Wisconsin Department of Health Services has used eligibility for free and reduced price lunch (FRL) program as a marker of overall socioeconomic status. In 2007-08, compared to third grade children from higher income schools, children in schools where ≥ 25% of children participated in FRL programs had a significantly higher prevalence of tooth decay and untreated tooth decay, and children in schools where ≥ 74% of children participated in FRL programs had a significantly lower prevalence of dental sealants (WDHS, 2008).

Oral health disparities in Wisconsin also exist by disability status. Wisconsin children with special health care needs were more likely to have decayed teeth or cavities in the past six months (21%) compared to children without special health care needs (15%) and were twice as likely to have had a toothache in the past six months. During the 2008-09 school year, the Wisconsin "Seal-A-Smile" program screened almost 9,800 children, placed dental sealants on more than 6,200 children, and provided fluoride varnish to almost 6,000 children (Children's Health Alliance of Wisconsin [CHAW] & HHS, CDC, 2009). Approximately 90% of Wisconsin's populations who are on a public

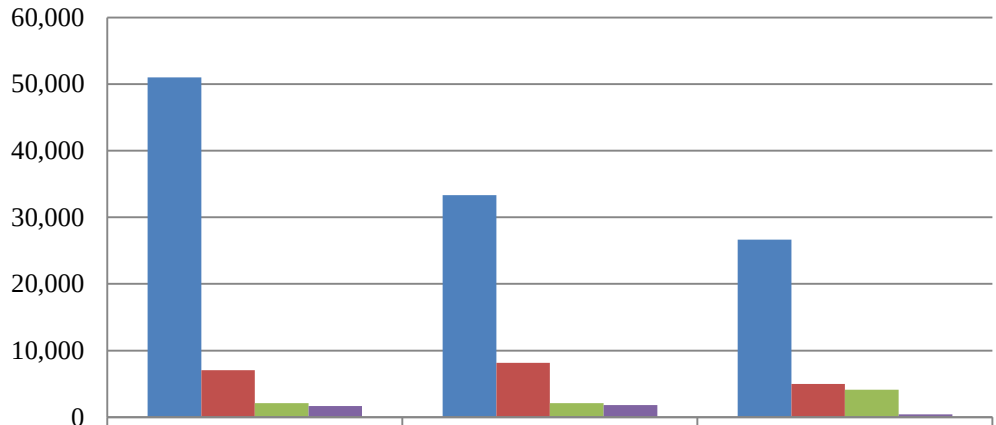
water supply receive the benefit of fluoride. Nationally, Wisconsin ranks 16th highest among the 50 states and District of Columbia for fluoridation of community water supplies (WDHS, 2009).

The proportion of children with untreated decay is disproportionately higher in the City of Milwaukee compared to the rest of the State. Statistics from two local school-based oral health programs show the rate of untreated decay in program participants to be 54%, of which, 14.8% was considered urgent. These programs target low-income schools based on high free and reduced lunch rates, i.e., students receiving free lunch typically exceeds 60%. This untreated decay rate far exceeds not only State averages, but also averages for low-income schools in Wisconsin. According to 2005 census data, there are 162,156 children under the age of 18 in the City of Milwaukee, with approximately 111,000 of those being Medicaid eligible. Only 18% of these children received a dental exam in 2006 (CHAW, 2010).

Figure 1 depicts the City of Milwaukee's Medicaid utilization for dental services and demonstrates its need for increased access to comprehensive oral health care for children.

Figure 1

City of Milwaukee Medicaid Utilization - 2003



	Ages 0 - 6	Ages 7 - 12	Ages 13 - 18
Medicaid Recipients	50,989	33,326	26,672
Oral Exams	7,074	8,150	4,974
Dental Cleanings	2,102	2,092	4,129
Urgent Care	1,669	1,805	437

Implications

Demographic trends in the United States predict that the numbers of low-income, minority, and immigrant children will rise more rapidly than the general population of children. The fastest growing populations of children are those that currently have the highest disease rates and the least dental care. If the strong correlation between these subpopulations and dental disease continues, caries rates are likely to increase, and the stress on publicly financed dental care will also increase (Edelstein, 2002).

Oral Health Disparity Reduction Strategies

Despite the availability of highly effective measures for primary prevention to address the oral health issues cited above, children in the U.S. and throughout Wisconsin continue to experience avoidable dental disease. As a result, dental caries (tooth decay) remains the single most common chronic disease of childhood (HHS, NIH, 2000; HHS, CDC, 2005).

Dental sealants are a widely utilized and popular method of caries prevention. When properly placed, dental sealants are almost 100% effective in preventing caries on the chewing surfaces of first and second permanent molar teeth. Dental sealants are a plastic material placed on the pits and fissures of the chewing surfaces of teeth, covering up to 90% of the places where decay occurs, and creating a barrier between a tooth and decay-causing bacteria. Sealants also stop cavities from growing and can prevent the need for expensive fillings. According to the Surgeon General's 2000 report on oral health, sealants have been shown to reduce decay by more than 70%. The combination of sealants and fluoride has the potential to nearly eliminate tooth decay in school age children. Past research strongly indicates that sealants are most cost-effective when provided to children who are at highest risk for tooth decay, and that dental sealants could serve as a mechanism to help eliminate oral health disparities in children (Gooch et al., 2009; Griffin, Jones, Lockwood, Mosca, & Honore, 2007; Vargas, et al., 1998).

However, sealants remain underused, particularly among children from low-income families and from racial/ethnic minority groups (HHS, Agency for Healthcare Research and Quality [AHRQ], 2003). As noted, multiple interrelated social and demographic factors, including income, race, and education can limit children's access to

preventive dental care. Low-income children are only half as likely to access preventive dental services as middle or high-income children, despite their higher occurrence of dental problems. They are also two to three times more likely to suffer from untreated dental disease. Minority children are less likely to have access to dental services than their white counterparts, as are children whose primary caregivers have limited education (Edelstein, 2002).

While research has shown dental sealants to be effective in preventing caries, particularly in permanent molars, only limited research exists relative to the cost-effectiveness of dental sealant applications in children. This is due in part to the difficulty in assigning costs and effects to the application process (Hodges, 2010). Researchers have sought to identify the variables which make dental sealants particularly cost-effective as an oral health preventive strategy.

In 1983, Houpt and Shey identified a series of influential variables which Mitchell and Murray enhanced and expanded in 1989. Both teams of researchers noted six key factors which impact dental sealant cost-effectiveness. These include: materials and equipment, operator technique, durability of the sealants and restorations, monitoring and reapplication, patient and tooth selection, and use of other preventive measures in conjunction with dental sealants.

In 2001, Weintraub, Stearns, Rozier, & Huang conducted a retrospective study to compare the cost-effectiveness of dental treatment with and without the inclusion of sealants among low-income children, all of whom were dental patients at the same health center over an extended period of time. All had at least 3 years between their first and last dental visit (mean = 5.8 years). A life table analysis was conducted to compare the

probability of survival (restoration-free tooth years) and costs incurred to first molars of children who did not receive sealants, or received sealants on all first molars. Among the children with sealants, comparisons were also made between sealed and unsealed teeth in children who did and did not have a first molar restoration prior to sealant placement. Costs included the cost of sealants and restorative treatments for these teeth over time. Depending on the conditions under which sealants were placed, cost-savings or improving cost-effectiveness with time was found. A strategy of identifying children with prior restorations and sealing the remaining molars showed cost-savings within 4-6 years. For other comparisons, incremental cost-effectiveness ratios became more favorable over time. The authors concluded that the results from the study provided plausible evidence of the beneficial effects from sealants in both a long and short term perspective. The long-term trends in reduced cost per additional restoration-free tooth year over time are consistent with an ultimate outcome of cost-savings from sealants (Weintraub et al., 2001).

A 2005 study by Quiñonez, Downs, Shugars, Christensen, & Vann provided evidence that sealing children's first permanent molars can improve outcomes and save money by delaying or avoiding invasive treatment and the destructive cycle of caries. The researchers compared three strategies for managing the occlusal surfaces of first permanent molars: 1) seal the teeth of all the children in the study (seal all strategy); 2) seal the teeth of children judged to be at high risk (seal high risk strategy); and 3) seal the teeth of none of the children (seal none strategy). The researchers constructed a decision tree to track the possible outcomes of each strategy which allowed for the construction of a chain of events (Markov Model) representing the natural history of sealant retention,

caries formation, and their associated health states. The outcome measures were the incremental cost per month gained in a cavity-free state over a ten-year period. The study model results revealed that the strategy of sealing the teeth of the high risk children improved clinical outcomes in the form of cavity-free months, and saved money over the strategy of sealing none of the children. The strategy of sealing all the children further improved outcomes but at an additional cost compared to just sealing those at high risk. However, the cost was small, $8 for each additional cavity-free month gained per tooth. Further, minor changes in the baseline assumptions, i.e., the number of cavity-free months, resulted in the seal all strategy being the dominant strategy (Hodges, 2010).

Similarly, in 2007, Griffin et al. compared the cost effectiveness of the three sealant strategies: seal all, seal children at high risk, and seal none regardless of risk. In this study, both the seal all and seal those at high risk strategies were less costly over time in comparison to the seal none strategy, and again, as with the Quiñonez, et al. study, the seal the high risk strategy was the least costly and most effective.

While noting that recent research is supportive of the notion that application of dental sealants to children at high risk is cost effective, researchers have also expressed the concern that the status of a child as high risk is primarily established after a child has experienced dental decay. Gooch et al. note that to help minimize this problem, school-based oral health programs which provide dental sealants commonly target schools with a high rate of children who qualify for the free-and-reduced lunch program in order to focus on the established link between low-socio-economic status and dental caries in children (2007).

Systems Theory

The previous section reviewed current and existing literature on the state of oral health among America's children, with a particular focus on the disparities that exist within the oral health delivery system relative to access and utilization. Recognizing that the access and utilization of oral health services is provided within the context of health delivery system, this section provides a review of the theoretical framework of Systems Theory, specifically emphasizing the concept of open Systems Theory and its focus on the concept of systems as self-regulating, i.e. systems that are self-correcting through feedback. Through this framework, strategies for correcting the disparities that exist within the oral health delivery system can be formulated and evaluated.

The term "Systems Theory" refers to a host of theoretical and methodological practices spanning many different disciplines. As a research methodology, Systems Theory can help investigators understand how systems both determine and are determined by those component and characteristics which comprise the system. And from a research or investigatory point of view, once the dynamics of the system are understood, Systems Theory can help professionals, policymakers, advocates, etc. make structural and behavioral changes to create positive change within the system (Katz & Kahn, 1978). Since Systems Theory refers to theoretical practices and methodologies that range across different disciplines, it is applicable to public health and health delivery systems such as those that deliver oral health services.

There are two versions of Systems Theory. The first, "closed" Systems Theory, originated out of classical physics. Closed systems have no inputs or interaction with their environments and tend to decay and entropy. "Open" Systems Theory, which is the

focus of this study's theoretical framework, has its foundations in biology and is primarily attributed to Ludwig von Bertalanffy. In contrast to closed systems, open Systems Theory postulates that open systems do have interactions with their environment, and routinely exchange information, energy and materials with its environment, and the system strives to achieve a steady state or dynamic equilibrium. In other words, in open Systems Theory, to be viable a system must be strongly goal-directed, governed by feedback and have the capability to adapt to changing circumstances.

Katz and Kahn, in ascribing open Systems Theory to organizations and large systems, defined open systems as coalitions of shifting interest groups, strongly influenced by environmental factors that develop goals by negotiating its structure, activities and outcomes (1978). Open systems stress complexity and variability of parts, looseness of connections, amorphous system boundaries and attention to process, not structure (Scott, 1981). As a consequence of these attributes, systems, in order to survive, must grow and achieve a dynamic equilibrium rather than achieve only a neutral state. It is for the aforementioned reasons that open Systems Theory has become an acceptable methodology for studying organizational and systems phenomena and in understanding the flexibility and adaptability of processes if the entities are to continue to thrive (Ansari, 2004).

Researchers have identified a number of key concepts of open Systems Theory, which are summarized below (Katz & Kahn, 1978; Kast & Rosenzweig, 1972; Scott, 1981).

Purpose

The systems tend to be purposeful and goal seeking, with the primary goal being survival. And for systems to work properly, there must be control mechanisms and criteria related to the goals the system's behavior and processes.

Environment

Systems work within the context of particular environments. The systems environment will place particular constraints upon a system. Common constraints include:

- Legal/Political – Laws and regulatory standards which govern the organization and its personnel and activities;
- Educational – The availability and willingness of trained personnel to perform the organizations tasks;
- Sociocultural – Attitudes, believes, behaviors of the individuals affect or impacted by the system, and the products or services provided by the system;
- Economic – Cost and quality of the system's products and services are viewed as being externally driven and must be managed by understanding the environmental influences on these variables.

Boundaries

Boundaries are the interface between a system and its subsystems or a system and its environment. Matter, energy and information flow back and forth across system boundaries. System boundaries are often where frictions and problems are first exhibited.

Interrelated Subsystems

Systems are comprised of a series of interrelated parts. This is the notion of the whole being greater than the sum of the parts. In open Systems Theory, there must be a focus on the interrelationships among the parts. Failure to understand the linkages of the parts could lead to unintended system consequences.

Input-Transformation Output Process

In Systems Theory, this concept conveys the concept of systems being in the constant process of inputs, acquired from the environment, being transformed into outputs, which are returned to the environment in a constant exchange.

Feedback

Feedback is the environmental reaction to system outputs, and it is through feedback loops that the system hopes to achieve its desired state. Feedback loops exist in two forms. Negative feedback loops are those where system errors are discovered after the fact and on which the system acts to take corrective action. The other is anticipatory feedback, which anticipates potential problems and takes corrective action prior to errors occurring within the system.

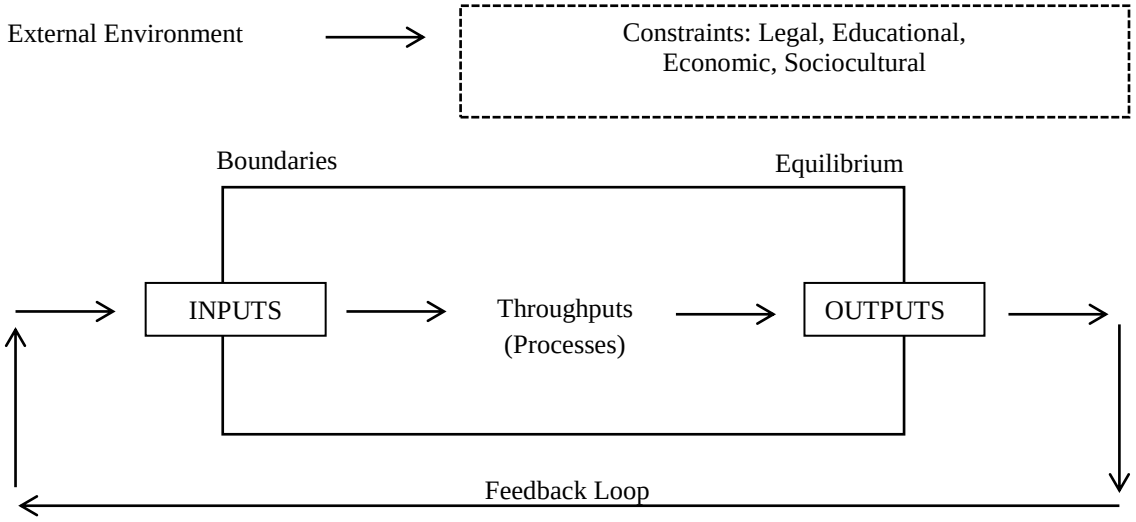
Equifinality

This term conveys the notion that systems can achieve the same result from many different conditions, that is, "systems exhibit a many-one behavior on which the system can find the same end-state from many different initial starting points." The usefulness of

this concept is that systems managers can have options to look for solutions within systems, knowing that there is not a one best way of doing things. This concept connotes system flexibility and adaptability (Katz & Kahn, 1978; Kast & Rosenzweig, 1972; Scott, 1981). Figure 2 offers a graphical depiction of the Systems Theory concepts **(**Jones, 2011**).**

Figure 2

Systems Theory Schematic



Systems Theory is a useful approach in analyzing systems to help understand effective functioning. Open Systems Theory acknowledges the importance of the environment and focuses attention on bridging boundaries, strengthening subsystems and constantly scanning and evaluating the input-transformation-output feedback loops for necessary change. Through its feedback loops, the open systems approach enables managers to identify and eliminate real and potential system dysfunctions (Charltan & Andras, 2003).

