

Use Authorization

In presenting this thesis in partial fulfillment of the requirements for an advanced degree at Idaho State University, I agree that the Library shall make it freely available for inspection. I further state that permission to download and/or print my thesis for scholarly purposes may be granted by the Dean of the Graduate School, Dean of my academic division, or by the University Librarian. It is understood that any copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Signature _____

Date _____

AN EVALUATION OF A SCHOOL-BASED SEALANT PROGRAM.

by

Rachelle Williams

A thesis

submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Dental Hygiene

Idaho State University

December, 2015

Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Rachelle Williams find it satisfactory and recommend that it be accepted.

Ellen Rogo, RDH, PhD
Major Advisor

JoAnn Gurenlian, RDH, PhD
Second Member

Paula Phelps, MHE, PA-C
Graduate Faculty Representative

Idaho State UNIVERSITY

Office of Research

921 South 8th Avenue, Stop 8130 •
Pocatello, Idaho 83209-8130

February 2, 2015
Dr. Ellen Rogo
Dept. of Dental
Hygiene
Idaho State
University
921 S. 8th Ave, MS 8048
Pocatello, ID 83209-8048

Dear Dr. Rogo:

Based on the information provided to me by Mrs. Karen Portillo, it is my determination that her project, "An Evaluation of a School-Based Sealant Program," does not constitute research with human subjects as defined in US federal law at 45 CFR 46.102(f). Therefore, it does not require any submission to or approval by the Human Subjects Committee (the IRB for Idaho State University).

Please feel free to contact me if you have any questions or concerns.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Chair, Human Subjects Committee

Acknowledgement

It is a pleasure to thank those who made this thesis possible. I owe my deepest gratitude to my thesis committee chair Dr. Ellen Rogo for her many hours of thesis guidance, words of encouragement, and inspiring me to write better than I ever thought possible.

I am very thankful for my mentor Karen Portillo. This thesis would not have been possible without her foresight to implement a school-based dental sealant program. I was honored to be part of the implementation process and thrilled to have evaluated this program. Thank you for modeling excellence in community service and mentorship.

I am also grateful to my thesis committee member and Graduate Program Director Dr. JoAnn Gurenlian for her unwavering encouragement and endless amount of support throughout my educational journey. I also want to acknowledge Paula Phelps for accepting the position as my graduate faculty representative and providing valuable feedback.

I especially want to acknowledge my family, particularly my husband Danny, for their limitless support and encouragement throughout my graduate studies. Without your assistance, I would not have been able to complete this educational goal. Thank you so much.

Table of Contents

List of Tables	viii
List of Figures.....	ix
Abstract.....	x
Chapter 1 Introduction.....	1
Historical Overview	1
Problem Statement.....	7
Purpose of the Study	8
Professional Significance of the Study	8
Hypothesis.....	9
Research Question	10
Dental sealants.....	11
Operational Definitions	11
Chapter 2 Review of the Literature	15
Caries Prevalence Overview	16
Dental Sealant Overview	25
School-Based Sealant Programs	31
Service-Learning School-Based Sealant Programs.....	39
Summary of Chapter 2	42
Chapter 3 Methodology	44
Research Context	46
Research Participants.....	47

Data Collection	48
Limitations	55
Proposed Statistical Analysis	55
Summary of Chapter 3	56
Appendix A Informed Consent Form.....	66
Appendix B Data Collection Form.....	69
Appendix C Author Guidelines.....	73
Title Page of Manuscript	81
Manuscript Abstract.....	82
Key Words	83
An Evaluation of a School-Based Dental Sealant Program	84
Introduction.....	84
Methods.....	85
Results	87
Discussion.....	89
Conclusions.....	94
Acknowledgements	95
References	96

List of Tables

Table 1.	Five Main Components of the Surgeon General’s Report.....	1
Table 2.	Five Main Components of the National Call to Action.....	4
Table 3.	Federal Poverty Levels 2014.....	17
Table 4.	Evidence Based Clinical Recommendations.....	26
Table 5.	Recommendations for School-Based Sealant Programs.....	35
Table 6.	The Community Preventive Service Task Force’s.....	37
Table 7.	Spring 2014 Data Collection Procedures.....	48
Table 8.	Ultrasal XT® Hydro Dental Sealant.....	50
Table 9.	Fall 2014 Data Collection Procedures.....	51
Table 10.	Spring 2015 Data Collection Procedures.....	52

List of Figures

<i>Figure 1.</i>	Dental Caries Prevalence in Permanent Teeth.....	18
<i>Figure 2.</i>	Prevalence of Untreated Tooth Decay in Permanent Teeth.....	19
<i>Figure 3.</i>	Prevalence of Dental Sealants on Permanent Teeth.....	20
<i>Figure 4.</i>	Prevalence of Untreated Dental Caries (2009-2010)	21
<i>Figure 5.</i>	Dental Sealant Prevalence (2009-2010)	22
<i>Figure 6.</i>	Prevalence of Dental Visits and Preventive Visits.....	23
<i>Figure 7.</i>	Dental Sealant Prevalence for Children Ages 5-19.....	24
<i>Figure 8.</i>	International Caries Detection and Assessment Scoring System.....	30

Abstract

In the spring of 2014 the Bengal Smiles school-based dental sealant program was implemented at a local Title 1 school. The purpose of this study was to evaluate the effectiveness of the Bengal Smiles program based on rates of decay, sealant placement, sealant retention, sealant decay rates, and referral treatment rates of children (n=32) ages 7-12. Outcomes from the sealant program showed a 16% decrease in active decay; however, a t-test analysis determined there was no statistically significant difference in decay rates from baseline to 12 months. Dental sealant placement increased prevalence to 370%. Sealant retention outcomes were 74% fully retained, with 0% decay, 13% partially retained with 25% decay, and 13% nonretained with 25% decay. At 6 months 40% of participants referred for dental treatment accessed care. The intervention of school administration staff had no statistically significant effect on increasing dental treatments from 6 months to 12 months ($p=0.75$).

Chapter 1 Introduction

Historical Overview

A historical report by the Surgeon General, *Oral Health in America* (U.S. Department of Health and Human Services [USDHHS], 2000) is the foundation to an enhanced approach to oral health. The Surgeon General's report was the first time a powerful connection between oral health and general health was acknowledged. Oral health was identified as essential to general health and well-being throughout an individual's lifetime (USDHHS, 2000). This connection has become the catalyst for oral health professionals, governmental agencies, the American public, and medical professionals to increase oral health care measures. Table 1 outlines the five main components of the Surgeon General's report, which provided guidance for increasing the oral health of Americans.

Table 1

Five Main Components of the Surgeon General's Report (USDHHS, 2000)

Five Main Components of the Surgeon General's Report	
1	Oral Health in America: Oral health including the craniofacial complex was defined in relation to general health and well-being.
2	Status of Oral Health in America: A look into the prevalence of oral diseases in the United States.
3	The Relationship between Oral Health and General Health and Well-Being: The linkage of oral health to general health and the effects on well-being and quality of life.
4	Oral Health Promotion and Maintenance and Oral Disease Prevention: Recommendations for nutrition counseling, fluoride and dental sealant treatments. Increased access to care with community programs such as school-based dental sealant programs.
5	Needs and Opportunities to Enhance Oral Health: Factors affecting oral health, facing the future and a framework for action.

Components two and four identified disparities in the achievement of oral health within the elderly, special need populations, specified ethnicities, and children from low-income families (USDHHS, 2000). Guidance in oral health promotion and disease prevention for underserved populations involved promoting oral health awareness and reducing caries prevalence by increasing access to preventive dental care (USDHHS, 2000). Dental caries were characterized as the most common preventable disease in children with the highest prevalence detected in low-income children (USDHHS, 2000). Section two of the Surgeon General's report discussed low socioeconomic children ages 2-9 as having 19.5% more untreated decay as compared to children from higher income families (USDHHS, 2000). Additionally, more than 51 million school hours were lost each year due to dental-related illnesses; low socioeconomic children were 12 times as likely to have this type of occurrence as compared to higher income children (USDHHS, 2000). Common barriers to achieving decreased caries prevalence in underserved populations were lack of a dental home (established dentist) and lack of receiving preventive oral health care such as dental sealants and fluoride (USDHHS, 2000).

Fluoride and dental sealants were identified as highly effective, but an underutilized means of caries prevention (USDHHS, 2000). A dental sealant is a thin resin placed within the pit and fissures to prevent caries by blocking the damaging effects of bacterial acids developed from foods and beverages in the oral cavity (Beauchamp et al., 2008; USDHHS, 2000). Kaste et al. recognized 90% of caries in school-aged children began in the pit and fissures of the occlusal tooth surfaces (as cited in USDHHS, 2000). Following a review of clinical trials from 1976- 1998, dental sealants were classified as an effective treatment for the reduction of occlusal caries (USDHHS, 2000). Furthermore,

dental sealants exhibited the greatest caries reduction when placed in the pit and fissures of newly erupted first and second molars of school-aged children (USDHHS, 2000).