Important to this process is the necessity for systems managers to have the best available information to make decisions. In this regards, evidence-based management practices can inform a system's feedback loop as the system seeks to evaluate its performance and create opportunities for improvement. What distinguishes evidence-based management from other evaluative processes is that whenever possible system managers should incorporate into their decision-making well conducted management research – research which can complement and augment other system information and knowledge. Within a System's Theory context, evidence-based management seeks to ask the right questions, gather supporting information from various sources, evaluate the information and apply the information to improve the performance of the system (Kovner, Fine, & D'Aquilla, 2009).

In sum, Systems Theory is a framework for perceiving the structures that underlie complex systems, and for helping identify high-leverage change opportunities. Systems Theory involves not only the recognition of the properties of complex systems, but also the skilled application of systems archetypes to illuminate the deeper structures that shape everyday organizational practices and behaviors.

CHAPTER 3

RESEARCH METHODOLOGY

Research Questions and Hypotheses

As discussed in Chapter 2, disparities in oral health and in access and utilization of oral health services exist among America's children and youth, particularly among children and youth from low-income families and racial and ethnic minorities. Further, demographic trends in the United States predict that the numbers of low-income and minority children are increasing more rapidly than the general population of U.S. children, creating a situation whereby, if the correlation between these subpopulations and dental disease continues, then dental caries and other oral health diseases will increase, further stressing an already overburdened public financing system for dental care and oral health services (Edelstein, 2002).

Systems Theory, particularly "open" Systems Theory, provides a useful theoretical framework for examining system dynamics, and asserts that primarily, systems are goal driven and self-regulating, i.e. they are self-correcting through constant feedback. Systems Theory provides a vehicle for examining the oral health care delivery system for children in America and exploring which subcomponents of the system can be "corrected" in order to address the issues of disparity in access and utilization. To assist in this process, Figure 2 from the previous Chapter has been repeated below.

Figure 2

Systems Theory Schematic

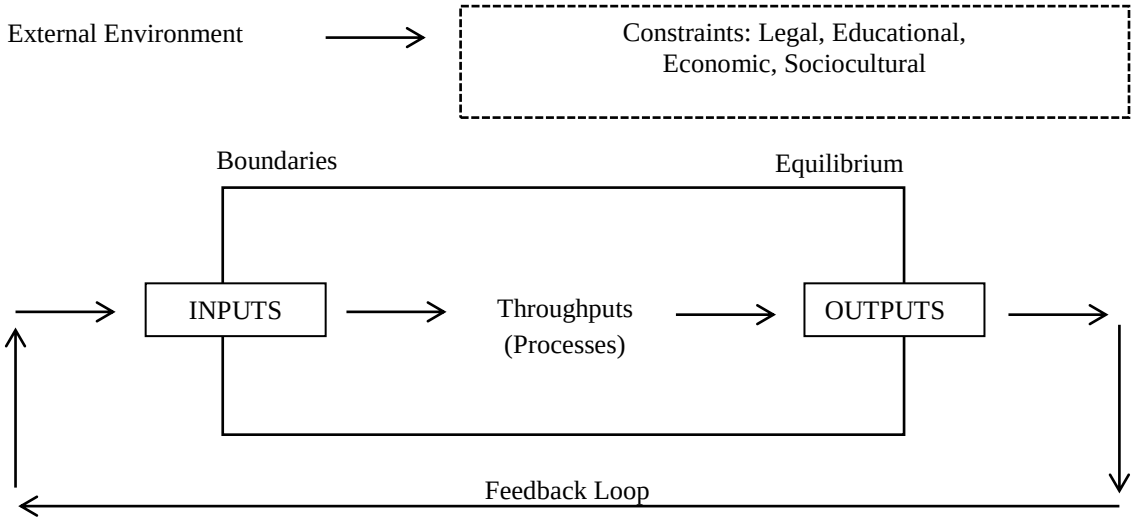


Table 1 extrapolates the input-throughput-output and feedback loop components of the schematic, and provides a model of how one might assess the oral health delivery system for children based upon the literature provided in Chapter 2.

Table 1

Oral Health Delivery System for Children Model

Inputs	Throughputs/Processes	Outputs	Feedback/Controls
Children needing oral health system access and treatment, providers, facilities, reimbursement systems	Coordination and organization of oral health services for children	Access to Care, oral health services rendered (utilization), service goals achieved	Outcomes measurement of system efficiency of access and utilization of services, problems identified and resolved

Existing literature has revealed that multiple problems and dysfunctions plague all facets (inputs-throughputs-outputs) of the oral health delivery system for children. As the oral health system has been evaluated, consistently among the strategies for system intervention and correction has been the desire to increase and enhance the preventive capability of the system, with a primary focus on efforts to increase the number of children receiving dental sealants.

Milwaukee Public Schools: Plan to Improve the Oral Health of Children in Milwaukee

In 2006, as a result of a Healthier Wisconsin Partnership Program (HWPP)[1] development grant, the following key partners formed the Healthy Teeth = Healthy Kids (HT=HK) partnership: Children's Health Alliance of Wisconsin (Alliance), Children's Hospital of Wisconsin (CHW) Dental Center, Marquette University School of Dentistry (MUSoD), Medical College of Wisconsin (MCW) and Milwaukee Public Schools (MPS). Funding from a HWPP development award allowed partners to create a plan to improve the oral health of Milwaukee children. Partners identified community stakeholders in the city of Milwaukee addressing children's oral health issues. These stakeholders included private dental and medical providers, dental and medical clinics, Federally Qualified Health Centers (FQHC), school personnel, state public health officials, community organizations, dental health plans, medical and dental insurers and others to gather detailed information and ideas. The partnership also conducted focus groups of both children and parents to obtain information related to their knowledge of oral health, and

[1] The Healthier Wisconsin Partnership Program is a component of the endowment fund at the Medical College of Wisconsin. The vision for the Healthier Wisconsin Partnership Program is to improve the health of the people of Wisconsin. The program supports community-academic partnerships that address public and community health improvement. The program supports projects that define public health inclusively, focusing on broad determinants of health in communities.

experience in accessing and receiving care. The HT=HK partners released "Healthy Teeth = Healthy Kids: a plan to improve the oral health of Milwaukee Children*"* in August 2007. HT=HK included four key recommendations focusing on the partnership's mission of increasing the number of children with a dental home. The partnership's overarching goal was reducing the proportion of Milwaukee children with untreated dental decay (CHAW, 2010). The HT=HK recommendations are identified in Table 2.

Table 2

Key Recommendations from Healthy Teeth = Healthy Kids
A Plan to Improve the Oral Health of Milwaukee's Children - 2007

	HT = HK Recommendations for Action
1.	Reduce the proportion of children in Milwaukee with urgent oral health needs.
2.	Increase the capacity of clinics and private practices to treat the uninsured and Medicaid populations.
3.	Increase the number of children having access to school based oral health prevention programs.
4.	Increase the rate of health care providers in assessing the oral health of Milwaukee children.

Specific to number three, the report articulated the following strategies:

- Expand current school-based oral health programs modeled after the Columbia St. Mary's Smart Smiles school-based oral health program;
- Expand early prevention services targeting infant and early childhood populations;
- Increase parental participation in oral health prevention and treatment;

- Encourage all schools to support and participate in school-based comprehensive oral health programs each year.

Milwaukee Public Schools (MPS) is a large, urban decentralized school district. It is the 33rd largest school district in the U.S. and the largest school district in the State of Wisconsin. During the 2008-2009 school year, Milwaukee's potential enrollment, i.e., the total number of children between the ages of 4 and 18, was approximately 125,000. This equates to roughly 21.4 % of the city's total population of 583,000. Approximately 90,000 of the children were elementary school age, between 4 and 14, while the remaining 35,000 were high school age, between 15 and 18.

More than two thirds of school-age children in Milwaukee attend public or charter schools. During the 2009-2010 school year, MPS enrolled 82,096 students in grades Pre-K through 12. Nearly all of these students reside in Milwaukee. However, it is estimated that another 850 students attend MPS from surrounding suburban communities, and as many as 6,900 students left the city to attend suburban schools. During 2009-2010, MPS student demographics reflected the following: 48.5% were female, 51.5% were male; 56.5% were African-American; 22.7% were Hispanic; 11.9% were White; .8% were American Indian; and 3.3% were other non-White. Further, 19.2% of students identified with special education needs and 9.5% of students had limited English proficiency.

Nearly 81% of the students were designated as economically disadvantaged. This designation denotes students in families who meet the income eligibility guidelines for free or reduced-price lunch under the National School Lunch Program. To meet these guidelines, household income must be less than or equal to 185% of the Federal Poverty Guidelines. The adjusted poverty guidelines are issued each year by the U.S. Dept. of

Health and Human Services in the Federal Register. The guidelines are a series of income levels with different values for family units of different sizes, below which the family units are considered poor eligible for free or reduced price lunch, an indicator of the number of children living in poverty. Individually, 40% of MPS's schools have free or reduced lunch rates of 90% or more and nearly 60% of all school sites have free/reduced lunch rates of 80% or more.

Table 3 presents a snapshot of Milwaukee Public School enrollment for academic years 2000 - 2009, including student demographics for gender and race/ethnicity.

Table 3

Enrollment – All Students, Milwaukee Public Schools

Year	Total Enrollment	% Female	% Male	% Native American	% Asian	% Black	% Hispanic	% White
2009-2010	82,096	48.5	51.5	0.8	4.8	56.5	22.7	15.2
2008-2009	85,376	48.9	51.1	0.8	4.6	56.9	22.6	15.1
2007-2008	86,815	49.3	50.7	0.8	4.5	57.3	21.9	15.6
2006-2007	89,903	50.0	50.0	0.8	4.5	57.7	21.0	16.0
2005-2006	92,388	49.6	50.4	0.8	4.5	58.3	20.1	16.3
2004-2005	93,653	49.2	50.8	0.9	4.4	58.6	19.2	16.9
2003-2004	97,354	49.3	50.7	0.9	4.4	59.4	18.0	17.3
2002-2003	97,293	49.0	51.0	0.9	4.3	59.7	17.1	17.9
2001-2002	97,762	49.0	51.0	1.0	4.3	60.3	16.1	18.3
2000-2001	97,985	49.1	50.9	1.0	4.4	60.8	15.1	19.7

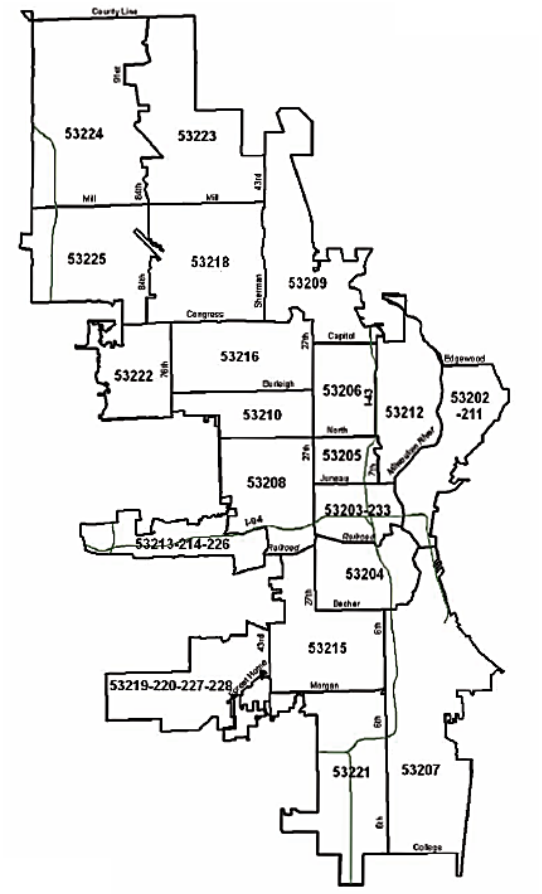
Source: Milwaukee Public Schools

As total enrollment has declined, MPS has enrolled a higher number (and percentage) of poor children. MPS now educates 25% of all Wisconsin students (public and private) from low-income families of poverty, but only 3% of middle income children in the state.

Nine Milwaukee zip codes historically targeted for Community Development Block Grant (CDBG) funding because of their concentrations of poverty, are home to approximately two-thirds of Milwaukee's K - 8 student volume. These zip codes are: 53204, 53205, 53206, 53208, 53210, 53212, 53216, 53218, and 53233. Figure 3 displays the zip codes comprising the City of Milwaukee with the study's nine inner city zip codes highlighted.

Figure 3

City of Milwaukee Zip Codes



Treatment Group
53204
53206
53208
53212
53218

Control Group
53205
53210
53216
53233

Source: City of Milwaukee

The state is making substantial efforts to increase enrollment of low-income children and families in federal/state medical insurance and FoodShare programs. In the nine inner city zip codes, as of March 2009, 59,365 children were enrolled in Medicaid/BadgerCare Plus, and 51,230 children were receiving FoodShare benefits. Table 4 reveals the percentage of Milwaukee's inner city schoolchildren who participate in the free and reduced lunch program. MPS had the second highest percentage of students in the state qualifying for free and reduced lunch at 82.6% in the 2010-2011 school year.

Table 4

Profile of Milwaukee Public Schools Grades K - 8
by Nine Inner City Zip Codes for 2010 School Year

Zip Code	2010 Enrollment	% Reduced Lunch	% Male	% Female	% Native American	% Asian	% Black	% Hispanic	% White
53204	5,832	79.9	54.2	45.8	.72	1.94	21.97	69.95	5.42
53205	2,227	77.1	48.2	51.8	.78	.38	91.42	1.42	6.0
53206	3,937	89.9	44.8	55.2	.32	.17	96.38	.65	2.48
53208	6,515	79.5	48.2	51.8	1.54	5.62	79.69	4.10	9.05
53210	3,407	69.8	45.1	54.9	.03	2.12	90.33	1.06	6.46
53212	4,806	75.6	47.1	52.9	.68	.84	70.42	17.81	10.25
53216	3,368	72.0	44.9	55.1	.28	.78	91.99	2.47	4.48
53218	5,333	82.5	46.2	53.8	.32	4.56	86.85	1.84	6.43
53233	1,625	69.7	53.8	46.2	.43	1.66	81.94	5.79	10.18

Source: Milwaukee Public Schools

Study Purpose

The purpose of this study was to evaluate the effectiveness of the systems intervention strategy of increasing the utilization of dental sealants among low-income and minority children through the implementation of school-based oral health programs within public schools in inner city Milwaukee.

Answering the following research questions will contribute to the generalizability of the existing literature, as well as provide policymakers with system feedback on processes which can aid in addressing system dysfunctions and which enhance oral health access and utilization to low-income children.

- How effective have school-based oral health programs been in increasing dental sealant utilization in public school children?
- What demographic characteristics of the participating students might drive dental sealant usage?

These research questions lead to the following hypothesis:

H_1: On average, the prevalence of dental sealants will be greater among low-income children who attended schools with school-based oral health program than children who attended schools without school-based oral health programs.

A corollary area of exploration, but whose proper examination is beyond the scope of this research study, is what is the financial impact of using dental sealants as an oral health intervention upon children who received sealants within the study, i.e., will children utilizing dental sealants have reduced caries and lower restorative costs than children not utilizing sealants?

Study Populations and Data Preparation/Cleaning

Data for this study was secured based upon an agreement between the Wisconsin Department of Health Services Division of Health Care Access and Accountability (DHCAA) and Marquette University signed in December, 2010. This agreement originally provided researchers from Marquette University's School of Dentistry and

Wake Forest's School of Public Health with access to health insurance and enrollment data related to dental claims and services provided to Wisconsin Medicaid and BadgerCare Plus Program participants for the time periods between January, 2001 and December, 2009. In March, 2012, an amendment to the agreement was signed, which enabled the author to utilize the data provided to Marquette University to conduct this study relative to oral health and the utilization of dental sealants within MPS (Appendix).

To conduct this study, a primary dataset was constructed by extracting Medicaid enrollment and claims data from the aforementioned data provided to Marquette University's School of Dentistry by the State of Wisconsin. The function of the dataset was to enable creation of a model to aid in the exploration of oral health care access by low-income school-aged children attending MPS in inner city Milwaukee.

The study's master dataset, Dental_Sealant_Medicaid, comprised 359,979 Medicaid eligible recipients and consisted of Medicaid enrollment and demographic data from January, 2001 to December, 2009 for children $\geq$ 6 years of age, but <15 years of age who resided within one of the City of Milwaukee's nine inner city zip codes. The dataset was compiled based upon the following:

1. Individual demographic information for all children enrolled in Medicaid for at least six months during the study's time frame included: proxy id, month/year of date of birth, race/ethnicity, gender and most recent zip code;
2. Since exact dates of birth were not available, i.e., the month and year of birth, it was assumed that everyone's birthday fell on the 15th of the month;

3. Variables tracked each enrollee's age year to year. These variables referred to each enrollee's age as of September 1, in an effort to capture age at the beginning of the school year in each given year;
4. The dataset was restricted to enrollees that were ≥6 years of age but <15 years of age as of September 1 in a given year;
5. The dataset contained all claims relative to the enrollees with a CPT code of D1351 (dental sealant application), regardless of the rendering provider type.
6. The dataset's nine zip codes encompassed those zip codes identified by the City of Milwaukee in federal grant applications and redevelopment plans since the early 1990s as constituting Milwaukee's most economically distressed neighborhoods (These zip codes were identified and displayed in Figure 3).

Method of Analysis

The study employed what is commonly referred to as a difference-in-differences analysis (DD), i.e., the comparison of outcome differences pre-post between two time series with comparison groups as control and treatment. The difference-in-differences methodology will be used to evaluate the impact of implementing school-based oral health programs in selected Milwaukee public schools on increasing the prevalence rate of dental sealants among Medicaid aged children 6 to 14 years of age. DD estimation has become an increasingly popular way to estimate causal relationships and to evaluate the effects of public interventions and other treatments of interest on relevant outcome variables. DD estimation consists of identifying a specific intervention or treatment. One then compares the difference in outcomes after and before the intervention for groups affected by the intervention to the same difference for unaffected groups. DD estimates

and their standard errors most often derive from regression analysis using repeated cross-sections (or a panel) of data on individuals in treatment and control groups for several years before and after a specific intervention (Woolridge, 2007; European Commission, 2011). Using DD methodology, the study compared the pre-post application of dental sealants among targeted children before and after the implementation of school-based oral health programs. The following are the steps that were followed in the DD analysis.

Step 1 – Determining Schools in Inner City Milwaukee which Meet the Study's Pre and Post Oral Health Program Implementation Requirements

Schools within inner city Milwaukee which implemented school-based oral health programs between the years 2001 and 2009 were determined in collaboration with MPS and community organizations such as Marquette University, Columbia-St. Mary's Health System and Children's Health Alliance of Wisconsin. Zip codes defined the study's geographic boundaries and served as location identifiers for schools which implemented oral health programs within the study's time frame.

Step 2 – Defining the Outcome Variable and Other Variables of Interest

The primary outcome variable reported for this study was the presence of dental sealants among targeted children in the cohort groups. Independent variables were race/ethnicity and gender. Age was accounted for via the study guidelines. The presence/availability of Medicaid providers offering dental sealant services within the identified school regions was explored as a confounding variable.

Step 3 – Defining the Time Dimension

The study conducted a basis difference analysis by simply comparing the mean value of each group's outcome variables. The two time periods to be compared were the period 2001-2003 and the period 2008-2009. The first period encompassed a time frame prior to the introduction of comprehensive strategies to initiate and expand school-based oral health programs within the MPS system. The second period included the implementation of school-based interventions through the concluding point of the study. The intent was that the selected pre-post time periods covered approximately the same length of time.

Step 4 – Difference-in-Differences Using Regression Techniques

The study presented difference-in-difference results through a regression models. The regression equation and methodology for conducting this process is as follows:

$$Y_i = \beta_0 + \beta_1 \ treat_i + \beta_2 \ after_i + \beta_3 \ treat_i * after_i + e_i$$

Where treat = 1 if in the treatment (sealant) group, = 0 if in the control group

after = 1 if after treatment, = 0 if before treatment

The coefficient on the interaction term (β_3) provides the difference-in-differences estimate of the treatment effect. Table 5 reflects how the regression estimates were reported.

Table 5

Difference-in-Differences Regression Estimation Table

	Treatment Group	Control Group	Difference
Before	$\beta_0 + \beta_1$	β_0	β_1
After	$\beta_0 + \beta_1 + \beta_2 + \beta_3$	$\beta_0 + \beta_2$	$\beta_1 + \beta_3$
Difference	$\beta_2 + \beta_3$	β_2	β_3

The coefficient estimate β1 provides the difference estimate between the treatment group and the control group before the treatment (sealants). The coefficient estimate β2 provides the difference estimate in the control group between the two periods of times. Basically, it describes the general time effect on the outcome. The coefficient on the interaction term, β3 gives us the difference-in-differences estimate of the treatment (sealants) effect. Thus, it picks up the true effect of the treatment (sealants).

Step 5 – Examining the Demographic Variables

The prevalence rates for the targeted children by demographic characteristics were examined and reported to determine which demographic characteristics might best predict dental sealant usage.

Step 6 – Estimating oral health system cost impacts based upon sealant utilization.

National study findings estimated that school-based sealant programs resulted in a median caries reduction of 60% in comparison to students who did not receive sealants. Dasanayake, Le, Kirk, Bronstein, & Childers note that "the ideal method of developing a valid estimation of the cost savings related to sealant utilization is to prospectively follow up a group of children with and without sealants" (2003). Obviously that is beyond the

purview of this study, but based upon the findings of the difference-in-differences analysis, an estimate/forecast of the cost impacts of the sealant programs utilizing average cost and cost savings estimates available from the Division of Health Care Financing in the Wisconsin Department of Health and Human Services was created. Available Medicaid claims data provided cost information on billed amounts, allowed amounts and paid amounts, which were used to construct the financial forecast of potential cost savings as a consequence of anticipated increased dental sealant utilization.

CHAPTER 4

RESULTS AND FINDINGS

Study Population Characteristics and Descriptive Statistics

As noted, the study included 359,979 Medicaid eligible children. A case summary analysis was conducted on the study's dataset via SPSS to descriptively summarize the sex, gender and race characteristics of the children (Table 6). The table reflects the study's N = 359,979 subjects in terms of number of person years, recognizing that a particular child may appear multiple times within the dataset based upon their meeting the study's age criteria of ≥ 6 and < 15.

A demographic comparability profile analysis of children enrolled in Milwaukee Public School Grade K-8 in Milwaukee's nine inner city zip codes with this study's Medicaid eligible children in Milwaukee's nine inner city zip codes is also presented (Table 7). The table illustrates the similarities between children attending MPS and the children within the study's dataset relative to gender and race. The race category "unknown" within the study's dataset reflects children whose racial/ethnicity was not identified.

Table 6

Descriptive Population / Demographics

Demographics	Number Per Person Years	Percent of Total
Sex		
Male	179,480	49.9%
Female	180,499	50.1%
	359,979	**100%**
Race / Ethnicity		
Non-Hispanic White	13,954	3.9%
Black	239,311	66.5%
Hispanic	46,061	12.8%
Asian / Pacific	16,964	4.7%
Race Unknown	39,693	11.0%
Race Other (Native	3,996	1.1%
American, Alaskan, Hawaiian)	**359,979**	**100%**
Age		
6	38,292	10.6%
7	40,336	11.2%
8	40,301	11.2%
9	40,025	11.1%
10	40,067	11.1%
11	40,130	11.1%
12	40,280	11.2%
13	40,342	11.2%
14	40,206	11.2%
	359,979	**100%**
Zip Codes		
53204	55,724	15.5%
53205	24,266	6.7%
53206	51,433	14.3%
53208	41,104	11.4%
53210	43,278	12.0%
53212	37,108	10.3%
53216	42,397	11.8%
53218	58,211	16.2%
53233	6,448	1.8%
	359,979	**100%**

Table 7

Comparison of Demographic Characteristics of Milwaukee Public School Children and Milwaukee Children in Study's Medicaid Dental Database (Trended 2001-2009)

		Milwaukee Public Schools Database	Dental Sealant Medicaid Database
Gender	Male	50.8%	49.9%
	Female	49.2%	50.1%
Race	White	14.4%	3.9%
	Black	56.2%	66.5%
	Hispanic	23.5%	12.8%
	Native American	.7%	1.1%
	Unknown	N/A	11%
		5.2%	4.7%

Study Model Design and Variable Descriptions

To evaluate the impact of initiatives and policies designed to increase the number of children having access to school-based oral health programs, and in particular to dental sealant utilization as a preventive oral health strategy, the study used a difference-in-differences analysis to compare dental sealant outcome differences pre-post implementation of school-based oral health programs employing dental sealants as a preventive oral health strategy. Information provided by the Children's Health Alliance of Wisconsin (CHAW), an entity founded by the State of Wisconsin, Children's Hospital of Wisconsin and the University of Wisconsin Children's Hospital,[2] identified elementary and middle schools within the nine inner city zip codes of Milwaukee which had implemented school-based programs, as well as the year the programs were initiated.

The information provided by CHAW revealed that during the time frame of 2001-2003 there was little to no penetration of school-based programs within the targeted nine zip codes, and that the time frame of 2004-2006 reflected a coalescing of public and

[2] The Alliance facilitates the Wisconsin Oral Health Coalition, which consists of over 130 organizations and individual members. The Alliance also partners with the Wisconsin Department of Health Services to administer the Wisconsin state Seal-A-Smile program, which provides grants for school-based and school-linked dental sealant programs.)

private dental providers and state public health officials toward strategies to improve the oral health of Milwaukee children. In this time frame, via the aforementioned Healthier Wisconsin Partnership Program development grant, the Healthy Teeth = Healthy Kids partnership was created which recommended implementation of four key oral health strategies including expansion of school-based oral health programs within the MPS system. Finally, a third time frame, 2007-2009, indicated a concerted and coordinated effort of implementing school-based programs, with the programs becoming more mature and expanding more broadly in the nine inner city zip codes in 2008 and 2009.

A pre time frame (2001-2003) was determined, as well as a post time frame (2008-2009). The post time frame acknowledged that, while in 2007 school-based programs were being initiated, the programs had been more fully implemented in 2008 and 2009. In addition, the CHAW information enabled identification of the "control" and "treatment" zip codes for comparison purposes as part of the difference-in-differences analysis. Control zip codes consisted of 53205, 53210, 53216 and 53233. Treatment zip codes were 53204, 53206, 53208, 53212, and 53218. The study model's variables and variable descriptions are detailed below (Table 8).

Table 8

Medicaid Dental Sealant Dataset Variables: Definitions and Descriptions

Independent Variables and the Outcome Variable
Independent Variable
Recipient_ID ▪ Medical Enrollment Identifier
My_ID ▪ Generated ID, Mapped from Recipient_ID
Year ▪ Variable denoting study years: 2001 - 2009
ZIP ▪ Variable denoting Milwaukee inner city zip codes: 53204, 53205, 53206, 53208, 53210, 53212, 53216, 53218, 53233
Age ▪ Variable denoting age of enrollment. Study enrollees will have been between 6 - 14 for at least one year between 2001 and 2009.
Enroll_Length ▪ Variable which counts person - years of enrollment for each year. The variable includes both full and partial year enrollment lengths.
Treat_ZIP ▪ Binary variable: equals 1 if school - based programs implemented, 0 if not.
Post_Year ▪ Binary variable: equals 0 in period 2001 - 2003, 1 in period 2008 - 2009.
Sealant_Policy Implemented ▪ Interaction binary variable: it is the product of Treat_ZIP and Post_Year and represents the difference-in-differences estimator.
Gender ▪ Denotes males or female.
Race_Variable identifing enrollee's race/ethnicity: NonHispanic White, Black, Hispanic, Asian, Race Unknown, Race Other.
Outcome Variable
Has_Sealant ▪ Binary variable denoting receipt/non-receipt of sealant.

Descriptive Analyses for Variables within the Model

Prior to conducting regression analyses on the study's dataset, several additional descriptive analyses were undertaken, utilizing several of the variables cited above, to further explicate the dataset and the study's primary out of interest: has_sealant - i.e., the presence or lack of a sealant application. For example, Table 9 depicts the demographic characteristics of sealant applications by gender, race/ethnicity, age and zip code. The table also calculates and reports by demographic category, the number of sealants per 1,000 person years (number of sealants per category/n = 359,979).

Table 9

Descriptive Statistics: Summary of Sealant Applications (2001-2009)

Demographics	Number of Sealant Application Visits	Percent of Total	Number of Sealants per 1,000 Person Years
Sex			
Male	8,977	51.7%	50.0
Female	8,388	48.3%	46.4
	17,365	**100%**	
Race / Ethnicity			
Non-Hispanic White	657	3.8%	47.1
Black	11,705	67.4%	48.9
Hispanic	2,635	15.2%	57.2
Asian / Pacific	546	3.1%	32.2
Race Unknown	1,629	9.4%	41.0
Race Other	193	1.1%	48.3
	17,365	**100%**	
Age			
6	1,030	6.0%	26.9
7	2,447	14.1%	60.1
8	2,837	16.3%	70.4
9	2,377	13.7%	59.4
10	1,926	11.1%	48.1
11	1,847	10.6%	46.0
12	1,936	11.1%	48.1
13	1,660	9.6%	41.1
14	1,305	7.5%	32.5
	17,365	**100%**	
Zip Codes			
53204	2,930	16.9%	53.0
53205	1,282	7.4%	53.0
53206	2,378	13.2%	46.2
53208	1,844	10.6%	44.9
53210	2,074	11.9%	48.0
53212	1,801	10.4%	48.5
53216	1,990	11.5%	47.0
53218	2,825	16.3%	48.5
53233	241	1.3%	37.4
	17,365	**100%**	
Year			
2001	674	3.9%	17.0
2002	1,008	5.8%	25.1
2003	1,157	6.7%	29.0
2004	1,579	9.1%	39.1
2005	1,698	9.8%	42.0
2006	2,009	11.6%	50.0
2007	2,748	15.8%	68.4
2008	2,768	15.9%	69.1
2009	3,724	21.4%	97.0
	17,365	**100%**	

Table 9 illustrates many salient facts pertinent to the study. First, similar to MPS, the percentages of males and females is almost equally split, both in terms of the total populations reflected in the study, but also specifically with regard to the numbers of males and females receiving sealants: 51.7% for males, 48.3 % for females. Secondly, with respect to race/ethnicity, the table reveals that blacks received over two-thirds of the sealant applications reported in the study (67.4%), followed by Hispanics (15.2%), race unknown (9.4%) and so on. These percentages track closely with data presented earlier in Table 6, which reveals that blacks constitute approximately two-thirds (66.4%) of the study's population, followed by Hispanics (12.8%), race unknown (11.0%), etc.