As a plan for action to reduce higher caries prevalence and provide equality in oral health care to low-income children, the Surgeon General recommended expanding the number of school-based dental sealant programs and increasing community water fluoridation (USDHHS, 2000). Many states complied and implemented additional school-based dental sealant programs; however, not all states have fulfilled this recommendation (Pew Center on the States, 2010). For example, the last survey by the National Oral Health Surveillance System (2011) identified third grade children with at least one dental sealant ranging from 23.5% in Mississippi (2009-2010) to 60.4% in North Dakota (2009-2010). Idaho is making great strides towards increasing sealant prevalence and the proportion of low-income children receiving dental services (Pew, 2010). The last survey by the National Oral Health Surveillance System (NOHSS, 2011) identified 51.7% of Idaho third graders with at least one dental sealant. Although Idaho is performing well with sealant prevalence, community water fluoridation is well below the recommendation of the Surgeon General (Pew, 2010). Children in Idaho are not receiving daily fluoride benefits from community water supplies, which create a heightened need to provide preventive dental sealant treatments for the 48.3% of children in Idaho without sealants (NOHSS, 2011). Additionally, the evaluation of school-based dental sealant programs is especially important because no community water fluoridation translates to dental sealants becoming the leading caries prevention defense (USDHHS, 2000).

To coordinate efforts in addressing national oral health needs such as caries prevention, the Surgeon General Richard Carmona extended an open invitation for

organizations to collaborate and develop a plan of action (USDHHS, 2003). The National Call to Action brought together public and private entities to develop an action plan to improve the oral health of Americans (USDHHS, 2003). In 2003, under the leadership of the office of the Surgeon General, a Partnership Network made up of the American Dental Association, American Dental Hygienists' Association, American Medical Association and 59 additional organizations collaborated and published the *National Call to Action to Promote Oral Health* (USDHHS, 2003). Table 2 identifies the five main components of the 2003 publication, which were designed to address oral health initiatives identified in the Surgeon General's report and to meet goals outlined in the Healthy People 2010 such as, fluoride, dental sealants, and dental sealant programs (USDHHS, 2003).

Table 2.

Five Components of the National Call to Action (USDHHS, 2003)

National Call to Action Five Main Components	
1	Change Perceptions of Oral Health: Change the publics', policymakers' and health providers' perceptions of oral health related to general health.
2	Overcome Barriers by Replicating Effective Programs and Proven Efforts: Improve access to oral health care and enhance health promotion.
3	Build Science Base and Accelerate Science Transfer: Increasing biomedical and behavioral research.
4	Increase Oral Health Workforce Diversity, Capacity, and Flexibility: Address healthcare shortage by changing State Practice Acts allowing a more flexible and efficient workforce.
5	Increase Collaboration: Implementing strategies to successful partnering at all societal levels to address the oral health needs of Americans.

Similar to the *National Call to Action*, Healthy People objectives continue to be utilized nationwide by community health programs and governmental agencies as guidance for increased oral health (USDHHS, 2013). Historically, Healthy People

originated in 1978 with subsequent objectives and goals published in 1990, 2000, 2010, and 2020 (USDHHS, 2013). Objectives in 1978 and 1990 were developed for guidance in the prevention of early mortality related to poor lifestyle choices such as tobacco use and lack of physical fitness (Brown, 2009). Each Healthy People publication built on the previous version and created increased goals in the areas identified as successful, and revised or created new objectives for areas identified as not successful (USDHHS, 2013). In the 2000 publication, which was being developed at the same time as the Surgeon General's report, the connection of oral health to overall well-being was reflected in the oral health objectives (USDHHS, 2013). Additionally, Healthy People 2000 recognized health disparities within certain populations and created objectives to address the problem (USDHHS, 2013). Enhancements continued with the 2010 and 2020 objectives in the development of improved data collection measures and clarification of objectives (USDHHS, 2013).

Furthermore, leading health indicators, a small group of highlighted priorities, were developed for focused guidance on the highest concerns related to oral health (USDHHS, 2013). The 2020 leading health indicator objective is "OH-7: Increase the proportion of children, adolescents, and adults who used the oral health care system in the past 12 months" (USDHHS, 2013, p. 257). Unfortunately, the USDHHS in 2014 updated findings in relation to OH-7, which identified a 6% decrease in children, adolescents, and adults who used oral health care systems in the past year (USDHHS, 2014). One means for addressing the deficiency of children using oral health care systems may be school-based dental sealant programs (USDHHS, 2000). In addition, evaluation of school-based

dental sealant programs is important for identifying and reporting results for the following oral health objectives:

OH-1: Reduce the proportion of children and adolescents who have dental caries experience in their primary or permanent teeth. OH-2: Reduce the proportion of children and adolescents with untreated dental decay. OH-7 Increase the proportion of children, adolescents and adults who used the oral health care system in the past 12 months. OH-8 Increase the proportion of low-income children and adolescents who received any preventive dental service during the past year. OH-9.1 Increase the proportion of school-based health centers with an oral health component that includes dental sealants. OH-12: Increase the proportion of children and adolescents who have received dental sealants on their molar teeth. (USDHHS, 2013, pp. 254-259)

The Department of Dental Hygiene at Idaho State University (ISU) pursued the recommendations of the Association of State and Territorial Dental Directors (ASTDD, 2014); CDC (2013b); USDHHS (2000), and implemented a school-based dental sealant program to address Healthy People 2020 oral health goals. School-based dental sealant programs target schools with a high prevalence of low-income children often determined by the percentage of children ($\geq 50\%$) who qualified for free or reduced lunch (CDC, 2013b). The Pocatello School District 25 identified Greenacres elementary school as a Title I school that met this criterion and was the site for the implementation of the Bengal Smiles school-based dental sealant program. In addition to addressing Healthy People 2020 objectives for low-income children in the community, the program provides dental hygiene students with service-learning experiences. Additionally, Keselyak, Simmer-

Beck, & Gadbury-Amyot (2011) identified dental hygiene students benefited from community-based service-learning with an increased opportunity to work with children in diverse populations, gained knowledge of additional roles of a dental hygienist, and increased awareness of needs within the local community.

Problem Statement

Caries is a preventable disease continuing to affect millions of children with low socioeconomic status (Bloom, Jones & Freeman, 2013; Dye et al., 2007; Dye, Li & Thornton-Evans, 2012; Griffin et al., 2014; USDHHS, 2000). A survey from the *Health Statistics for U.S. Children: National Health Interview Survey 2012* identified four million children with untreated dental needs due to insufficient funds (Bloom et al., 2013). Additionally, 21% of uninsured children did not go to the dentist within two years (Bloom, et al., 2013). A well-known means for preventing caries is fluoride and dental sealants; however, all children are not receiving preventive services equally (Assunção, Costa, & Borges, 2014; Griffin et al., 2014). School-based dental sealant programs provide additional access to preventive dental services and assist in the equality of dental sealant prevalence between low and high income children (Dawkins et al. 2013; Siegal & Detty, 2010).

Pocatello is a non-fluoridated city with 1.3% of household incomes at higher federal poverty levels compared to the Idaho average (U.S. Census Bureau, 2008-2012). The Bengal Smiles school-based dental sealant program was developed to provide preventive oral health care to underserved Idaho children. The evaluation of this program is essential to ensure low-income children receive preventive oral health care; one year reevaluations allow monitoring of caries prevalence, determines dental sealant retention,

and applying new sealants as needed (ASTDD, 2014) Moreover, state and governmental agencies are depending on community programs to report descriptive data to aid in the evaluation of state and national objectives (Healthy People 2020) being met (ASTDD, 2014).

Purpose of the Study

The purpose of this study is to evaluate the effectiveness of a school-based dental sealant program based on the rate of decay, dental sealant placement, dental sealant retention, dental sealant decay, and referral treatment at 12 months after program implementation.

Professional Significance of the Study

Findings from this research will contribute to the body of knowledge by identifying dental hygienists' ability to provide preventive services to low-income children. In 2007, expanded oral health services provided by dental hygienists were addressed in the National Dental Hygiene Research Agenda (ADHA, 2007). The agenda encouraged further research into the investigation of how alternative models of dental hygiene treatment could reduce oral health care inequities (ADHA, 2007). Additionally, dental hygienists were evaluated on strategies employed to effectively influence decision-makers involved in health care legislation (ADHA, 2007). Five years later, the ADHA identified the continued need to recognize dental hygienists as qualified preventive specialist with the ability to impact oral health disparities (ADHA, 2012). One barrier dental hygienists continue to encounter is 21 out of 51 states require a dentist to perform a dental examination prior to a dental hygienist placing a dental sealant (Pew, 2010). The need for a dentist to be present has a negative impact on a dental hygienists availability to

provide increased oral health services to underserved populations (ADHA, 2012).

Implications of this study may encourage dental hygienists to advocate for change within the 21 states that require a dental examination prior to sealant placement.

An additional implication of this study is a means for dental hygiene students to obtain two competencies expected for entry into the dental hygiene profession (American Dental Education Association [ADEA], 2004). The first is competency “CM.3: Provide community oral health services in a variety of settings” (ADEA, 2004, p. 746). Secondly, the Commission on Dental Accreditation [CODA], (2007) listed competency “2-16: Graduates must be competent in providing dental hygiene care for the child, adolescent, adult and geriatric patient” (p. 21). School-based dental sealant programs provide dental hygiene students service-learning opportunities to become competent in providing oral health care for children in community oral health settings.