Table 9 also reflects a relative flatness among children's ages with respect to sealant applications, with children 6 years old comprising the lowest percentage within the study (6.0%) and 8 year olds the highest (16.3%). In terms of zip codes, children in zip code 53204 received the highest percentage of sealants (16.9%), children in zip code 53233 the lowest (1.3%). Within the study, zip code 53204 was within the treatment group, zip code 53233 was within the control group. And finally, the table reveals the upward trend of sealant applications through the years of the study – from a low of 3.9% of sealant applications in 2001, to a high of 21.4% in 2009.

Figures 4A and 4B plot the rate of dental sealant applications (per 1000 person-years of enrollment) across the study's nine years, broken down by zip code. Figure 4A plots the sealant application rate by the study's control zip codes. Figure 4B plots the sealant application rate by the study's treatment zip codes. The figures depict increasing trends for all zip codes, regardless of whether they were control or treatment zip codes.

Further, the figures reflect a wider range of sealant applications among the control zip codes versus a narrower, more focused range among the treatment zip codes.

Figure 4A

Rate of Dental Sealant Applications
Control Zip Codes

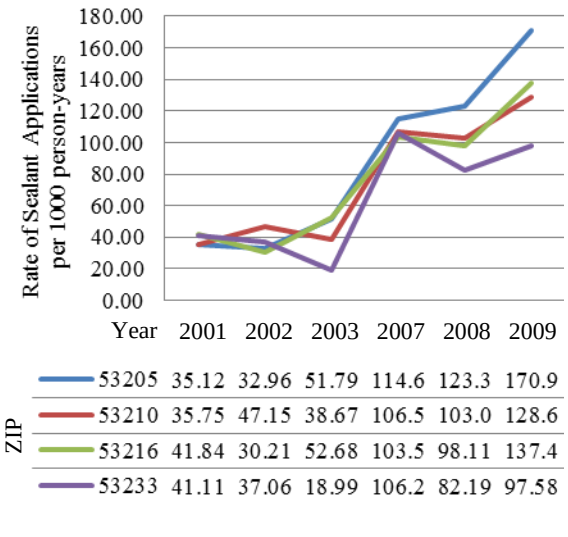
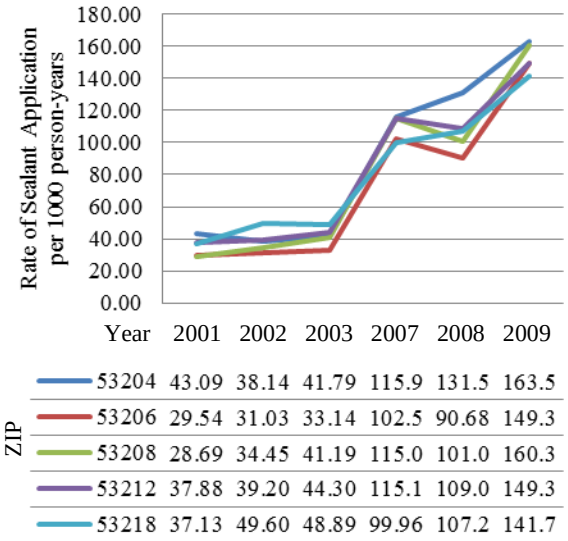


Figure 4B

Rate of Dental Sealant Applications
ZIP Codes with School – Based Programs



Though both figures indicate a sizable increase in sealant applications over time, these figures in and of themselves don't reveal if the increase in sealant applications is a consequence of the school-based oral health programs, or what other factors might also be influencing the upward trend of sealant applications among MPS children residing in these zip codes. Table 10 provides a basic analysis of dental sealant applications between the pre-post time frames. Sealant averages for the control and treatment groups per time frame are computed and displayed showing the groups on rows and time periods on columns. The simple differences are found in the margins, with the difference between the differences shown in the lowest right cell of the table.

Table 10

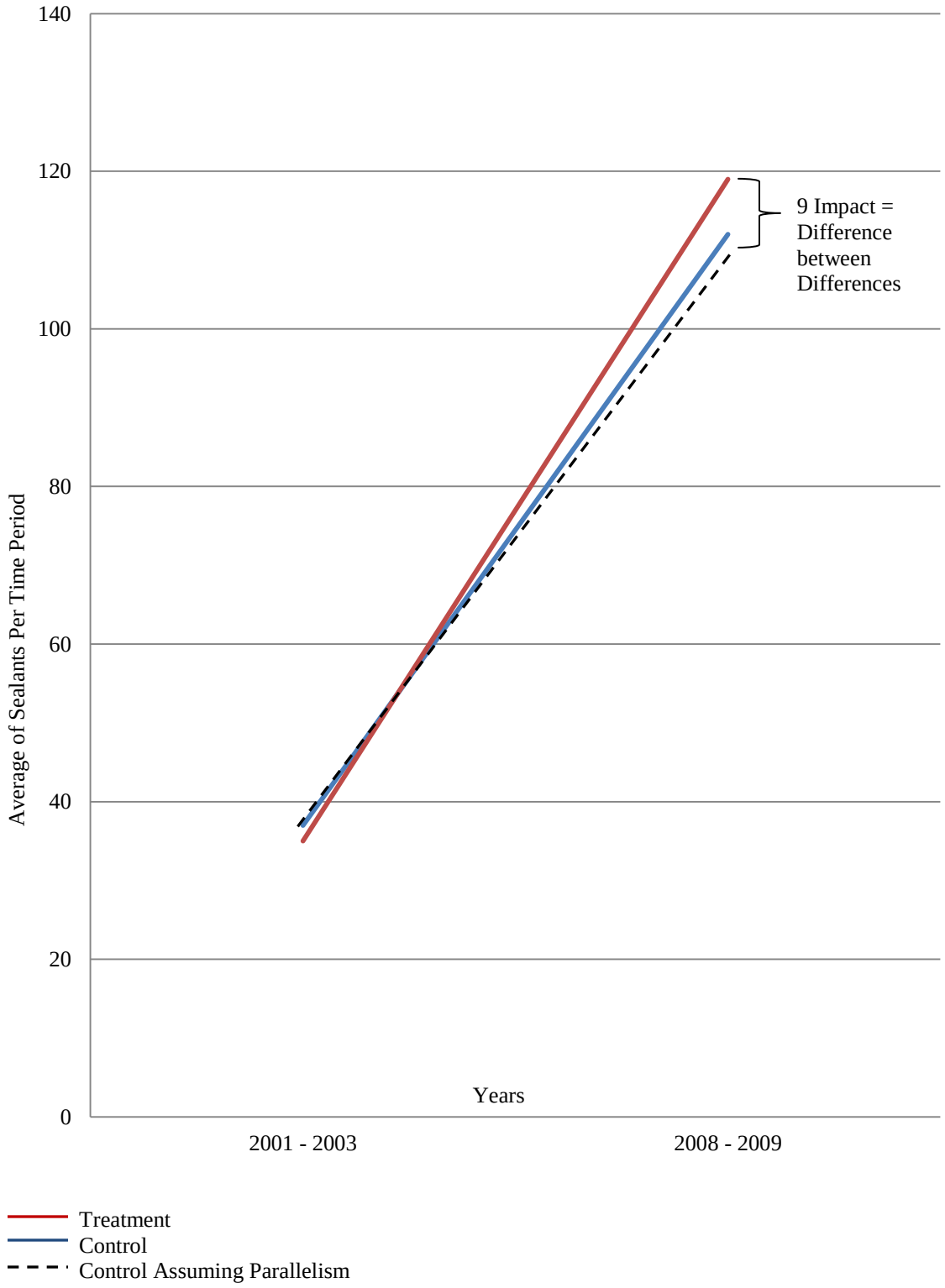
Difference-in-Differences Estimate of the Increase of Dental Sealant Applications Based Upon Implementation of School-Based Oral Health Programs

	Pre 2001 – 2003	Post 2008 - 2009	Difference
Control	37	112	75
Treatment	35	119	84
	- 2	**7**	**9**

Figure 5 graphically illustrates the data reflected in Table 10. The blue line reflects the observed pre-post change in sealant applications for zip codes in the control group. The green line reflects the observed pre-post change in sealant applications for zip codes in the treatment group. The red line reflects an assumption of parallelism, i.e., what would be expected pre-post changes for sealants in the absence of a policy intervention. The difference between the red and green line reflects the difference between differences impact.

Figure 5

Difference-in-Differences between Pre – Post Differences per 1,000 Person Years



Results

Increasing Dental Sealant Utilization in Milwaukee Public Schools

For our primary analysis we used regression analysis techniques to explore the previously described variables (Table 9) comprising the Dental_Sealant_Medicaid dataset. Two sets of analyses were conducted, the first tested Hypotheses I, which states that, on average, the prevalence of dental sealants will be greater among low-income children who attended schools with school-based oral health program than children who attended schools without school-based oral health programs.

Binary logistic regression analysis was used to further examine has_sealant, the study's primary variable of interest. The first analysis examined only the three difference-in-differences predictors: treat_zip, post_year, and sealant policy with has_sealant. Has_sealant, which measures the presence or absence of a dental sealant, is equal to 1 if a sealant is present, and 0 otherwise. Treat_zip is a binary variable that equals 1 if school-based programs have been implemented, and 0 if not. It represents the treatment group. Post_year is a binary variable that equals 0 in period 2001-2003, 1 in period 2008-2009, and represents the control group. Sealant_policy is an interactive binary variable. It is the product of treat_zip and post_year and represents the difference-in-differences estimator. All regression analyses were performed using SPSS. The results of this analysis are displayed in Table 11.

Table 11

Analysis of Pre-Post Dental Sealant Application in Milwaukee Inner City Zip Codes for Milwaukee Public Schools Implementing Sealant-based Oral Health Programs

Parameter			95% Wald Confidence Interval		Hypothesis Test				95% Wald Confidence Interval for Exp (B)	
	B	STD. ERROR	LOWER	UPPER	WALD CHI SQUARE	df	SIG.	Exp (B)	LOWER	UPPER
treat_zip	-.044	.0256	-.095	.006	3.019	1	.082	.957	.910	1.006
post_year	.889	.0305	.829	.949	850.020	1	.000	2.433	2.292	2.583
sealant_policy	.086	.0370	.014	.159	5.421	1	.020	1.090	1.014	1.172

Table 11 shows the logistic regression coefficient, Wald test, and Exp (B), i.e., the odds ratio for each of the predictors. Employing a .05 criterion of statistical significance, post_year and sealant policy had significant effects. Specifically, the table reveals for post_year that B = .889, with 95% CI of .829 to.949, and p = .001, and for sealant policy, the difference -in-differences estimator variable, B = .086, with 95% CI of .014 to .159, and p = .020. For every one unit change in post_year, the log odds of having a sealant (versus not having a sealant) increase by .889. For every one unit increase in sealant_policy, the log odds of having a sealant are increased by .086.

Marginal Effects

Marginal effects are useful to explore because they often provide a good approximation to the amount of change in y that will be produced by a one unit change in x. With binary dependent variables, they provide a single number that expresses the effect of a variable on p(y=1). For a binary logistic main-effects model, $\text{logit}(p)=\Sigma_i x_i \beta_i$, the marginal effect of x_i is equal to $p(1-p)b_i$, where p is the event probability at the chosen setting of the predictors and b_i is the parameter estimate for x_i. To help determine

p in our analysis, Tables 12 and 13 are helpful. They are SPSS cross-tabulations for has_sealant • sealant policy (Table 12) and for has_sealant • post_year (Table 13).

Table 12

Cross Tabulation for Has_Sealant • Sealant Policy

			Has_Sealant		
			0	1	Total
Sealant Policy has been Implemented	0	Count	255,298	10,081	265,379
		% within Sealant Policy has been Implemented	96.2%	3.8%	100.0%
	1	Count	49,763	4,536	54,299
		% within Sealant Policy has been Implemented	91.6%	8.4%	100.0%
Total		Count	305,061	14,617	319,678
		% within Sealant Policy has been Implemented	95.4%	4.6%	100.0%

Table 13

Cross Tabulation for Has_Sealant • Post_Year

			Has_Sealant		
			0	1	Total
Post_Year	0	Count	232,925	8,125	241,050
		% within Post_Year	96.6%	3.4%	100.0%
	1	Count	72,136	6,492	78,628
		% within Post_Year	91.7%	8.3%	100.0%
Total		Count	305,061	14,617	319,678
		% within Post_Year	95.4%	4.6%	100.0%

The cross tabulation output for Table 12 reveals an 8.4% probability for the effect of implementing sealant_policy. Utilizing the formula $p(1–p)b_i$, the resulting marginal effect is .084*.916*.086 =.006617. In Table 13, for post_year, the baseline probability would be the non-post year percentage, 3.4% because the same changes cannot be introduced again. The resulting marginal effect is: .034*.966*.889 = .029. Out of the 54,299 persons who belonged in the sealant policy years/zip codes, approximately 360

got sealants because of the policy (54,299*.00617 = 359.29). In the same group, there were approximately 1,575 sealant applications due to it being a post_year (54,299* .029 = 1,574.67).

The marginal effects described above reflect the effects on the study's general population from the implementation of the sealant policy. However, the probability of an individual child receiving a sealant varies from family to family for varieties of reasons, but as has been previous cited, children and adolescents from low-income and minority families are almost 50% less likely to receive dental sealants than children from higher income families. And for many low-income children, the likelihood of receiving a sealant is significantly less than this due to lack of parental knowledge relative to the benefits of sealants, parental follow-up, lack of access to services, etc. To further explore the marginal effects on children within the study, the following illustrative examples are presented with various pre-policy implementation probabilities for obtaining a sealant.

Example I – If a child has 50% probability of obtaining a sealant pre-policy implementation, then utilizing the formula $p(1–p)b_i$, for sealant_policy the marginal effect is .5 * .5 *.086 = .0215, or approximately a 2.1% increased probability of obtaining a sealant due to the policy implementation. The resulting marginal effect relative to post_year is .5 * .5 * .889 = .222, or approximately a 22.2% increased probability of the child having obtained a sealant.

Example II – If a child has a 25% probability of obtaining a sealant pre-study implementation, then for sealant_policy the marginal effect is .25 * .75 * .086 = .016 or approximately a 1.6% increased probability of obtaining a sealant due to the policy implementation. For post_year, the marginal effect is .25 * .75 * .889 = .166, or approximately a 16.6% increased probability of the child having obtained a sealant.

From the analyses conducted so far, we find support for Hypotheses I. From the binary regression analysis results reported in Table 11, the difference-in-differences estimator, sealant_policy, was implemented, and was statistically significant at $p < .02$. Descriptive statistics, reflected in Table 9, graphically displayed sealant application upward trending data for treatment intervention zip codes in post policy implemented years. And marginal effects analyses reflect sealant increases as a consequence of the policy treatment interventions.

Demographic Characteristics' Impact on Sealant Usage

To carry the analysis to the next level and examine which demographic characteristics might drive sealant utilization by low income children, a second binary logistic regression was conducted examining the dependent variable has_sealant with two of the three previous variables, post_year and sealant_policy, and with the addition of variable categories for sex, race, zip code and age. Within this logistic regression model, in order to allow for intra-category comparison among the aforementioned categories, the following variables were used as reference points for comparison against the other variables within the applicable categories: female (females and males were almost equally distributed within the dataset), black (the largest of the race/ethnicity variables),

53204 (one of the largest of the nine zip codes), and age 10 (the median age within the study). Table 14 displays the output data from the logistic regression procedure.

Table 14

Analysis of Sealant Application by Race, Zip Code and Age vs. Race: Black, Zip: 54204, and Age: 10

Parameter			95% Wald Confidence Interval		Hypothesis Test				95% Wald Confidence Interval for Exp (B)	
	B	STD. ERROR	LOWER	UPPER	WALD CHI SQUARE	df	SIG.	Exp (B)	LOWER	UPPER
post_year	.878	.0306	.818	.938	820.916	1	.000	2.406	2.266	2.555
sealant_policy	.069	.0372	-.004	.142	3.470	1	.062	1.072	.996	1.153
male vs. female	-.071	.0189	-.108	-.034	14.059	1	.000	.932	.898	.967
NH_white vs. black	.012	.0497	-.086	.109	.055	1	.814	1.012	.918	1.115
hispanic vs. black	.147	.0359	.076	.217	16.694	1	.000	1.158	1.079	1.242
asian_pacific vs. black	-.420	.0536	-.525	-.315	61.582	1	.000	.657	.591	.730
race unknown vs. black	-.144	.0317	-.207	-.082	20.721	1	.000	.865	.813	.921
race other vs. black	.008	.0898	-.168	.184	.008	1	.928	1.008	.845	1.202
53205 vs. 53204	.208	.0494	.111	.304	17.676	1	.000	1.231	1.117	1.356
53206 vs. 53204	-.031	.0416	-.112	.051	.543	1	.461	.970	.894	1.052
53208 vs. 53204	-.014	.0424	-.097	.069	.106	1	.745	.986	.908	1.072
53210 vs. 53204	.050	.0454	-.039	.139	1.216	1	.270	1.051	.962	1.149
53212 vs. 53204	.020	.0424	-.063	.103	.219	1	.640	1.020	.939	1.108
53216 vs. 53204	.035	.0456	-.055	.124	.583	1	.445	1.035	.947	1.132
53218 vs. 53204	.082	.0394	.005	.160	4.386	1	.036	1.086	1.005	1.173
53233 vs. 53204	-.174	.0859	-.343	-.006	4.110	1	.043	.840	.710	.994
6 vs. 10	-.513	.0426	-.596	-.429	145.024	1	.000	.599	.551	.651
7 vs. 10	.265	.0337	.199	.331	61.933	1	.000	1.304	1.220	1.393
8 vs. 10	.418	.0331	.353	.483	158.708	1	.000	1.518	1.423	1.620
9 vs. 10	.235	.0340	.169	.302	47.757	1	.000	1.265	1.184	1.353
11 vs. 10	.002	.0359	-.068	.072	.003	1	.955	1.002	.934	1.075
12 vs. 10	.056	.0357	-.014	.126	2.427	1	.119	1.057	.986	1.134
13 vs. 10	-.103	.0367	-.175	-.031	7.899	1	.005	.902	.840	.969
14 vs. 10	-.369	.0398	-.447	-.290	85.728	1	.000	.692	.640	.748

Dependent Variable: has_sealant
Model: post_year, sealant_policy, male vs. female, NH_white vs. black, hispanic vs. black, asian_pacific vs. black, race unknown vs. black, race other vs. black, 53205 vs. 53204, 53206 vs. 53204, 53208 vs. 53204, 53210 vs. 53204, 53212 vs. 53204, 53216 vs. 53204, 53218 vs. 53204, 53233 vs. 53204, 6 vs. 10, 7 vs. 10, 8 vs. 10, 9 vs. 10, 11 vs. 10, 12 vs. 10, 13 vs. 10, 14 vs. 10.

Again employing a criterion of .05 of statistical significance, analysis results revealed that the post_year variable remains significant, i.e., p = .001, 95% CI of .818 to .938. However, in this model sealant_policy now has a p value of p < .062, and is not significant at the p < .05 level, though at .062, given the number of variables added to the model, it is not dramatically different quantitatively. However, at a criterion of .10 of statistical significance the 90% confidence interval for sealant_policy is 1.008 to 1.139 and sealant_policy's p value of p < .062 is significant. Further results reflect the following relative to the demographic variables displayed within Table 14.

Male (.001) is significant at the 5% level. On average, the odds of a male having a sealant are 7% less likely than a female. The categories non-Hispanic white (.814) and race_other (.928) are not significant at the 5% level. The remaining categories, Hispanic (.001), Asian_pacific (.001) and race unknown (.001) are significant at the 5% level. The odds of a non-Hispanic white having a sealant are 1% greater than the odds of a black having a sealant. The odds of a Hispanic having a sealant are 16% greater than a black having a sealant. The odds of an Asian having a sealant are 34% less than the odds of a black having a sealant. The odds of a child classified as race unknown are 14% less than a black having a sealant. The odds of a child classified as race other are 1% greater than a black having a sealant.

In comparing the study's zip codes against zip code 53204, zip codes 53205 (.001), 53218 (.036) and 53233 (.043) are significant at the 5% level. The remaining zip codes 53206 (.461), 53208 (.745), 53210 (.270), 53212 (.640), and 53216 (.445) are not. On average, the odds of children residing in 53205 having a sealant are 23% greater than children residing in 53204. The odds of children in 53206 having a sealant are 3% less

than children in 53204. The odds of children in 53208 having a sealant are 1.4% less than children in 53204. The odds of children in 53210 having a sealant are 5% greater than children in 53204. The odds of children in 53212 having a sealant are 2% greater than children in 53204. The odds of children in 53216 having a sealant are 3.5% greater than children living in 53204. The odds of children in 53218 having a sealant are 8.6% greater than children in 53204. The odds of children in 53233 having a sealant are 16% less than children living in 53204.

In comparing the study's ages against age 10, analysis reveals that ages 11 (.955) and 12 (.119) are not significant at 5%, but all remaining ages within the model are significant. The odds of a child of age 6 having a sealant are 40.1% less than a child of age 10. The odds of a child of age 7 having a sealant are 30% greater than a child of age 10. The odds of a child of age 8 having a sealant are 52% greater than a child of age 10. The odds of a child of age 9 having a sealant are 26.5% greater than a child of age 10. The odds of a child of age 11 having a sealant are 4.5% less than a child of age 10. The odds of a child of age 12 having a sealant are 11.9 % greater than a child of age 10. The odds of a child of age 13 having a sealant are 9.8% less than a child of age 10. The odds of a child of age 14 having a sealant are 30.8% greater than a child of age 10.

The odds information presented above from Table 14 tracks with the descriptive statistics information regarding sealant applications provided in Table 9, specifically Table 9's column entitled "Number of Sealants Per 1,000 Person Years." The column standardizes sealant applications across race/ethnicity, age and zip code, enabling a better visualization of the similarities and differences within these demographic categories. The two tables mutually reinforce each other.

Based upon the regression results presented in Table 14, interpreted above and supported through the descriptive statistical summaries of Table 9, these findings as well support Hypothesis I.

Financial Impact of Sealant Utilization

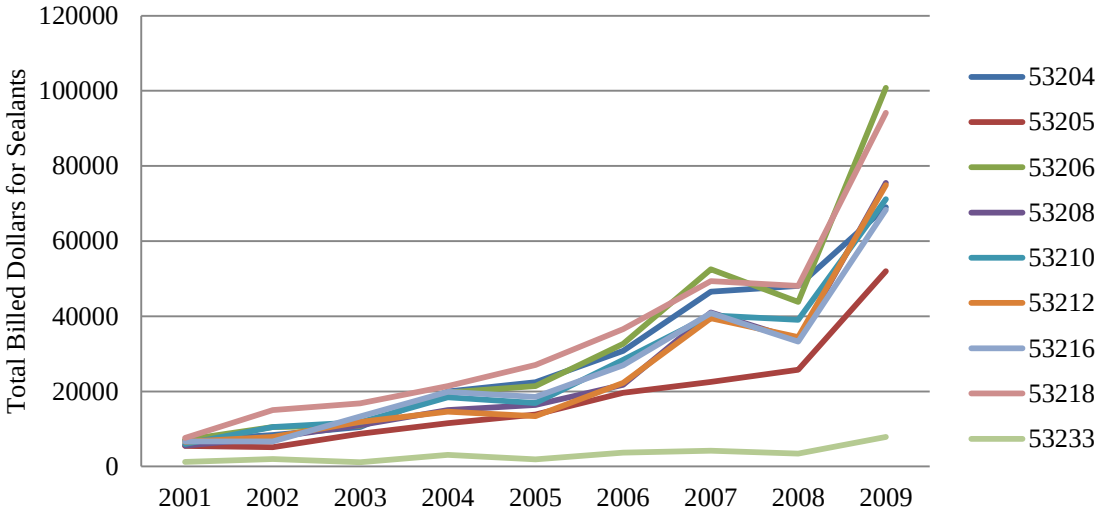
Little focus has been placed to this point on the financial impact of sealant placements among the study's low-income children. While the data reflects a dramatic increase in the numbers of dental sealants placed among children aged 6 - 14 residing in Milwaukee inner city zip codes and attending Milwaukee Public Schools, there is presently limited information relative to the operational costs of school-based programs and specifically, the costs of dental sealant delivery. Similarly, there is presently limited clinical and financial information available to make definitive determinations as to whether, as a consequence of sealant placement, children within this study experienced reduced cavities and subsequent lower restorative costs than children not receiving sealants.

However, as noted, while a thorough examination of whether children experiencing sealant placements in this study experienced subsequent reductions in caries and restorative costs is beyond the scope of this study, in an effort to examine this issue, Medicaid billings for sealants per tooth (dental procedure code D1351) placed among the study's eligible children were analyzed against Medicaid billings for two dental restorative procedures which sealants are placed to help prevent. These restorative procedures were: amalgam - one surface, primary or permanent tooth (D2140) and resin-based composite - one surface - posterior tooth (D2391). Amalgams are dental fillings

used to treat caries that are alloys of mercury and silver, and resin-based composites are dental fillings made of ceramic or plastic compounds. As noted previously, the master dataset utilized for this study contained both Medicaid eligibility and claims data for the years 2001 - 2009. Figure 6a presents total billed costs for sealants for all enrolled children (either full or partial years) aged 6 - 14 residing in Milwaukee's 9 inner city zip codes.

Figure 6a

Total Billings for Sealants (All Enrollees)



The figure reveals relatively small amounts of billed dollars for sealants in the early years of the study, but clearly reflects increased billing amounts as the number of sealants placed over the course of the study increased. And, it appears that the study's treatment zip codes experienced the greatest increase in sealant billings.

Figure 6b

Total Billings for Restorative Procedure (All Enrollees)

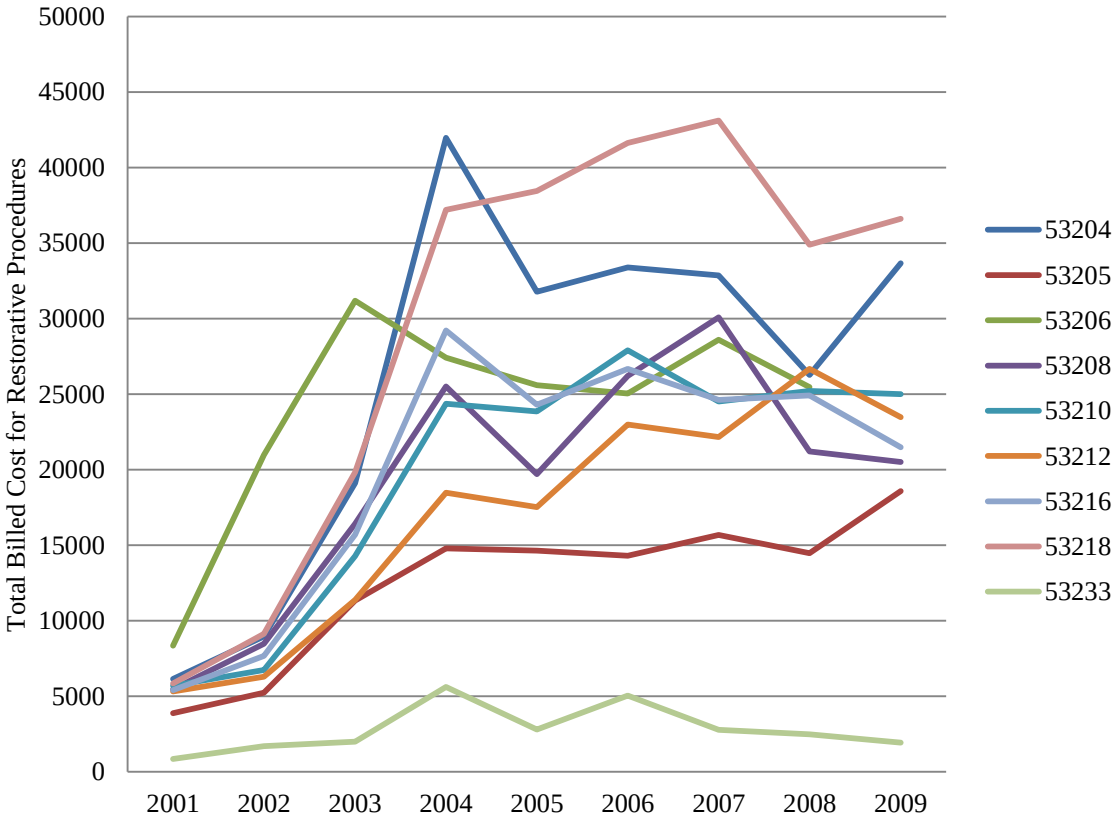


Figure 6b shows the combined total billings for the restorative procedures, i.e. amalgam (D2140) and resin-based composite (D2391). Similar to Figure 6a, this figure reveals relatively small initial amounts of billings for thee restorative procedures, with the total billings increasing over the years of the study. In both figures, one would expect to observe increased billings as a result of the concerted actions to address these oral health issues. Additionally, as noted, in 2007, dental hygienists were certified as Medicaid providers, thereby enabling additional providers to render and bill for services. Figure 6b also reflects in some zip codes decreases in restorative billings in the latter years of the study, at the same time that billings for sealants was increasing.