Furthermore, quantitative results gained throughout this study can contribute to data collected for the ASTDD on Idaho dental sealant prevalence and caries experience. The ASTDD organizes individual state data and displays it within sources such as the National Oral Health Surveillance System (ASTDD, 2014). In addition, the data reported to the ASTDD could be combined into national data requested by the Community Preventive Services Task Force to identify the following: “1- The age at which dental sealants should be placed. 2- The need and timing for sealant maintenance. 3- The effectiveness of dental sealant application onsite and offsite. 4- The benefit of programs for children at moderate to low risk” (CDC, 2013c, p. 2).

Hypothesis

The null hypotheses to be tested in this study are:

- 1) There is no statistically significant difference in the decay rate at baseline and at 12 months after implementation of a school-based dental sealant program.
- 2) There is no statistically significant difference in the dental sealant placement rate at baseline and at 12 months after implementation of a school-based dental sealant program.
- 3) There is no statistically significant difference in the dental sealant retention rate at baseline and at 12 months after implementation of a school-based dental sealant program.
- 4) There is no statistically significant difference in the referral treatment rate at baseline, six months, and at 12 months after implementation of a school-based dental sealant program.

Research Question

What is the dental sealant decay rate at 12 months after implementation of a school-based dental sealant program?

Conceptual Definitions

Major conceptual terms used in this investigation include: dental caries, decay rate, restorations, dental sealants, school-based dental sealant programs, Title 1 elementary schools, and Ultraseal XT hydro.

Dental caries. The word caries is used interchangeably with tooth decay and cavities. Caries is a hole in the tooth resulting from acids produced from bacteria and foods/beverages high in sugar or acid. When teeth are not brushed and flossed regularly the bacterial acids cause irreversible damage (USDHHS, 2000).

Dental restorations. Restoration is a term used in dentistry to describe restoring the function of the tooth by replacing missing or damaged tooth structure (Watson, 2014).

Dental sealants. Dental sealants are a thin plastic coating used to cover the chewing surfaces of teeth. The plastic coating provides a barrier between bacterial acids and tooth structure. Properly placed dental sealants can prevent tooth decay in the area of protection. Sealant placement is painless and does not require the removal of tooth structure prior to placement. The tooth structure is prepared with an etchant material, rinsed, and dried. The thin plastic coating is then painted onto the occlusal tooth surface and cured. Dental sealants can last 5-10 years; however, the integrity of the sealant should be reevaluated at each dental visit for retention (CDC, 2013b).

Title 1 elementary schools. Title 1 schools are identified as having a high percentage of children from low-income families based primarily on the U.S. census poverty estimates. Educational funds are granted to Title 1 schools to ensure children meet challenging academic requirements (U.S. Department of Education, 2014). School-based dental sealant programs. “School-based dental sealant delivery programs provide sealants to children unlikely to receive them otherwise. Such programs define a target population within a school district, apply rules for selecting schools, verify unmet need for sealants, apply sealants at school or offsite in clinics, get financial, material, and policy support” (CDC, 2013d, p. 1).

UltraSeal XT® hydro is a light-cured, radiopaque, fluoride-releasing composite sealant. It is stronger and more wear resistant because the material is a 53%-filled resin and has less polymerization shrinkage than competitive products (Ultradent, 2014)

Operational Definitions

Major operational terms used in this investigation include: decay rate, dental sealant placement rate, dental sealant full retention rate, dental sealant partial retention

rate, dental sealant no retention rate, dental sealant decay rate for fully retained dental sealants, dental sealant decay rate for partially retained dental sealants, dental sealant decay rate for non-retained dental sealants, and referral treatment rate.

Decay rate for the purpose of this study, decay rate is computed by dividing the number of decayed permanent posterior teeth by the number of permanent posterior erupted teeth (premolars and molars). Measurements will be taken at baseline and 12 months.

Dental sealant placement rate for the purpose of this study, dental sealant placement rate is computed by dividing the number of dental sealants placed in permanent posterior erupted teeth (premolars and molars) by the number of dental sealants existing in permanent posterior erupted teeth (premolars and molars). Measurements will be taken at baseline and 12 months.

Dental sealant full retention rate for the purpose of this study, dental sealant full retention rate is computed by dividing the number of dental sealants that remain covering the entire pits and fissures on the occlusal surface by the number of dental sealants placed in permanent posterior erupted teeth (premolars and molars). Measurements will be taken at baseline and 12 months.

Dental sealant partial retention rates for the purpose of this study, dental sealant partial retention rate is computed by dividing the number of dental sealants that remain covering only a portion of the pits and fissures on the occlusal surface by the number of dental sealants placed in permanent posterior erupted teeth (premolars and molars). Measurements will be taken at baseline and 12 months.

Dental sealant no retention rate for the purpose of this study, dental sealant no retention rate is computed by dividing the number of dental sealants that no longer cover any of the pits and fissures on the occlusal surface by the number of dental sealants placed in permanent posterior erupted teeth (premolars and molars). Measurements will be taken at baseline and 12 months.

Dental sealant decay rate for fully retained dental sealants for the purpose of this study, dental sealant decay rate for fully retained dental sealants is computed by dividing the number of dental sealants with decayed tooth structure by the number of dental sealants placed in permanent posterior erupted teeth (premolars and molars) that remain covering the entire pits and fissures on the occlusal surface. Measurements will be taken at baseline and 12 months.

Dental sealant decay rate for partially retained dental sealants for the purpose of this study, dental sealant decay rate for partially retained dental sealants is computed by dividing the number of dental sealants with decayed tooth structure by the number of dental sealants placed in permanent posterior erupted teeth (premolars and molars) that remain covering only a portion of the pits and fissures on the occlusal surface. Measurements will be taken at baseline and 12 months.

Dental sealant decay rate for non-retained dental sealants for the purpose of this study, dental sealant decay rate for non-retained dental sealants is computed by dividing the number of dental sealants with decayed tooth structure by the number of dental sealants placed in permanent posterior erupted teeth (premolars and molars) dental sealants that no longer cover any of the pits and fissures on the occlusal surface. Measurements will be taken at baseline and 12 months.

Referral treatment rate for the purpose of this study, referral treatment rate is computed by dividing the number of primary and permanent teeth referred for restorative therapy that received treatment by the number of primary and permanent teeth referred for restorative therapy. Measurements will be taken at baseline, 6 months and 12 months.

Summary of Chapter 1

The goal of this quasi-experimental research design is to evaluate the effectiveness of a school-based dental sealant program. This chapter identified the importance of school-based dental sealant programs. The null hypotheses and research question were identified along with definitions for conceptual and operational terms. This study provides professional significance to the dental hygiene profession by identifying dental hygienists as competent oral health care providers. Dental hygiene students were identified as obtaining educational competencies through school-based programs.

Chapter 2 Review of the Literature

Low-income children continue to have greater caries prevalence than higher-income children (Bloom et al., 2013; Dye et al., 2007; Dye et al., 2012; Griffin et al., 2014; USDHHS, 2000). Evidence provided by previous research has identified dental sealants placed and retained on the pit and fissures of occlusal tooth surfaces as the best prevention for dental caries (Ahovuo-Saloranta et al., 2013; Assunção et al., 2014). Beauuchamp et al., 2008; Fontana et al., 2014; USDHHS, 2000). Dental sealants originated in the 1960s and were initially identified to prevent dental caries by providing a protective covering on the occlusal surfaces of teeth (Ahovuo-Saloranta et al., 2013). Throughout the years, dental sealants have demonstrated additional effectiveness in preventing the progression of noncavitated lesions (Ahovuo-Saloranta et al., 2013) and cavitated lesions (Fontana et al., 2014). Although, dental sealants have shown throughout the years to be effective for caries prevention, disparities in obtaining dental sealants continue to be identified with children in low-income families, of Non-Hispanic black or Hispanic ethnicity, and/or with no private dental insurance (Bloom et al., 2013; Dye et al., 2007; Dye et al., 2012; Griffin et al., 2014). School-based dental sealant programs are an ideal setting to provide increased access to preventive care and increase the equality of sealant prevalence for children of all socioeconomic levels (ASTDD, 2014; CDC, 2013c; Dawkins et al., 2013; Siegal & Detty, 2010). Additionally, service learning school-based dental sealant programs provide dental hygiene students opportunities to provide highly needed preventive services to underserved populations and gain competencies in community-based dental services (Devlin, 2011; Keselyak et al., 2011; Simmer-Beck et al., 2011).

Research results from the literature provide an overview of the progress made to address disparities in the oral health of America as they relate to caries prevalence in children (Dye et al., 2007; Dye et al., 2012). Caries prevalence was identified as a continued problem for low-income children (Bloom et al., 2013; Dye et al., 2007; Dye et al., 2012; Griffin et al., 2014; USDHHS, 2000). Dental sealants were identified as a highly effective means to caries prevention (Ahovuo-Saloranta et al., 2013; Assunção et al., 2014; Beauuchamp et al., 2008; Fontana et al., 2014; USDHHS, 2000). School-based dental sealant programs were recognized as the means to provide preventive care to low-income children (ASTDD, 2014; CDC, 2013c; Dawkins et al., 2013; Siegal & Detty, 2010). Dental hygiene students gain experience in providing oral health care to diverse populations within school-based dental sealant programs (Devlin, 2011; Keselyak et al., 2011; Simmer-Beck et al., 2011).