Figure 6c

Relative Percentage of Billings for Sealants versus Restorative Procedures (All Enrollees)

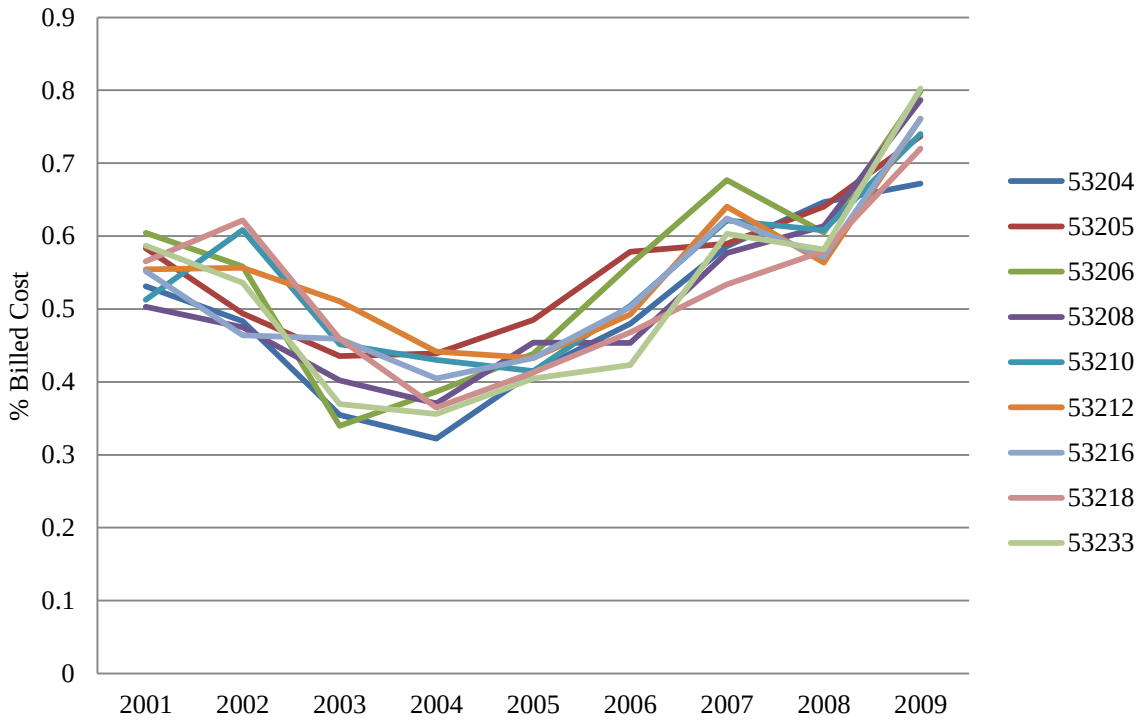


Figure 6c presents the relative percentage of billings of sealants versus the combined billings of the two restorative procedures. Figure 6c represents sealant billings/sealant billings + the combined billings for the restorative procedures. Figure 6c illustrates that per person year billings are greater for sealants than the restorative procedures and that the growth in sealant billings is outpacing billings for the restorative services.

While, at least from a billing perspective this data suggests that over time, there has been a drive toward increased billings for sealants and an increasing percentage of sealant billings versus selected restorative procedure billings, in terms of the question as

to whether children utilizing dental sealants will have reduced caries and subsequent lower restorative costs than children not utilizing sealants, the results are inconclusive, and worthy of future research utilizing more precise and comprehensive cost and billing data to examine potential causal relationships between sealant applications and dental caries and restorative procedure reductions.

In sum, the study found support for Hypothesis I in terms of illustrating that dental sealants are more prevalent among low-income children who attend schools with school-based oral health programs than children who do not, and that a child's demographic characteristics do impact dental sealant utilization. Relative to dental sealants having a positive impact on reducing caries and subsequent restorative oral health, as school-based oral health programs within MPS continue to mature, and cost and expenditure data, as well as more standardized processes for sealant delivery, are implemented, the questions of financial impact of dental sealants can be more readily and effectively explored and examined as future research topics.

CHAPTER V

SUMMARY AND CONCLUSIONS

Discussion of Study Findings

Overall, the use of differences-in-differences analysis was found to be useful in assessing the delivery of dental sealants through school-based oral health programs as a preventive public policy intervention. In response to overwhelming national and local evidence of disparities in oral health care for low-income and minority children, a coalition of community institutions came together, including dental and medical providers, insurers and academic institutions, to address the significant issues of oral health disparities evident within the City of Milwaukee.

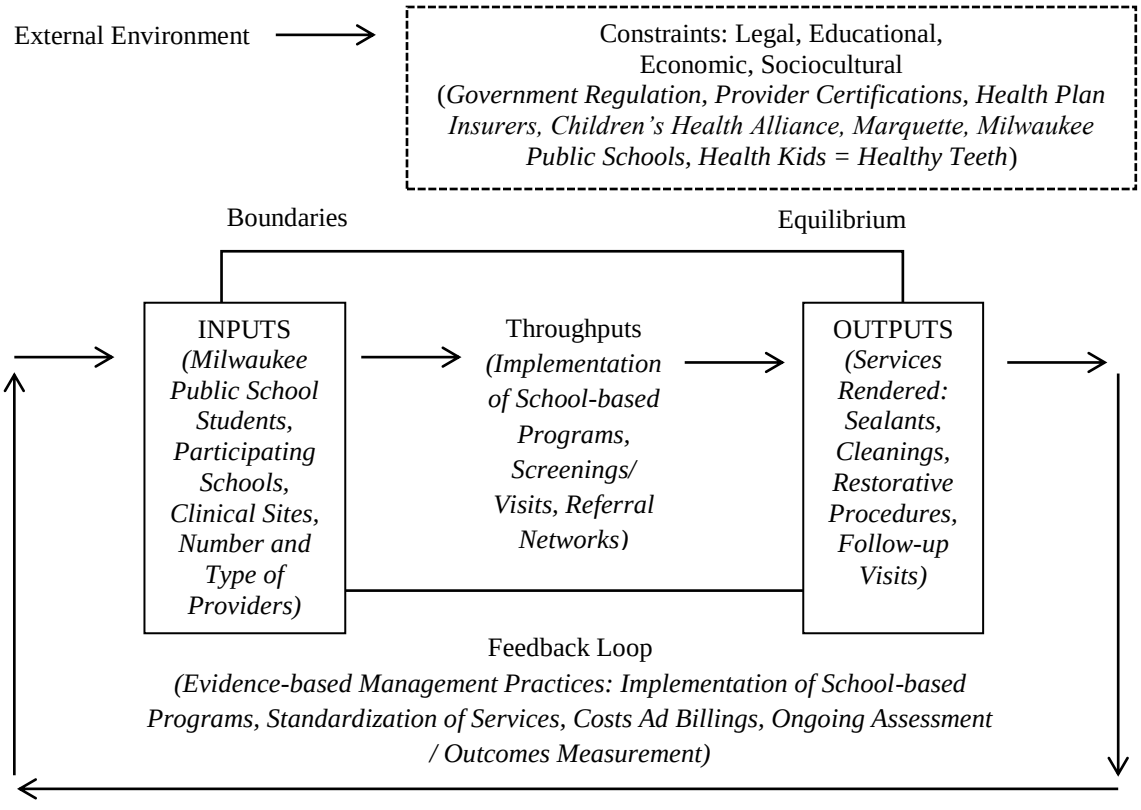
A multi-pronged public policy initiative was created to reduce the proportion of Milwaukee children with untreated dental decay. A major component of the initiative was the expansion of school-based oral health programs within MPS, which had as a deliverable, increased placement of dental sealants in children at high risk for dental decay and disease.

Systems Theory argues that systems are self-regulating and self-correcting, and that systems rely on feedback loops as processes of discernment and assessment to indicate inefficiency and ineffectiveness, as well as to evaluate performance and create opportunities for improvement. Within a System's Theory context, evidence-based management is the systematic application of the best available evidence to the evaluation of managerial strategies for improving the performance of organizations and systems. (Kovner et al., 2009)

In this study, Milwaukee's public health policy initiative to expand the number of school-based programs with a specific emphasis on increasing the placement of sealants among high risk children, was examined using a System's Theory framework. This framework (previously depicted in Figure 2), as applied to this study, is illustrated in Figure 7.

Figure 7

Milwaukee Public Schools Oral Health Delivery System



As part of this examination, evidence-based management techniques were employed in evaluating the operational and strategic effectiveness of implementing school-based oral health programs designed to increase dental sealant delivery among children from low-income and minority families. Specifically, the following operational questions were explored:

1. How effective have school-based oral health programs been in increasing dental sealant utilization in public school children.
2. What demographic characteristics of the participating students might drive dental sealant usage?

And, a third question, exploring the financial impact of dental sealants as an oral health intervention upon children who received sealants within the study was also examined.

The findings of the study revealed a number of interesting facts. First, logistic regression supports the hypothesis that the presence of sealant application is greater among low-income children who attended schools with school-based oral health program than children who attended schools without school-based oral health programs. Though a marginal effects analysis indicated that sealant applications did increase as a consequence treatment interventions, it is also clear from the data that sealant usage increased significantly among both the treatment *and* control groups, indicating the likelihood that other factors not identified within this study also influenced sealant utilization. While information from the Children's Health Alliance of Wisconsin and Milwaukee Public Schools is reasonably specific about the academic years that school-based programs were initiated, information about the numbers of age-eligible children receiving dental services from clinics or providers outside the school-based program is limited. However, the

number of Medicaid providers, i.e., dentists or dental hygienists, is very limited, and this fact clearly presents problems of access for children within the inner city.

Second, the demographic characteristics of children ages 6 to 14, attending Milwaukee Public Schools, and living in Milwaukee's 9 inner city zip codes, are remarkably similar to the study's Medicaid eligibility and claims datasets for children ages 6 to 14 living in Milwaukee's inner city. In both datasets, the proportion of males to females is virtually identical, and the racial/ethnicity demographics are strikingly similar, with blacks comprising well over 50% of the children in both datasets.

It is also clear from the data that demographic factors do play a role in the delivery of sealant applications to the study populations. The data indicates that males and females during the study years both experienced roughly the same percentage of sealant visits (51.7% to 48.3% respectively). And though blacks, in terms of total numbers of sealants placed during the study years, overwhelmingly received the highest percentage of sealants (67.4%), when the demographic variables are adjusted by numbers of sealants per 1,000 person years, there is more similarity of numbers among the demographics categories race/ethnicity, age, and zip code (Table 9).

Similar to national trends, study data also revealed that 7, 8, and 9 year old children are the age cohorts most likely to be targeted to receive sealants. In this study, children aged 6 and 14 were the least likely to receive sealants, while children aged 7, 8, and 9 were the most likely to receive sealants. Children aged 10 to 13 displayed similar sealant application rates with children 7 to 9.

While we find our results inconclusive relative to the financial impact of dental sealants, there are however, other encouraging signs that school-based oral health

programs and sealant placement in particular are beginning to have positive impacts in reducing the number of cavities in children and decreasing the cost of dental care for Milwaukee's children. As noted previously, the Children's Health Alliance of Wisconsin has been a major community-based participant in efforts to raise awareness of the oral health issues facing Milwaukee's children and improve their access to preventive and treatment dental services. In a recent publication, entitled "2012 Partnering to Seal-A-Smile: A Report on the Success of Wisconsin's School-Based Dental Sealant Program," it is reported that a number of indicators have impacted the implementation of dental sealant programs, primarily between the years 2005 and 2010. With the initial implementations of school-based programs in MPS, the following occurred:

- The number of high risk children who have been screened, and received oral health education, sealants and dental cleaning exams has increased dramatically, and much of this increase is attributed to the presence of oral health coordinators within schools offering oral health programs who facilitate the oral health care needs of children including urgent and emergent needs. Additionally oral health care coordinators liaise with community oral health providers and provide referrals to local dentists and clinics for follow-up care – in effect the oral health care coordinators in school-based programs help provide an organized system of connecting children to oral health care services within the community;
- The percentage of children seen with untreated tooth decay has begun to go down, but still averages about 45%;
- The percentage of children with urgent treatment needs has decreased from 10.2% in 2005 to 8.1% in 2010;

- In 2007, with the advent of dental hygienists being permitted to become Medicaid providers, there has been an increase in billings, but also in the capability of adding additional providers into scenarios where heretofore there have been limited dental personnel to provide services in inner city Milwaukee. Dental hygienists are the primary oral health provider in many school-based oral health programs and their service capabilities now include not only oral health and nutrition education, but sealant placements, fluoride treatments, cleanings/polishing caries risk assessments, prophylaxis; and the capability of taking radiographs as necessary;
- Medicaid funding via billings for sealants and other dental services in school-based programs is being supplemented by community grants and dental insurers providing reduced and discounted fees, enabling long-term sustainability of the school-based programs.

Future goals that have been articulated for Milwaukee's school-based oral health programs include increased levels of Medicaid reimbursement rates, enhanced relationships with dentists to assist low-income children requiring restorative care, expanded sealant programs to reduce rising decay rates, implementation of best practices and standardized clinical, operational and cost processes within the school-based programs, and processes which improve the overall retention rates of sealants.

Strengths and Limitations

Study Strengths

This study has a number of strengths. First, the study accessed subcomponents of the State of Wisconsin's Medicaid and BadgerPlus programs, which enabled the construction of a relatively large dataset (N = 359,979 children) with age and location (zip codes) specific Medicaid enrollment and encounter data targeted toward a specific dental procedure, i.e., the application of dental sealants, for the years 2001 to 2009. As a consequence, the dataset was of a sufficient size to enable effective econometric evaluation over a multitude of demographic variables.

Secondly, though there has been substantial interest among many public and private healthcare constituencies in addressing the issue of oral health disparities among Milwaukee's children, specifically children meeting high-risk criteria from low-income families and from racial/ethnic minorities, this study represented one of the first attempts to comprehensively evaluate the impact school-based oral health programs have had in impacting specific preventive initiatives like dental sealants within MPS. This study raised awareness and generated interest among children's health providers, academic institutions, local and state governmental officials, and potential funders to explore further the issue of oral health disparities among Milwaukee's children.

In sum, the study raised the awareness of this issue among multiple constituencies including policy-makers, and enhanced the desire to pursue further studies better designed to more precisely measure financial expenditures and future benefits of preventive oral health procedures such as dental sealants.

Study Limitations

The study experienced a series of limitations as well, specifically in the areas of data and measurement and in results generalization. A limitation was the inability to know precisely which schools Medicaid recipients attended, i.e., an inability to know for certain that Medicaid eligible children noted as living in a specific zip code actually attended a public school within that zip code. A recent study by researchers at the University of Wisconsin - Milwaukee noted that the mobility rate of children within MPS could be as high as 25-30%, meaning that children listed as living in a zip code might, for a variety of reasons, attend school in another zip code. Consequently, a fair number of children within the study could have been floating among zip codes in terms of their school attendance.

Some assumptions were also made relative to a child's age, since, due to privacy issues, exact dates of birth were not available. To calculate ages, it was assumed that everyone's birthday fell on the 15th of the month. Similarly, variables were created which tracked each enrollee's age year to year. These variables defaulted each enrollee's age as of September 1, to capture age at the beginning of the school year.

A further limitation is that the dataset provided only limited information about the sealant application process. For example, the data noted that a recipient experienced the application of a sealant, but it was not clear if during that episode the recipient received one sealant or multiple sealants. Additionally, accurate and consistent cost and expenditure data relating to the sealant application process among school-based programs wasn't available, consequently one of the limitations of the study has been its limited capability to accurately and effectively project sealant effectiveness and potential cost

savings as a preventive measure. Finally, many of the children within this study were enrolled as Medicaid recipients continuously for multiple years, and precise information of their at risk status for dental caries as well as other aspects of their socio-economic status is unknown, hence it is not completely possible to know if some of the children represented a population not normally targeted by sealant delivery.

Recommendations for Future Research

This study affords several opportunities for follow-up and further research. As mentioned, despite a great deal of interest in the topic of oral health disparities among children, particularly those from low-income families and minorities, very few comprehensive and longitudinal studies have been conducted which examine the efficacy and effectiveness of dental sealants in terms of how sealants are utilized, accurate and consistent cost development of the sealant application procedure, the incremental costs of additional sealant placements, as well as the effectiveness and acceptance of sealant applications among demographic subpopulations.

What remains true is the overwhelming call at national levels by public healthcare professionals and organizations, such as the U.S. Surgeon General and the U.S Department of Health and Human Services, for greater utilization of dental sealants for children aged 8 through 14, particularly among those children at high risk of experiencing dental caries. In spite of these calls, there is general agreement that dental sealants as a preventive and treatment modality is underutilized. Additional research with respect to the most efficient way to deliver dental sealants is important if the suspected benefits of increased sealant utilization are to be realized.

This study and others have noted issues such as lack of dentists in poor neighborhoods, insufficient participation by dentists in Medicaid programs, and complexities associated with qualifying children for Medicaid enrollment and treatments, and could serve as the basis for further research designed to augment the provision of oral health services in school-based programs by dentists and dental or medical providers.

Further research as noted above is clearly needed to document the costs of sealant applications, to document and measure the cost-effectiveness of different restorative treatments, and to determine how to integrate preventive and restorative treatments into school-based programs to best address the needs of poor children.

Final Conclusion

Utilizing a System's Theory framework, this study has sought to examine the impact of dental sealants as a preventive therapy offered by school-based based oral health programs as a systemic intervention to address oral health disparities among low-income and minority children within public schools in inner city Milwaukee. Specifically explored was how the delivery of dental sealants through school-based programs after the implementation of concerted policy interventions reduces oral health disparities among children from low-income families and minorities. Despite some limitations, difference-in-differences and binary logistic analyses were found to be effective methodologies for examining the questions of interest explored by this study.

Results from this study bolster public policy efforts to increase the number of children having access to school-based oral health programs and to reduce the proportion of children in Milwaukee with urgent oral health care needs, and to reduce levels of

untreated tooth decay among children. Findings revealed increased numbers of sealants among Milwaukee's inner city school children as a consequence of a policy intervention to expand school-based oral health programs which provide sealant applications. Operational reports from the school-based programs reflect that urgent and emergent oral health treatment services have diminished as a consequence of school-based programs, as well as a reduction in the amount of untreated tooth decay.

Finally, though it has been beyond the scope of this study to specifically document cost savings as a consequence of increased sealant applications among children within inner city Milwaukee, a significant contribution of this study is that it demonstrated that key operational systems and reporting processes are now in place to permit future research and comprehensive examination of the real costs of sealant delivery within school-based oral health programmatic environments and better trace any resultant cost savings from reduced caries and restorative costs for children who receive sealants. In this manner, future research built upon this study will continue to serve as a systemic "feedback loop" for Milwaukee's school-based oral health programs and help create evidence-based improvement opportunities to better serve the oral health needs of low-income and minority children within Milwaukee.

REFERENCES

Ansari, S. (2004). Teaching Note Systems Theory and Management Control. Retrieved from http://faculty.darden.virginia.edu/ansaris/systems%20theory%20and%20mcs-tn.pdf

Association of State and Territorial Dental Directors (2012). *Best Practice Approach Reports - School-Based Dental Sealant Programs*. Retrieved from http://www.astdd.org/school-based-dental-sealant-programs/

Association of State and Territorial Health Officials (2012). *Children's Oral Health: State Initiatives and Opportunities to Address the Silent Epidemic*. Retrieved from www.healthinschools.org/~/media/Files/childrenoral.ashx

Bloom, B., Gift, H.C., & Jack, S.S. (1992). *Vital and Health Statistics - Dental Service and Oral Health in the United States, 1989.* Hyattsville, MD: National Health Survey of the U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Center for Health Statistics.

Brown, L.J., Wall, T.P., & Lazar, V. (2000). Trends in Untreated Caries in Permanent Teeth of Children 6 to 18 Years. *Journal of American Dental Association, 131* (1) 26.

Centers for Medicare and Medicaid Services & U.S. Department of Health and Human Services (2004). *Guide to Children's Dental Care in Medicaid*. Retrieved from http://www.aapd.org/assets/1/7/Periodicity-DentalGuide.pdf

Charlton, B.G., & Andras, P. (2003). What is Management and What Do Managers Do? A Systems Theory Account. *Philosophy of Management. 3*, 1-15.

Children's Health Alliance of Wisconsin (2010). *Healthy Teeth = Healthy Kids: A Plan to Improve the Oral Health of Milwaukee Children*. Retrieved from http://www.chawisconsin.org/documents/OH1Plan8.07.pdf

Children's Health Alliance of Wisconsin & U.S. Department of Health and Human Services Centers for Disease Control and Prevention. (2009). *Sealant Efficiency Assessment for Locals and States*. Retrieved from http://www.cdc.gov/oralhealth/state_programs/infrastructure/seals.htm

Dasanayake, A.P., Le, Y., Kirk, K., Bronstein, J., & Childers, N.K. (2003). Restorative Cost Savings Related to Dental Sealants in Alabama Medicaid Children. *Pediatric Dentistry, 25*, 6.

Dietrich, T., Culler, C., Garcia, R.I., & Henshaw, M.M. (2008). Racial and Ethnic Disparities in Children's Oral Health. *Journal of American Dental Association, 139* (11), 1507-1517.

Edelstein, B.L. (2002). Disparities in Oral Health and Access to Care: Findings of National Surveys. *Ambulatory Pediatrics, 2* (2), 141-147.

European Commission (2011). *Difference-in-Differences*. Retrieved from http://ec. europa.eu/regional_policy/sources/docgener/evaluations.

Forrester, J.W. (1968). *Principles of Systems*. Cambridge, MA: Wright-Allen Press.

Gooch, B.F., Griffin, S.O., Gray, S.K., Kohn, W.G., Rozier, R.G., Siegal, M., Fontana, M., Brunson, D., Carter, N., Curtis, D.K., Donly, K.J., Haering, H., Hill, L.F., Hinson, H.P., Kumar, J., Lampiris,L., Mallatt, M., Meyer, D.M., Miller, W.R., Sanzi-Schaedel, S.M., Simonsen, R., Truman, B.I., & Zero, D.T. (2009). Preventing Dental Caries Through School-based Sealant Programs: Updated Recommendations and Reviews of Evidence. *Journal of the American Dental Association, 140,* 1356-1365.

Graves, A. (2009) A Model for Assessment of Potential Geographical Accessibility: A Case for Geographical Information Systems. *Online Journal of Rural Nursing and Health Care, 9.* Farmington Hills, MI: Gale Group.

Griffin, S.O., Jones, K.A., Lockwood, S., Mosca, N.G., & Honore, P.A. (2007). Impact of Increasing Medical Dental Reimbursement and Implementing School Sealant Programs on Sealant Prevalence. *Journal of Public Health Management Practice, 13* (2), 202-206.

Hodges, V.A. (2010*). Examination of Oral Health Prevention Strategy of Dental Sealants in Children: Cost-effectiveness Analysis and Policy Implications*. Andrew Young School of Policy Studies, Georgia State University.

Holt, K. & Kraft, K. (2003). *Oral Health and Learning: When Children's Health Suffers, So Does Their Ability to Learn*. National Maternal and Child Oral Health Resource Center, Georgetown University. Retrieved from http://www. mchoralhealth.org/pdfs/learningfactsheet.pdf

Houpt, M. & Shey, Z. (1983). The Effectiveness of a Fissure Sealant after Six Years. *Pediatric Dentistry, 5*(2), 104-106.

Hughes, D.C., Duderstadt, K.G., Soobader, M.P., & Newacheck, P.W. (2005). Disparities in Children's Use of Oral Health Services. *Public Health Reports, 120* (4), 455-462.

Jackson, D.M., Jahnke, L.R., Kerber, L., Nyer, G., Siemens, K., & Clark, C. (2007) Creating a Successful School-Based Mobile Dental Program. *Journal of School Health, 77* (1), 1-6.

Jones, B. (2011). *Systems Theory*. Retrieved from www.nevadahosa.org/PPT/Systems %20Theory.ppt

Kaiser Commission on Medicaid and the Uninsured (2006). *Analysis of 2006 MEPS*. The Kaiser Family Foundation.

Kaiser Commission on Medicaid and the Uninsured (2009). *Oral Health Coverage and Care for Low Income Children: The Role of Medicaid and CHIP*. The Kaiser Family Foundation.

Kane, D., Mosca, N., Zotti, M., & Schwalberg, R. (2008). Factors Associated with Access to Dental Care for Children with Special Health Care Needs. *Journal of American Dental Association, 139* (3), 326-333.

Kast, F., & Rosenzweig, J. (1972). General Systems Theory: Applications for Organizations and Management. *Academy of Management Journal*, *15* (4), 447-464.

Katz, D., & Kahn, R. L. (1978*). The Social Psychology of Organizations*. New York, NY: Wiley.

Kovner, A.R., Fine, D.J., & D'Aquilla, R. (2009). *Evidence-Based Management in Healthcare*. Chicago, IL: Health Administration Press.

Mitchell, L., & Murray J.J. (1989). Fissure Sealants: a Critique of their Cost-effectiveness. *Community Dentistry and Oral Epidemiology, 17*(1), 19-23.

Mouradian, W.E., Wehr, E., & Crall, J.J. (2000). Disparities in Children's Oral Health and Access to Dental Care. *Journal of the American Medical Association, 284*(20), 2625-2631.

Newacheck, P.W., Hughes, D.C., Yun, Y.H., Wong, S., & Stoddard, J.J. (2000). The Unmet Health Needs of America's Children. *Pediatrics, 105* (4), 989-997.

Patrick, D.L., Lee, R., Shuk Yin Lee, R., Nucci, M., Grembowski, D., Zane Jolies, C., & Milgrom, P. (2006). Reducing Oral health Disparities: A Focus on Social and Cultural Determinants. *BMC Oral Health, 6*, S4.

Quiñonez, R.B., Downs, S.M., Shugars, D., Christensen, J., Vann, W.F. Jr. (2005). Assessing Cost-effectiveness of Sealant Placement in Children. *Journal of Public Health Dentistry, 65*(2), 82-89.

Scott, W. R. (1981). *Organizations: Rational, Natural and Open Systems*. Englewood Cliffs, NJ: Prentice-Hall.

Simpson, G., Bloom, B., Cohan, R.A., & Parsons, P.E. (1997). *Vital and Health Statistics*: *Access to Health Care. Part 1: Children*. U.S. Department of Health and Human Services Centers for Disease Control and Prevention National Center

for Health Statistics. Retrieved from http://www.cdc.gov/nchs/data/series/sr_10/sr10_196.pdf

U.S. General Accounting Office (2000). *Report to Congressional Requesters: ORAL HEALTH: Dental Disease is a Chronic Problem Among Low-Income Populations*. Retrieved from http://www.gao.gov/new.items/he00072.pdf

U.S. Department of Health and Human Services Agency for Healthcare Research and Quality (2003). *Dental Care: Improving Access and Quality*. Retrieved from http://www.ahrq.gov/research/dentalcare/dentria.pdf

U.S. Department of Health and Human Services Centers for Disease Control and Prevention (2005). *Preventing Chronic Diseases: Investing Wisely in Health: Preventing Dental Caries*. Retrieved from http://dental.ufl.edu/files/2012/06/PreventingDentalCaries.pdf

U.S. Department of Health and Human Services National Institutes of Health (2000). *Oral Health in America: A Report of the Surgeon General*. National Institute of Dental and Craniofacial Research. Retrieved from http://www.nidcr.nih.gov/DataStatistics/SurgeonGeneral/

Vargas, C.M., Crall, J.J., & Schneider, D.A. (1998). Socio-demographic Distribution of Pediatric Dental Caries. National Health and Nutritional Examination Survey (NHANES) III, 1988-1994. *Journal of American Dental Association, 129* (9),1229-1238.

Weintraub, J.A., Stearns, S.C., Rozier, R.G., & Huang, C.C. (2001). Treatment Outcomes and Costs of Dental Sealants Among Children Enrolled in Medicaid. *American Journal of Public Health, 91* (11), 1877-1881.

Wisconsin Department of Health Services (2008). *Make Your Smile Count: The Oral Health of Wisconsin's Children*. Retrieved from http://www.dhs.wisconsin.gov/publications/p0/p00095.pdf

Wisconsin Department of Health Services (2009). *Wisconsin Public Water Supply Fluoridation Census*. Retrieved from http://worldcat.org /oclc/233032988/viewonline

Wisconsin Department of Health Services (2010). *Healthiest Wisconsin 2020: Oral Health Profile*. Retrieved from http://www.dhs.wisconsin.gov/hw2020/pdf/oralhealth.pdf

Woolridge, J. (2007). *What's New in Econometrics?.* Retrieved from http://www.nber.org/WNE/lect_10_diffindiffs.pdf

APPENDIX A

STANDARD WISCONSIN MEDICAID AND BADGERCARE PLUS DATA AGREEMENT

Scott Walker
Governor

Dennis G. Smith
Secretary

DIVISION OF HEALTH CARE ACCESS AND ACCOUNTABILITY

1 WEST WILSON STREET
P O BOX 309
MADISON WI 53701-0309

Telephone: 608-266-8922
FAX: 608-266-1096
TTY: 711 or 800-947-3529
dhs.wisconsin.gov

State of Wisconsin

Department of Health Services

Standard Wisconsin Medicaid and BadgerCare Plus
Data Agreement

This document represents an amendment to the Agreement between the Wisconsin Department of Health Services, Division of Health Care Access and Accountability (DHCAA) and the Marquette University (Recipient) signed December 10, 2010 and January 18, 2011.

In the event of any inconsistency between the provisions of this Agreement and mandatory provisions of the federal Health Insurance Portability and Accountability Act, as amended ("HIPAA"), the HIPAA provisions shall control. Where provisions of this Agreement are different from those provided in HIPAA, but are permitted by HIPAA, the provisions of this Agreement shall control.

Marquette University agrees to the following confidentiality and security conditions:

A. Access to Confidential Data

1. Use of any data and information provided pursuant to this Agreement is limited to recipient, recipient organization, and their staff and affiliates.

2. Recipient and Recipient organization shall be responsible for informing any user who has access to the data that:

   a. Any information concerning past or present applicants and participants of Wisconsin Medicaid and BadgerCare Plus is confidential under Wis. Stats. §49.45(4) and federal regulations and may only be disclosed under the circumstances identified in Wis. Admin. Code HSS 108.01, and the HIPAA Privacy Rule, 45 CFR Parts 160 and 164. Violators may be subject to prosecution.

   b. Any information from treatment records for persons who are now receiving or who have at any time received services for *developmental disabilities, mental illness, alcoholism, or drug dependence or abuse* is confidential under Wis. Stats., § 51.30, and applicable federal regulations and may only be disclosed under the circumstances identified in Wis. Admin. Code HFS Ch. 92 and the HIPAA Privacy Rule, 45 CFR Parts 160 and 164. Violators may be subject to prosecution.

   c. Any information from patient records for persons who are now

receiving or who have at any time received services for *alcoholism or drug abuse* is also confidential under the federal Confidentiality of Alcohol and Drug Abuse Patient Records administrative rule, 42 CFR Part 2 and may only be disclosed under the circumstances identified in 42 CFR Part 2 and the HIPAA Privacy Rule, 45 CFR Parts 160 and 164. Violators may be subject to prosecution.

3. Recipient and recipient organization will not use or further disclose data and information provided pursuant to this Agreement, other than as permitted by this Agreement or as otherwise required by law.

4. In the event that DHCAA notifies recipient or recipient organization that it has determined an occurrence constituting a material breach of this Agreement, recipient and recipient organization may not disclose any further confidential data until the breach is cured or the violation has ended.

B. Use of Data

1. Any data or information received from DHCAA shall be utilized only for the following purpose(s): **This agreement is an amendment from the agreement (dated December 21, 2010 and January 18, 2011) to utilize the data provided to Marquette University for the initial study (see attached agreement).**

   Mark Anderson, from Marquette University will be utilizing this data (Attachment A in original agreement) to enable him to conduct an oral health sealant study within Milwaukee Public Schools. The study could result in policy implications for City and State policy officials relative to oral health prevention strategies for low-income and minority children.