A search was conducted of CINAHL, EBSCOhost, and PubMed, with key terms, dental caries, caries prevalence, dental caries prevention, dental sealants, pit and fissure sealants, school-based programs, school-based dental sealant programs, and publication dates of 5 years. Additionally, governmental agencies within the United States Department of Health and Human Services were searched utilizing the same key terms and all searches yielded the following information.

Caries Prevalence Overview

Between 1970-2000, dental caries rates declined for children within higher income populations; however, low-income and minority ethnic groups did not benefit from the same decrease in caries prevalence (USDHHS, 2000). In 2000, caries prevalence in children, most specifically the underserved populations, was significant

enough to be considered the number one preventable childhood disease (USDHHS, 2000). Years later in 2012, the National Center for Health and Statistics Data Brief identified a continued higher prevalence of dental caries for low-income children and Non-Hispanic black or Hispanic ethnic groups (Dye et al., 2012). Additionally in 2013, dental caries continues to be the most common infectious childhood disease (Çolak, Dülgergil, Dalli, & Hamidi, 2013). Dental caries is a preventable disease that many public health and governmental agencies have tried to address; however, this disease continues to be a serious public health problem for underserved populations (Çolak, Dülgergil, Dalli, & Hamidi, 2013).

To gain a better understanding of childhood caries prevalence, Dye et al. (2007) reviewed the National Health and Nutrition Examination Survey for the years 1988-1994 and 1999-2004 to evaluate past trends in caries prevalence, untreated tooth decay, and dental sealant prevalence of children in America. For this review, Dye et al. (2007) utilized federal poverty levels to identify children's family income levels. Federal poverty levels (FPL) are calculated by the U.S. Department of Health and Human Services yearly (see Table 3) and represent the dollar amounts estimated to be adequate to support a specified household size (USDHHS, 2014).

Table 3

2014 Federal Poverty Levels (https://static.ark.org/eeuploads/hbe/fpl2014_color.jpg)

Household Size	100%	138%	250%	400%
1	\$11,670	\$16,104	\$29,175	\$46,680
2	15,730	21,707	39,325	62,920
3	19,790	27,310	49,475	79,160

4	23,850	32,913	59,625	95,400
5	27,910	38,515	69,775	111,640
6	31,970	44,118	79,925	127,880
7	36,030	49,721	90,075	144,120
8	40,090	55,324	100,225	160,360

The first part of the review by Dye et al. (2007) analyzed the trends for caries prevalence in children ages 6-11 from 1988-1994 and 1999-2004. Figure 1 shows a decrease in caries prevalence in children whose household incomes were at or above the FPL; however, caries prevalence was unchanged among children whose household incomes were below the FPL (Dye et al., 2007).

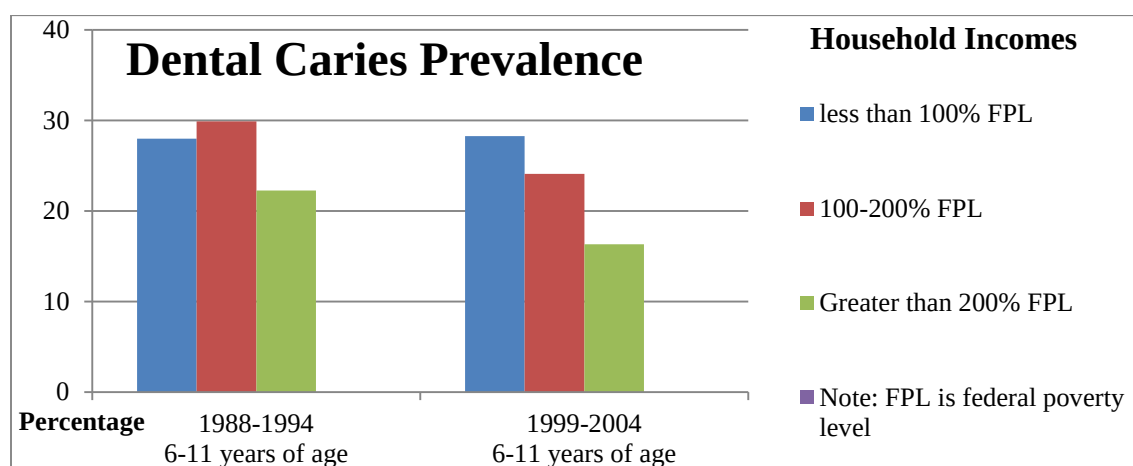


Figure 1. Dental caries prevalence in permanent teeth among children ages 6-11 (Dye et al., 2007)

The second part of the review by Dye et al. (2007) analyzed untreated tooth decay in permanent teeth and identified similar trends as caries prevalence. Figure 2 displays the 1988-1994 results of children with household incomes below the 100% FPL with 3% more untreated tooth decay as compared to children in the 100-200% FPL and 8% more untreated tooth decay than children in the greater than the 200% FPL (Dye et

al., 2007). In 1999-2004 children in the less than 100% FPL and 100-200% FPL were equal on untreated decay as compared to a continued discrepancy of 8% with children in the greater than 200% FPL (Dye et al., 2007).

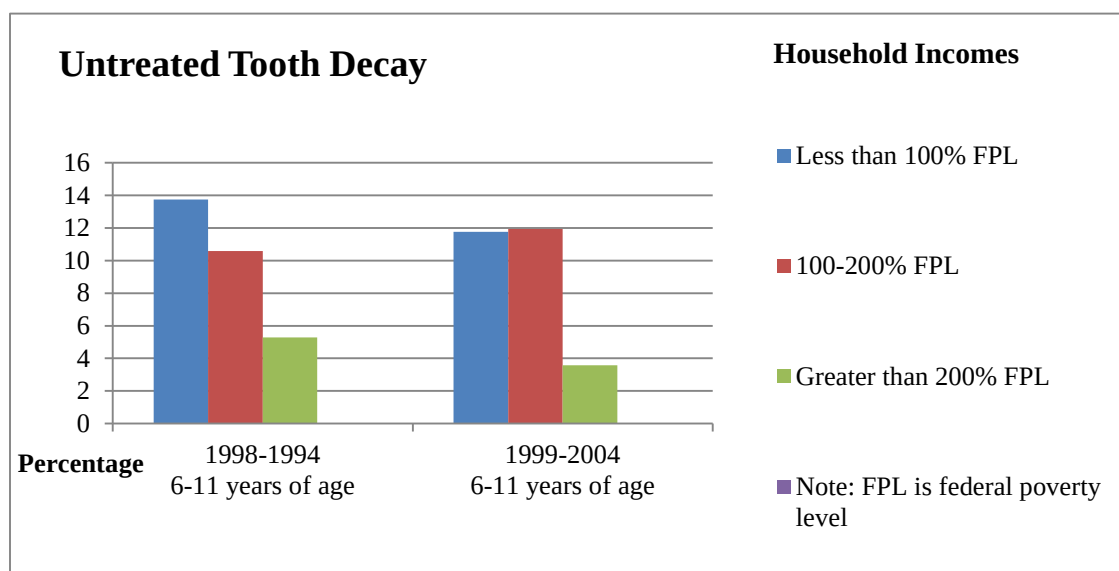


Figure 2. Prevalence of untreated tooth decay in permanent teeth among children ages 6-11 (Dye et al., 2007)

Dye et al. (2007) also analyzed dental sealant prevalence in 1988-1994 and 1999-2004. Similar trends as caries prevalence and untreated dental caries in children ages 6-11 years were identified (Dye et al., 2007). Figure 3 displays the results of a large disparity in children ages 6-11 with dental sealants (Dye et al., 2007). Children in families with incomes greater than 200% FPL received 17% more dental sealants in 1988-1994 and 20% more dental sealants in 1999-2004 as compared to children within the lower federal poverty levels (Dye et al., 2007).

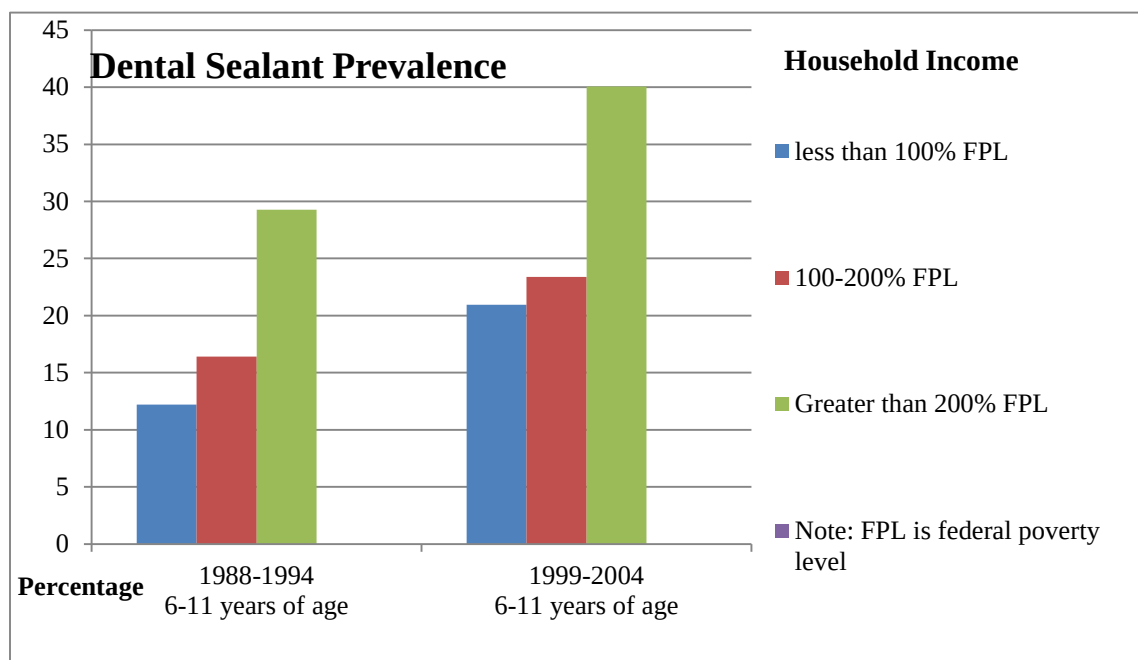


Figure 3. Prevalence of dental sealants on permanent teeth among children ages 6-11 (Dye et al., 2007)

Dye et al. (2007) measured findings from this review towards the national oral health goals found in the Healthy People 2010 objectives. In relation to objectives 21-1b (caries experience) and 21-2b (untreated tooth decay) no significant changes were identified towards attaining a 10% decrease in caries prevalence and untreated decay in the years 1988-1994 and 1999-2004. The trends reviewed by Dye et al. (2007) indicate Americans are not meeting the national oral health goals for all children with an even greater lack of attainment for low-income children (Dye et al., 2007).

An additional report by Dye et al. (2012) provided an updated review of oral health disparities. The Dye et al. (2012) report was organized to monitor health disparities related to the Healthy People 2020 objectives covering select age groups by race, ethnicity, and poverty status. Dye et al. (2012) utilized the data from the 2009-2010 National Health and Nutrition Survey for the analysis. Findings from this report

identified continued disparities in low-income, Non-Hispanic black and Hispanic children in obtaining improved oral health (Dye et al. 2012). Figure 4 displays children ages 6-9 with family incomes below the 100% federal poverty level or Hispanic ethnicity as having the highest prevalence of untreated dental caries. Within the 13-15 age groups the highest prevalence of untreated decay occurred with Non-Hispanic black children and secondly with children below the 100% federal poverty level (Dye et al., 2012).

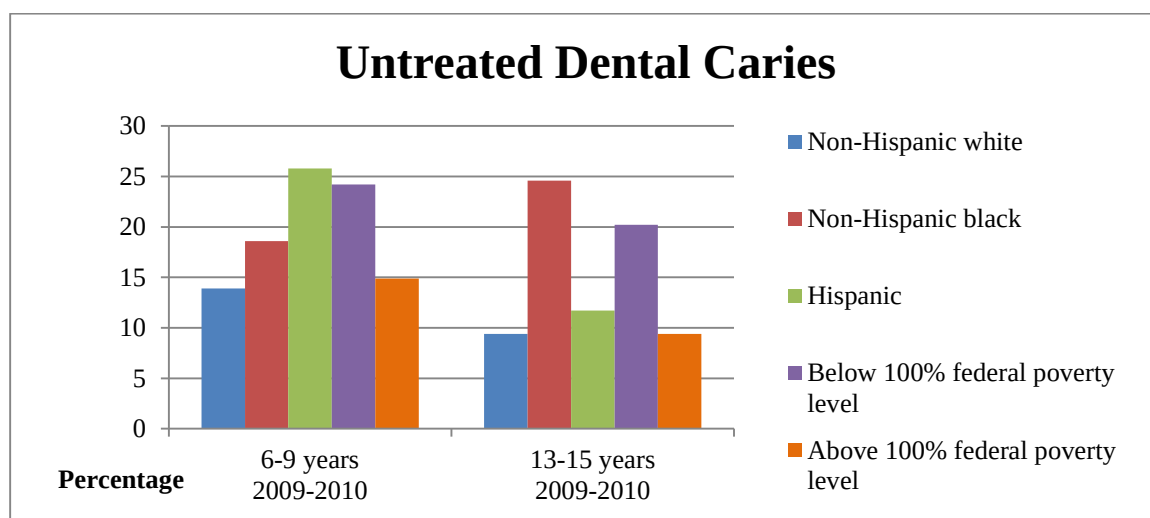


Figure 4. 2009-2010 prevalence of untreated dental caries in children ages 6-9 and 13-15 (Dye et al., 2012).

Additionally, Dye et al. (2012) reviewed the data from the National Health and Nutrition Examination Survey to determine if underserved populations were receiving dental sealants as preventive dental care. Sealant prevalence was determined by at least one dental sealant on a permanent tooth, per child (Dye et al., 2012). Figure 5 displays results for both categories ages 6-9 and 13-15 for sealant prevalence. Findings revealed Non-Hispanic white and children above the 100% federal poverty level continue to have the highest prevalence of dental sealants and confirmed a continued need for increasing access to preventive oral health services for underserved populations (Dye et al., 2012).

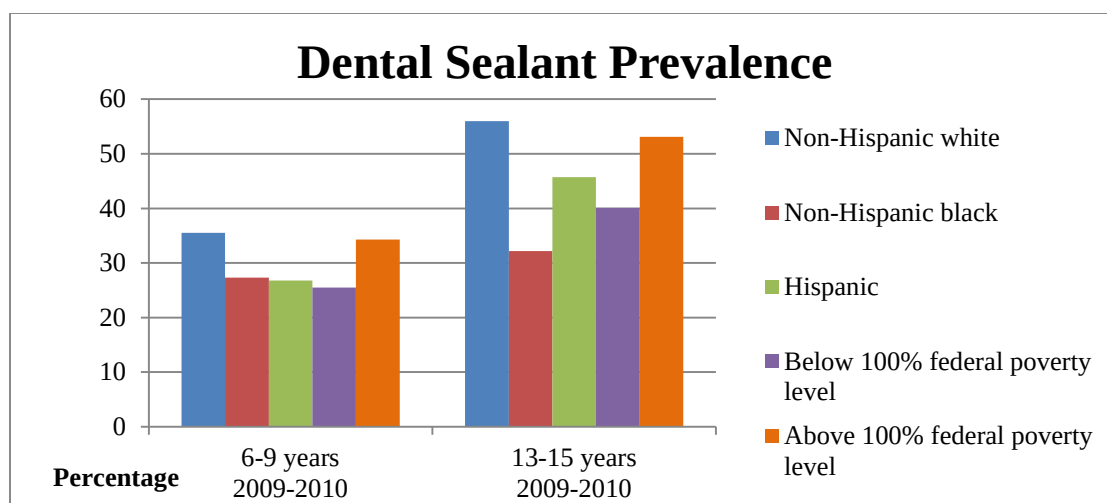


Figure 5. 2009-2010 dental sealant prevalence among children by age, ethnicity and poverty level (Dye et al., 2012).

Additional insight into caries prevalence and obtaining dental care for low-income and uninsured children were identified from reviewing the *Summary Health Statistics for U.S. Children: National Health Interview Survey 2012* (Bloom et al., 2013). The survey identified relationships between children receiving dental services with or without insurance and how income levels factored into children's receiving dental services (Bloom et al., 2013). The survey design utilized a multi-stage cluster sample for the selection of the target population and the questionnaire consisted of three component questions asked of children ages 2-17 within non-military households (Bloom et al., 2013). Findings from the survey identified four million children with untreated dental needs due to insufficient funds (Bloom et al., 2013). Additionally, 21% of uninsured children did not go to the dentist within two years (Bloom et al., 2013). Furthermore, to address the inequality of improved oral health of all American children and to meet the Healthy People 2020 target goal of 44.5% of children and adolescents utilizing the oral health care system, a continued need to increase access to preventive dental care for low income and uninsured children is essential (Bloom et al., 2013).

In 2014, the systematic review conducted by Griffin et al. (2014) suggested disparities in underserved children continue to persist. Caries prevalence in the underserved population and the lack of preventive dental services were identified within a systematic review of the Medical Expenditure Panel Survey by Griffin et al. (2014). The results of this systematic review were published in the September 12, 2014 Morbidity and Mortality Weekly Report, which is often referred to as the voice of the CDC (Griffin et al., 2012). The systematic review identified 43.8% of all children ages 0-21 utilized dental services for needed treatments; however, only 14.2% of the children surveyed received preventive dental treatments (Griffin et al., 2014). Furthermore, Figure 6 displays uninsured, less than 100% federal poverty level, and Non-Hispanic black children as obtaining less dental visits and receiving fewer preventive services compared to all children (Griffin et al., 2014).