2. The data and information received from DHCAA cannot be provided or shared with any other party, including agents (other than authorized staff) or subcontractors, without the prior written approval of the Department.

3. Recipient and recipient organization shall use appropriate administrative, physical, and technical safeguards that reasonably and appropriately protect the confidentiality, integrity, and availability of any information provided pursuant to this Agreement.

4. Recipient and recipient organization shall ensure that any agents, including a subcontractor to whom it provides a data set, agree to the same restrictions on use and access that apply to recipient and recipient organization and shall use appropriate safeguards to protect the data from misuse or inappropriate disclosure of PHI other than as provided in this Agreement or as otherwise required by law or regulation.

5. Recipient and recipient organization shall report to DHCAA immediately upon becoming aware of any use or disclosure of information not authorized by this Agreement.

6. Recipient shall not change the definition, data condition, or use of a data element or segment in any of the data or information provided pursuant to this Agreement.

7. Recipient shall follow internal protocol for the use, disclosure and disposal of all data provided by DHCAA.

C. Payment of Costs of Producing Requested Data

Not applicable – utilizing original data extract.

D. Notification and Review Procedures for Publications and Presentations

1. Recipient and its employees, agents, or any other person who would have access to the use of the Wisconsin Medicaid BadgerCare Plus data and information provided in response to this request shall not publicly present or submit for publication, in oral form or in writing, on a formal or informal basis, subjects or research which used the Medicaid data and information obtained under this Agreement without the prior review by the Administrator of the Division of Health Care Access and Accountability. "Publication" includes any written article for publication in a professional journal or other publication, or any printed material for presentation to any person, conference or group external to the recipient's organization. This includes providing copies of planned articles, the text of speeches, slides and other graphics.

2. DHCAA's right to review is for the purposes of determining if the material could have an impact on Department policies and procedures, or misinterprets data, or violates the confidentiality rights of participants or the Department. Upon review, DHCAA may request revisions. Recipient shall notify the Administrator of comments not adopted. If the article is accepted for publication, the participant shall notify the Administrator of the anticipated date of publication, so that the Administrator may concurrently submit a letter to the editor regarding comments not adopted.

3. Unless otherwise mutually agreed upon between the parties, participant shall provide the Administrator of DHCAA with a minimum of 20 working days for the first review of such presentations (e.g., abstracts, slides) and publications and 10 working days for any subsequent review. In specific situations, DHCAA may choose to delegate the review function to another agency or organization with more direct and detailed substantive knowledge of the issues being studied.

D. Effective Dates and Termination

1. This Agreement shall become effective upon the date of signing by the DHCAA Administrator.

2. This Agreement shall continue in effect until terminated. Recipient may terminate this Agreement by written notice to the DHCAA Administrator. DHCAA may terminate this Agreement by written notice to Recipient.

3. Upon termination, cancellation, expiration or other conclusion of the Agreement, the Recipient shall within 30 days provide written documentation to DHCAA certifying that it has destroyed all data and information provided by DHCAA remaining in recipient's or recipient organization's possession.

Signatures:

Brett Davis, Administrator
Division of Health Care Access and Accountability
Department of Health Services

3/05/2021
Date

Katherine Durben, Executive Director
Office of Research and Sponsored Programs
Marquette University

Date

Jim Doyle
Governor

Karen E. Timberlake
Secretary

State of Wisconsin
Department of Health Services

DIVISION OF HEALTH CARE FINANCING

1 WEST WILSON STREET
P O BOX 309
MADISON WI 53701-0309

Telephone: 608-266-8922
FAX: 608-266-1096
TTY: 888-692-1402
dhfs.wisconsin.gov

Standard Wisconsin Medicaid and BadgerCare Plus
Data Agreement

This document represents an Agreement between the Wisconsin Department of Health Services Division of Health Care Access and Accountability [DHCAA] and Marquette University for the provision of health insurance data related to services provided to Wisconsin Medicaid and BadgerCare Plus Program participants. The data covered is described in Attachment A.

In the event of any inconsistency between the provisions of this Agreement and mandatory provisions of the federal Health Insurance Portability and Accountability Act, as amended ("HIPAA"), the HIPAA provisions shall control. Where provisions of this Agreement are different from those provided in HIPAA, but are permitted by HIPAA, the provisions of this Agreement shall control.

Marquette University agrees to the following confidentiality and security conditions:

A. Access to Confidential Data:

1. Use of any data and information provided pursuant to this Agreement is limited to recipient, recipient organization, and their staff and affiliates.

2. Recipient and Recipient organization shall be responsible for informing any user who has access to the data that:

   a. Any information concerning past or present applicants and particpants of Wisconsin Medicaid and BadgerCare Plus is confidential under Wis. Stats. §49.45(4) and federal regulations and may only be disclosed under the circumstances identified in Wis. Admin. Code HSS 108.01, and the HIPAA Privacy Rule, 45 CFR Parts 160 and 164. Violators may be subject to prosecution.

   b. Any information from treatment records for persons who are now receiving or who have at any time received services for *developmental disabilities, mental illness, alcoholism, or drug dependence or abuse* is confidential under Wis. Stats., § 51.30, and applicable federal regulations and may only be disclosed under the circumstances identified in Wis. Admin. Code HFS Ch. 92 and the HIPAA Privacy Rule, 45 CFR Parts 160 and 164. Violators may be subject to prosecution.

   c. Any information from patient records for persons who are now

receiving or who have at any time received services for *alcoholism or drug abuse* is also confidential under the federal Confidentiality of Alcohol and Drug Abuse Patient Records administrative rule, 42 CFR Part 2 and may only be disclosed under the circumstances identified in 42 CFR Part 2 and the HIPAA Privacy Rule, 45 CFR Parts 160 and 164. Violators may be subject to prosecution.

3. Recipient and recipient organization will not use or further disclose data and information provided pursuant to this Agreement, other than as permitted by this Agreement or as otherwise required by law.

4. In the event that DHCAA notifies recipient or recipient organization that it has determined an occurrence constituting a material breach of this Agreement, recipient and recipient organization may not disclose any further confidential data until the breach is cured or the violation has ended.

B. Use of Data:

1. Any data or information received from DHCAA shall be utilized only for the following purpose(s): analyze patterns of dental service utilization amongst Medicaid enrollees, particularly as it relates to the use of emergency departments and physician offices for non-traumatic dental conditions.

2. The data and information received from DHCAA cannot be provided or shared with any other party, including agents (other than authorized staff) or subcontractors, without the prior written approval of the Department.

3. Recipient and recipient organization shall use appropriate administrative, physical, and technical safeguards that reasonably and appropriately protect the confidentiality, integrity, and availability of any information provided pursuant to this Agreement.

4. Recipient and recipient organization shall ensure that any agents, including a subcontractor to whom it provides a data set, agree to the same restrictions on use and access that apply to recipient and recipient organization and shall use appropriate safeguards to protect the data from misuse or inappropriate disclosure of PHI other than as provided in this Agreement or as otherwise required by law or regulation.

5. Recipient and recipient organization shall report to DHCAA immediately upon becoming aware of any use or disclosure of information not authorized by this Agreement.

6. Recipient and recipient organization shall not attempt to identify individual Wisconsin Medicaid and BadgerCare Plus participants based upon the

information obtained or contact individual Wisconsin Medicaid and BadgerCare Plus participants without the prior written approval of DHCAA.

7. Recipient shall not change the definition, data condition, or use of a data element or segment in any of the data or information provided pursuant to this Agreement.

8. Recipient shall provide written documentation certifying that it has destroyed all data provided by DHCAA at the conclusion of the stated purpose for which DHCAA provided the data.

C. Payment of Costs of Producing Requested Data

1. Recipient shall be responsible for the cost of producing all the data Requested which is $8,214.92. This includes the actual cost of extracting the requested data and the professional services required producing the requested data and information. Recipient will be informed in advance of the cost of producing the requested data and information.

2. Recipient shall submit a check payable to the Department of Health of Services, Division of Health Care Access and Accountability to pay the cost of producing the data within 30 days of receipt of the requested data. The check should be mailed to:

Division of Health Care Access and Accountability
P.O. Box 309
Madison, WI 53701

D. Notification and Review Procedures for Publications and Presentations

1. Recipient and its employees, agents, or any other person who would have access to the use of the Wisconsin Medicaid and BadgerCare Plus data and information provided in response to this request shall not publicly present or submit for publication, in oral form or in writing, on a formal or informal basis, subjects or research which used the Medicaid data and information obtained under this Agreement without the prior review by the Administrator of the Division of Health Care Access and Accountability. "Publication" includes any written article for publication in a professional journal or other publication, or any printed material for presentation to any person, conference or group external to the recipient's organization. This includes providing copies of planned articles, the text of speeches, slides and other graphics.

2. DHCAA's right to review is for the purposes of determining if the material could have an impact on Department policies and procedures, or misinterprets data, or violates the confidentiality rights of participants or the Department. Upon review, DHCAA may request revisions. Recipient shall

notify the Administrator of comments not adopted. If the article is accepted for publication, the participant shall notify the Administrator of the anticipated date of publication, so that the Administrator may concurrently submit a letter to the editor regarding comments not adopted.

3. Unless otherwise mutually agreed upon between the parties, participant shall provide the Administrator of DHCAA with a minimum of 20 working days for the first review of such presentations (e.g., abstracts, slides) and publications and 10 working days for any subsequent review. In specific situations, DHCAA may choose to delegate the review function to another agency or organization with more direct and detailed substantive knowledge of the issues being studied.

E. Effective Dates and Termination

1. This Agreement shall become effective upon the date of signing by the DHCAA Administrator.

2. This Agreement shall continue in effect until terminated. Recipient may terminate this Agreement by written notice to the DHCAA Administrator. DHCAA may terminate this Agreement by written notice to Recipient.

3. Upon termination, cancellation, expiration or other conclusion of the Agreement, the Recipient shall within 30 days provide written documentation to DHCAA certifying that it has destroyed all data and information provided by DHCAA remaining in recipient's or recipient organization's possession.

Signatures:

Jason A. Helgerson, Administrator — Date 12/21/10
Division of Health Care Access and Accountability
Department of Health Services

Keith Osterhage, Executive Director — Date 1/18/2011
Marquette University

APPENDIX B

DESCRIPTION OF COVERED DATA

All Dental claims from Medical providers for the time period between January 2001 and December 2009.

Claims should be included if either the primary or secondary diagnosis includes the following ICD-9 codes: 521.0-521.9 (diseases of dental hard tissues of teeth), 522.0-522.9 (diseases of pulp and periapical tissues), 523.0-523.9 (gingival and periodontal diseases), 525.3 (retained dental root), 525.9 (unspecified disorder of the teeth and supporting structures), and 873.63 (internal structures of mouth, without broken tooth).

Variables to include:

- Medical Claims data table (Names in parentheses denote variables names for fields that we have received in previous data queries) :
  - Calendar Year (YEAR)
  - Individual Recipient Identifier (UNIQUE_PROXY)
  - Date of Service (DOS)
  - Primary diagnosis for the service (DX1)
  - Description of the Primary Diagnosis (DX1_DESC)
  - Secondary diagnosis for the service (DX2)
  - Description of the Secondary diagnosis (DX2_DESC)
  - Medicaid ID of the provider (PROV_ID)
  - Name of the provider (PROV_NAME)
  - County of the provider (PROV_CNTY)
  - Managed Care organization charge data (MC_CHARGE)
  - FFS claim paid amount (FFS_PAID)
  - ER: Emergency Room related/DR (Physician office related) (SOURCE)
  - Cost information (MC_CHARGE and FFS_PAID)

All Dental Claims from Dental providers for the time period between January 2001 and December 2009.

This would be any claim with a corresponding Dxxxx code

Variables to include:

- Procedure Code
- Date of service
- Provider type
- Provider county

- Cost (paid amount on FFS claims and FFS max fee for managed care encounters)

Medicaid enrollment and demographic data from January 2001 to December 2009.

We request individual level recipient demographic information for all individuals enrolled for at least 6 month during the specified study time frame.

Variables to include:

- Proxy ID
- Month/Year of DOB
- Race/Ethnicity
- Gender
- Most recent county based on zip code of residence
- Medical status grouping

Month to month enrollment data to track potential gaps in coverage, etc. by county of residence for each year (county where members spent the most enrolled months).

APPENDIX C

UAB IRB APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on August 29, 2016. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator: ANDERSON, MARK E

Co-Investigator(s):

Protocol Number: **X120120002**

Protocol Title: *Exploring Oral Health Disparities in the City of Milwaukee*

The IRB reviewed and approved the above named project on 1-20-12. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 1-20-12

Date IRB Approval Issued: 1-20-12

HIPAA Waiver Approved?: Yes

Marilyn Doss

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
205.934.3789
Fax 205.934.1301
irb@uab.edu

The University of
Alabama at Birmingham
Mailing Address:
AB 470
1530 3RD AVE S
BIRMINGHAM AL 35294-0104

UAB IRB Approval of
Waiver of Informed Consent and/or Waiver of Patient Authorization

☑ **Approval of Waiver of Informed Consent to Participate in Research.** The IRB reviewed the proposed research and granted the request for waiver of informed consent to participate in research, based on the following findings:

1. The research involves no more than minimal risk to the subjects.
2. The research cannot practicably be carried out without the waiver.
3. The waiver will not adversely affect the rights and welfare of the subjects.
4. When appropriate, the subjects will be provided with additional pertinent information after participation.

Check one:
- ☑ **and** Waiver of Authorization (below)
- ☐ **or** Waiver of Authorization (below)
- ☐ Waiver of Authorization not applicable

☑ **Approval of Waiver of Patient Authorization to Use PHI in Research.** The IRB reviewed the proposed research and granted the request for waiver of patient authorization to use PHI in research, based on the following findings:

1. The use/disclosure of PHI involves no more than minimal risk to the privacy of individuals
   i. There is an adequate plan to protect the identifiers from improper use and disclosure.
   ii. There is an adequate plan to destroy the identifiers at the earliest opportunity consistent with conduct of the research, unless there is a health or research justification for retaining the identifiers or such retention that is otherwise required by law.
   iii. There is an assurance that the PHI will not be reused or disclosed to any other person or entity, except as required by law, for authorized oversight of the research study, or for other research for which the use or disclosure of PHI would be permitted.
2. The research cannot practicably be conducted without the waiver or alteration.
3. The research cannot practicably be conducted without access to and use of the PHI.

—OR—

☐ **Full Review**
The IRB reviewed the proposed research at a **convened meeting** at which a majority of the IRB was present, including one member who is not affiliated with any entity conducting or sponsoring the research, and not related to any person who is affiliated with any of such entities. The waiver of authorization was approved by the majority of the IRB members present at the meeting.

Date of Meeting

Signature of Chair, Vice-Chair or Designee

Date

☑ **Expedited Review**
The IRB used an **expedited review procedure** because the research involves no more than minimal risk to the privacy of the individuals who are the subject of the PHI for which use or disclosure is being sought. The review and approval of the waiver of authorization were carried out by the Chair of the IRB, or by one of the Vice-Chairs of the IRB as designated by the Chair of the IRB.

1-20-12
Date of Expedited Review

Maureen Davis
Signature of Chair, Vice-Chair or Designee

Date 1-20-12

470 Administration Building
701 20th Street South
205.934.3789
Fax 205.934.1301
irb@uab.edu

The University of
Alabama at Birmingham
Mailing Address:
AB 470
1530 3RD AVE S
BIRMINGHAM AL 35294-0104