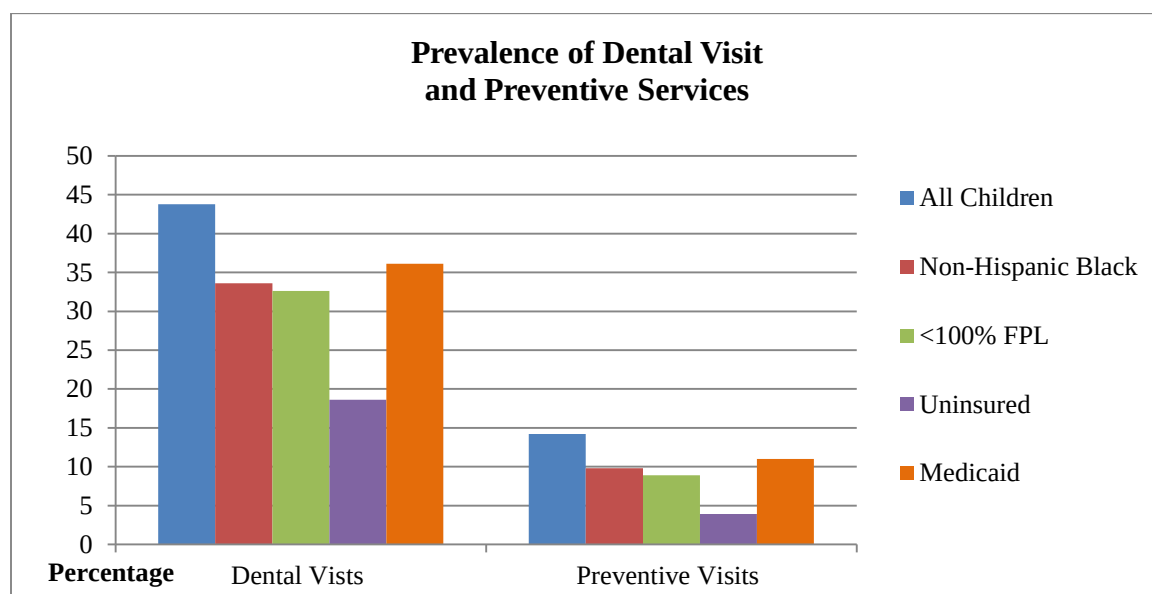


Figure 6. Prevalence of Dental Visits and Preventive Services (Griffin et al., 2014).

Additionally, Griffin et al. (2014) evaluated children ages 5-19 with at least one permanent tooth with a dental sealant. The National Health and Nutrition Examination Surveys for 2005-2010 were analyzed for three cycles to determine dental sealant

prevalence on 8,481 children ages 5-19. The review reported a total of 31.3% of children had sealants, which is above the 28.1% Healthy People 2020 goal of children with dental sealants; however, when analyzed by categories, the underserved populations continue to have the lowest percentages of dental sealant prevalence and are below the Healthy People 2020 goal. Figure 7 outlines the percentages of dental sealant prevalence for underserved children within households of incomes less than 100% poverty level, uninsured, or have an ethnicity of Hispanic or Non-Hispanic black (Griffin et al., 2014). Preventive dental treatments have strong evidence for caries prevention; however, 68.7% of the 8,481 children analyzed did not receive preventive dental sealants. Additionally, children who are uninsured, Hispanic, Non-Hispanic black, or within households with less than the 100% poverty level, continue to exhibit an inequality of obtaining preventive dental treatments (Griffin et al., 2014).

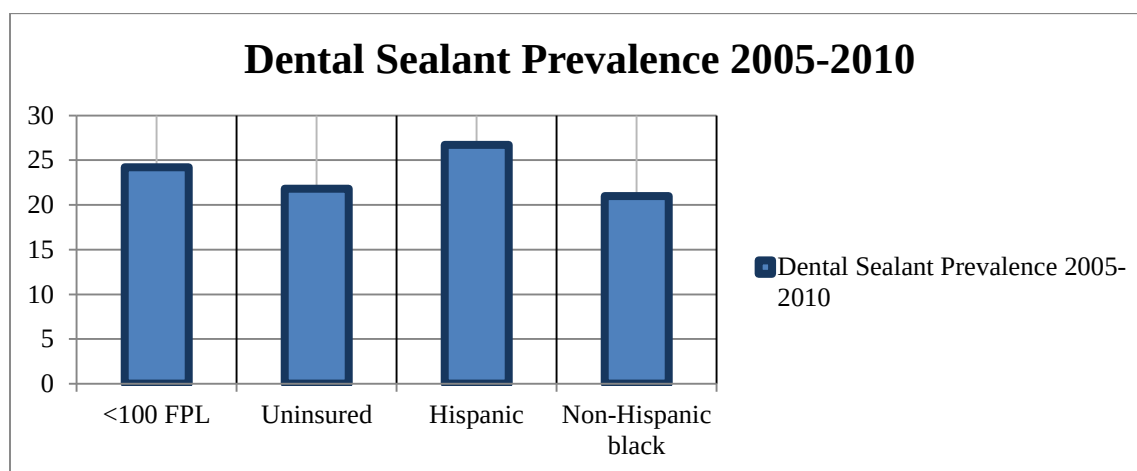


Figure 7. Dental sealant prevalence for children ages 5-19 from the National Health and Nutrition Examination Survey and the Medical Expenditure Panel Survey, 2005-2010

From 1970 to 2014, higher caries prevalence and untreated dental decay has persisted for children within low-income households, uninsured, and Non-Hispanic black and Hispanic ethnicity (Bloom et al., 2013; Dye et al., 2007; Dye et al., 2012; Griffin et al., 2014). Additionally, the use of dental sealants for caries prevention was greatly

underutilized by all children; however, underserved children from 2007-2014 were observed to have the lowest dental sealant prevalence (Bloom et al., 2013; Dye et al., 2007; Dye et al., 2012; Griffin et al., 2014). Furthermore, research identifies dental sealants as a highly effective means for reducing caries prevalence (Ahovuo-Saloranta et al., 2013; Assunção et al., 2014; Beauchamp et al., 2008). The following section identifies evidence into the efficacy of dental sealants for caries prevention.

Dental Sealant Overview

Historical research studies identified dental sealants as an effective means for caries prevention in children with higher caries risk (Dye et al., 2007; USDHHS, 2000). Dental sealants from 1960-2014 have transcended on an evidence-based journey, which established the efficacy of caries prevention (Ahovuo-Saloranta et al., 2013; Assunção et al., 2014; Beauchamp et al., 2008; Fontana et al., 2014). Early clinical evidence determined the primary function of dental sealants in cavity prevention was a protective barrier, which was resistant to acids found in the oral cavity (Ahovuo-Saloranta et al., 2013; USDHHS, 2000). As clinical evidence progressed, dental sealants demonstrated an ability to slow or stop the progression of noncavitated and cavitated lesions (Ahovuo-Saloranta et al., 2013; Assunção et al., 2014; Beauchamp et al., 2008; Fontana et al., 2014).

In 2008, the *Evidence-Based Clinical Recommendations for the Use of Pit and Fissure Sealants* was one of the key systematic reviews, which acknowledged dental sealants as a means to stop noncavitated lesion progression and identified how the results applied to clinical implementation (Beauchamp et al., 2008). In that review, a select panel of experts from the American Dental Association (ADA) Council on Scientific Affairs

evaluated systematic reviews and clinical trials selected by the ADA Center for Evidence-based Dentistry (Beauchamp et al., 2008). The panel evaluated the selected data and developed clinical recommendations for the use of dental sealants on sound and noncavitated tooth surfaces (Beauchamp et al., 2008). The developed recommendations were reviewed and analyzed by external scientific experts. Following the external reviews, revisions were completed, submitted, and approved by the ADA Council on Scientific Affairs (Beauchamp et al., 2008). The evidence-based clinical recommendations regarding pit and fissure sealants covered five main areas (see Table 4). A current search of the ADA website revealed clinical recommendations developed by Beauchamp et al. (2008) for dental sealants remained unchanged from the original recommendations listed in Table 4.

Table 4

Evidence-based clinical recommendations for the use of pit-and-fissure sealants (Beauchamp et al., 2008, p. 263)

ADA Recommendations	
1. Caries Prevention	Sealants should be placed in pits and fissures of children's primary teeth when it is determined that the tooth, or the patient, is at risk of developing caries. Sealants should be placed on pits and fissures of children's and adolescents' permanent teeth when it is determined that the tooth, or the patient, is at risk of developing caries. Sealants should be placed on pits and fissures of adults' permanent teeth when it is determined that the tooth, or the patient, is at risk of developing caries.
2. Noncavitated Carious Lesions	Pit and fissure sealants should be placed on early (noncavitated) carious lesions, as defined in this document, in children, adolescents and young adults to reduce the percentage of lesions that progress.

	Pit and fissure sealants should be placed on early (noncavitated) carious lesions, as defined in this document, in adults to reduce the percentage of lesions that progress.
3. Resin- Based	Resin-based sealants are the first choice of material for dental sealants.
4. Glass Ionomer Cement	Glass ionomer cement may be used as an interim preventive agent when there are indications for placement of a resin-based sealant but concerns about moisture control may compromise such placement.
5. Placement Techniques	A compatible one-bottle bonding agent, which contains both an adhesive and a primer, may be used between the previously acid-etched enamel surface and the sealant material when, in the opinion of the dental professional, the bonding agent would enhance sealant retentions. Use of available self-etching bonding agents, which do not involve a separate etching step, may provide less retention than the standard acid-etching technique and is not recommended. Routine mechanical preparation of enamel before acid-etching is not recommended. When possible, a four-handed technique should be used for placement of resin-based sealants. The oral health care professional should monitor and reapply sealants as needed to maximize effectiveness.

Continued research by Ahovuo-Saloranta et al. (2013); Assunção et al. (2014); and Fontana et al. (2014) provided information on the correlation of dental sealants and caries prevention related to sound, noncavitated, or cavitated tooth structures and the most effective dental sealant materials. In 2013, a well-respected Cochrane Collaboration conducted an updated systematic review led by Ahovuo-Saloranta et al. to determine the efficacy of dental sealants on preventing caries in sound permanent tooth structure. An initial search identified 3,982 studies, including 3,507 studies from the previous 2008 systematic review (Ahovuo-Saloranta et al., 2013). Following specified inclusion criteria,

34 studies were identified for a two-part review. The first part utilized 13 studies to determine the difference of caries prevalence in premolars and molars with dental sealants, and caries prevalence in premolars and molars without dental sealants (Ahovuo-Saloranta et al., 2013). To determine caries prevalence in children ages 5-10 with and without a resin sealant, an outline was created to determine the presence of caries at 12, 24, 36, and 48-54 months. At 12 months, children ages 5-10 without a resin sealant were six times more likely to develop a carious lesion as those with a resin sealant (Ahovuo-Saloranta et al., 2013). Additionally, at 48-54 months teeth without a resin sealant were 21 more times likely to develop a carious lesion as those with a resin sealant. Further research is needed to determine caries reduction in premolars and molars with dental sealants after 54 months (Ahovuo-Saloranta et al., 2013).

The second portion of the systematic review utilized the additional 22 studies to compare the difference of resin-based and glass ionomer retention rates (Ahovuo-Saloranta et al., 2013). Resin-based dental sealants exhibited an 80% retention rate after 12 and 24 months and a 78% retention rate at 36 months (Ahovuo-Saloranta et al., 2013). Only one study that met specified inclusion was found on glass ionomer sealant retention; a low retention rate was identified (Ahovuo-Saloranta et al., 2013). Further research is needed to determine if resin based dental sealants have higher retention rates, which lead to decreased caries incidence, compared to glass ionomer dental sealants (Ahovuo-Saloranta et al., 2013).

In 2014, Assunção et al. conducted further research on the effects of resin-based and glass ionomer dental sealants on arresting noncavitated lesions from disease progression. Noncavitated lesions were defined as caries not involving the dentin

(Assunção et al., 2014). An initial search of worldwide databases identified 204 research reports. Utilizing specified inclusion criteria, five articles qualified for the systematic review. The five studies included in the research involved one study on glass ionomer and four studies on resin-based dental sealant placements on noncavitated lesions (Assunção et al., 2014). The glass ionomer dental sealants demonstrated a rapid loss of retention, leaving the pit and fissures susceptible to caries progression. A six month evaluation noted visual cavitation of noncavitated lesions in areas of glass ionomer dental sealant loss (Assunção et al., 2014). The resin based dental sealant placement on previous noncavitated lesions demonstrated a high retention rate and an arrest of noncavitated lesion progression up to 38 months. Studies with longer durations are needed to determine continued arrest of noncavitated lesion past 38 months (Assunção et al., 2014).

An additional study by Fontana et al. (2014) examined the effect dental sealants had on carious tooth structure for 44 months. Following examinations for inclusion criteria, 77 children ages 7-10 with at least two permanent molars qualified for the study. Baseline information for sound or carious tooth structure was detected by means of International Caries Detection and Assessment System, DIAGNOdent®, quantitative light-induced fluorescence, and radiographs (Fontana et al., 2014). Once tooth structure was examined, all but one child (in which a strong gag reflex prevented isolation) was isolated with the Isolite system and clear dental sealants were placed on examined permanent molars (Fontana et al., 2014). Post sealant examinations were completed at 1, 12, 24 and 44 months utilizing the same caries detection methods at baseline (Fontana et al., 2014). The study population was determined to be high risk children because to 71% of the children had untreated caries at baseline (Fontana et al., 2014). Figure 8 shows the

International Caries Detection and Assessment System (ICDAS) assigned numerical scores, determined by the severity of the carious lesion.

Sound Tooth Structure	Early Stage Decay		Established Decay		Severe Decay	
Sound	First visual change in enamel	Distinct visual change in enamel	Localized enamel breakdown	Underlying dentin shadow	Distinct cavity with visible dentin	Extensive cavity With visible dentin
0	1	2	3	4	5	6

Figure 8. International Caries Detection and Assessment System scoring system (<https://www.icdas.org/>)

The Fontana et al. (2014) study monitored carious lesions under clear dental sealants, which were placed by a single experienced dentist, for advancement of the carious lesion from baseline to 44 months. Findings were considered significant if the ICDAS scores of 0-2 progressed to a 3 or higher, baseline of 3 progressed to 4 or higher, and baseline of 4 progressed to a 5 or higher. The results of the Fontana et al. study determined there were no significant increases in ICDAS scores at one month and a small indication of ICDAS change at 12, 24 and 44 months. Of the 228 teeth evaluated, only four teeth progressed into ICDAS score of ≥ 5 (Fontana et al., 2014). Results from this study suggest that children with carious lesions at various stages of progression benefit from dental sealant placement over a 44 month period (Fontana et al., 2014). Additionally, placing dental sealants on carious lesions did not reveal an increased growth of carious bacteria and may have decreased the number of teeth in need of restorative treatments (Fontana et al., 2014).

Dental sealants effectively prevent caries on sound and noncavitated pit and fissure surfaces when resin-based dental sealants are properly placed; however, this procedure is greatly underutilized in America with underserved populations benefitting

the least (Ahovuo-Saloranta et al., 2013; Assunção et al., 2014; Beauchamp et al., 2008; USDHHS, 2000). School-based programs are one means to address disparities in access to preventive dental care for underserved populations of children (CDC, 2013c; Siegal & Detty, 2010; USDHHS, 2000).

School-Based Sealant Programs

Research by Dye et al. (2012), Bloom et al. (2013), and Griffin et al. (2014) reported higher caries rates and lower sealant prevalence still exist for children below the 100% federal poverty level, and for those who are Hispanic, Non-Hispanic black, and uninsured. School-based dental sealant programs (SBDSP) target schools with a high prevalence of low-income children in an effort to address the inequality of preventive dental care within these populations (CDC, 2013b). A study by Siegal and Detty (2010) researched the effectiveness of SBDSPs in reaching high risk children. All schools in Ohio with a third grade were considered for the study and were selected by means of a stratified, clustered random sample (Siegal & Detty, 2010). Children in the third grade of 374 schools were classified as low or high risk depending on qualifications for free or reduced lunch programs (Siegal & Detty, 2010). Initial findings indicated children in schools with school-based dental sealant programs were twice as likely to have a sealant as compared to children in schools without school-based dental sealant programs (Siegal & Detty, 2010). Further statistical analysis identified equality in sealant prevalence for high and low risk children at schools with a SBDSP (Siegal & Detty, 2010).

Dawkins et al. (2013) agreed with the findings by Siegal and Detty (2010) that school-based dental sealant programs increased equality of care between children of different social, economic, and cultural backgrounds because all children are allowed to

participate. An even greater access to preventive dental care was investigated by Dawkins et al. (2013) with an evaluation of a mobile dental sealant program in Kentucky. Many Kentucky children live in rural areas and have higher decay rates compared to the national average (Dawkins et al., 2013). An estimated 50% of second grade children in Kentucky have tooth decay, which increased to 75% for adolescents 15 and older (Dawkins et al., 2013). Children living in rural areas often do not have access to school-based programs, which creates a need for community dental programs in Kentucky to be mobile (Dawkins et al., 2013). The Institute for Rural Health at Western Kentucky University in 2001 developed a mobile dental sealant program to increase access to preventive care for children (Dawkins et al., 2013). An evaluation of the mobile program allowed Dawkins et al. (2013) to determine if 2,453 children ages 6 to 15 with untreated caries would correlate to rural location, age, and lack of private dental insurance status (Dawkins et al., 2013). The results of the analysis identified children living in rural areas had the highest caries rate at 62.9%, and 49.0% of children in the 8-9 age group presented with the second highest caries rates (Dawkins et al., 2013). Children with a lack of private dental insurance had 13.9% caries prevalence, much lower than expected (Dawkins et al., 2013). Implications from this study suggested mobile or school-based dental programs are necessary to increase access to preventive care for low-income children before the age of eight (Dawkins et al., 2013).

Additional considerations for school-based dental sealant programs are the potential to provide more than preventive dental services to low-income children (Detty & Oza-Frank, 2014). Access to preventive dental care lowers caries prevalence and can inadvertently affect academic performance (Detty & Oza-Frank, 2014). A study

conducted by Detty and Oza-Frank (2014) investigated this possibility by analyzing third grade students in Ohio elementary schools. The study utilized two documents: Ohio Health Department's state-wide survey of oral health among third grade children and yearly achievement tests from the Ohio Department of Education (Detty & Oza-Frank, 2014). Linear regression was used to determine if there was an association between untreated caries in third grade children and academic performance; regression coefficients and P-values were used to determine statistical significance (Detty & Oza-Frank, 2014). The results of this study showed untreated decay as having a statistically significant effect on academic performance at schools without a school-based dental sealant program (Detty & Oza-Frank, 2014). Comparatively, untreated decay did not have a statistically significant effect on academic performance at schools with school-based dental sealant programs (Detty & Oza-Frank, 2014). In addition to caries prevention identified by previous research, this study revealed school-based dental sealant programs could have a positive effect on academic performance (Detty & Oza-Frank, 2014).

School-based dental sealant programs have gained momentum since the 2000 Surgeon General report and have been strongly endorsed by organizations such as the ADA, ASTDD, CDC and the Oral Health of America's Smiles Across America program (Oral Health of America, 2015). Smiles Across America practitioners partnered with public schools and community oral health providers in 2004 to help communities respond to the critical need for oral health promotion (Oral Health of America, 2015). This organization provides resources and technical assistance to community programs, especially school-based dental sealant programs (Oral Health of America, 2015).

The Idaho Oral Health Program is an additional agency in support of school-based dental sealant programs. This state agency collects and reports data, which provides valuable information for oral health professionals to develop community programs based on need (Idaho Department of Health and Welfare, 2014). The Idaho Oral Health Program relies on school-based dental sealant programs to evaluate and report findings for continued monitoring of sealant prevalence and oral health (Idaho Department of Health and Welfare, 2014).

The CDC is an additional governmental agency with strong endorsements for SBDSPs. In 2009, the CDC developed recommendations for dental sealant use in school-based programs (Gooch et al., 2009). The recommendations were developed by Gooch et al. (2009) and followed similar guidelines as the ADA's 2008 report (see Table 5). Gooch et al. (2009) searched MEDLINE, Embase, Cochrane Library, and Web of Science to identify clinical studies for determining effectiveness of dental sealants in managing caries progression and bacterial levels (Gooch et al., 2009). The committee performed a systematic review on clinical studies to address dental professionals' concerns with dental sealants placed on noncavitated and cavitated teeth causing an increase in lesions masked by a dental sealant (Gooch et al., 2009). Table 5 provides the CDC's recommendations for school-based sealant programs developed following the systematic review (Gooch et al., 2009).

Table 5

Recommendations for School-Based Sealant Programs (Gooch et al., 2009, p. 1362)

Topic	CDC Recommendations
Indications for Sealant Placement	Seal sound and noncavitated pit and fissure surfaces of posterior teeth, with first and second permanent molars receiving highest priority.
Tooth Surface Assessment	Differentiate cavitated and noncavitated lesions. ▪ Unaided visual assessment is appropriate and adequate. ▪ Dry teeth before assessment with cotton rolls, gauze or, when available, compressed air. ▪ An explorer may be used to gently confirm cavitations (that is, breaks in the continuity of the surface); do not use a sharp explorer under force. ▪ Radiographs are unnecessary solely for sealant placement. Other diagnostic technologies are not required.
Sealant Placement and Evaluation	Clean the tooth surface. ▪ Toothbrush prophylaxis is acceptable. ▪ Additional surface preparation methods, such as air abrasion or enameloplasty, are not recommended. Use a four-handed technique, when resources allow. Seal teeth of children even if follow-up cannot be ensured. Evaluate sealant retention within one year.

In 2013, the CDC updated the Gooch et al. (2009) recommendations and included information on oral health professional's competencies in utilizing visual examination of a tooth structure as an adequate means in determining the need for sealant placement. X-rays are not needed to determine sealant placement (CDC, 2013d). Cost effective recommendations for SBDSP were placing dental sealants on children ages 6 and 12, soon after first and second molar eruption (CDC, 2013d). Additionally, evaluation of dental sealants at one year is still recommended; however, the updated report determined children are not in danger of increased caries if a maintenance appointment cannot occur (CDC, 2013d). Furthermore, educating parents, children, and clinicians about the value of dental sealants could help to eliminate barriers to a successful program (CDC, 2013d). Likewise, school-based dental sealant programs continuing success depends on program administrators staying current with state and local needs of target populations (CDC, 2013d).

Another governmental agency with strong endorsements for SBDSPs is the Community Preventive Services Task Force, which was established in 1996 to provide continuous research needed for community programs (CDC, 2013a). A panel of public health and prevention experts makes up the fifteen members Task Force, and is appointed by the Director of the CDC (CDC, 2013a). The Community Preventive Service Task Force reviewed the 2013 Cochrane systematic review and three additional studies of dental sealant programs to develop recommendations for school-based dental sealant programs (CDC, 2013c). Table 6 outlines the Task Force's recommendations for dental sealant placement on permanent molars of children participating in (on-site and off-site) school-based dental sealant programs (CDC, 2013c).

Table 6

Considerations and limitations for SBDSP (CDC, 2013c, p. 2)

Considerations and Limitations for School-Based Dental Sealant Programs	
1	Sealant application demands meticulous technique, and licensed dental health professionals should consult the manufacturer's instructions for use of specific sealant products in either school settings or offsite dental clinics.
2	Despite few studies focusing on the effectiveness of school-based sealant delivery programs, they demonstrate a large reduction in caries and the evidence is strong with regard to the efficacy of sealants placed in a school setting. The majority of this evidence comes from studies of children aged 5-10 years. Ideally, sealants should be applied as soon as possible after tooth eruption.
3	There is a general lack of evidence, in favor or against, school-based programs that apply sealants off-site in dental clinics. There is no evidence to suggest sealant efficacy would be reduced in programs that applied sealants off-site in dental clinics; however it is anticipated that participation rates may be affected.
4	Maintenance is encouraged, but a lack of resources or opportunities to maintain sealants should not be a reason not to apply them to high risk children.
5	Potential barriers to the implementation of school-based sealant delivery programs include the education of parents, children, and clinicians with regard to the value of pit and fissure sealants; socioeconomic issues including the proficiency and use of English language; and the availability of funding for public programs.

In addition to the CDC's 2009 recommendations and the Community Preventive Task Force's considerations and limitations for school-based dental sealant programs, the

ASTDD (2014) developed an additional guideline for school-based dental sealant programs. The ASTDD's (2014) best practice approaches for community and states oral health programs included:

1. Deliver dental sealants to a large number of high-risk children.
 2. Maximize program efficiency by minimizing children's time away from the classroom, utilizing cost effective methods, four-handed dentistry, and selection of sealant material.
 3. Maintain a quality assurance system by use of consent forms, infection control, implementing HIPAA regulations, and sealant retention.
 4. Identify children with treatment needs and ensure they receive appropriate care.
 5. One year reevaluation to check retention and apply new dental sealants as 1 year needed.
 6. Maintain descriptive data, which can be reported to state dental directors for the ASTDD, and to determine if SBDSP goals and objectives were met.
- (a) School-based dental sealant programs must have a plan for covering expenses required for sustainability. (p. 4-7)

School-based dental sealant programs have strong endorsements from the ASTDD (2014), CDC (2013c), and Oral Health of America (2015) and have established efficacy in bringing equality of dental sealant prevalence to high and low income children (Dawkins et al., 2013; Siegal & Detty, 2010). Guidelines have been established to provide guidance for implementation of school-based dental sealant programs (ASTDD, 2014; CDC, 2013c; Gooch et al., 2009). Additionally, evaluations of programs are

important to determine sealant retention and gathering quantitative data to be utilized by state and national organizations (ASTDD, 2014; CDC, 2013c).

Service-Learning School-Based Sealant Programs

School-based dental sealant programs provide access to preventive oral health care for high risk children; however, acquiring funding and implementing programs can be time consuming and costly (ASTDD, 2014; CDC, 2013c). Programs developed and implemented by a university are cost effective and provides students with service-learning opportunities (ASTDD, 2014). In 2000, a Massachusetts dental school formed a collaborative partnership with surrounding elementary schools and began the planning phase of a SBDSP. A needs assessment was conducted for the local community and children in low-income families were identified as the target population (Devlin, 2011). Three elementary schools with close to 50% of children who qualified for free or reduced lunch were targeted as the initial sites for program implementation (Devlin, 2011). Staffing for the program included a dentist, dental hygienist, dental assistant, and the dental school's program director (Devlin, 2011). In 2002 to 2003, the dentist performed dental screenings and the dental hygienist placed dental sealants on third grade children with informed consent (Devlin, 2011). Baseline data were collected from the screenings and served as the comparative data for the upcoming implementation of oral health services for second grade children (Devlin, 2011). In 2004, the SBDSP expanded to all eight Framingham elementary schools and data were assessed over a six year period. In 2003-2004, dental screenings were provided for 286 second grade children; 88 of those children had restored teeth and 84 had active decay. The final screening in 2008-2009, revealed 284 second grade children received dental screenings; 115 of the 284 had

restored teeth and 85 had active decay (Devlin, 2011). Furthermore, in 2008-2009 the SBDSPs only fell one percent short of meeting the Healthy People 2010 objective of 50% of children 8 years of age with at least one dental sealant (Devlin, 2011). Data collected from second grade children (2003 to 2009) exhibited a fluctuation in results; however, the overall trend was toward oral health improvement (Devlin, 2011). The dental school's SBDSP provided valuable community preventive services and was a successful program; however, the Massachusetts dental school missed the opportunity to provide dental students service-learning opportunities that may have influenced a desire to serve the community following graduation.

Another successful school-based dental sealant program developed by a university was the Miles of Smiles clinic. The University of Missouri-Kansas City collaborated with the local community and developed this successful program (Keselyak et al., 2011; Simmer-Beck et al., 2011). Different than Massachusetts' dental school, the Missouri program administrators seized the opportunity to provide dental hygiene students with service learning opportunities. Two reports on the Miles of Smiles clinic were created to provide a descriptive overview of the program by Simmer-Beck et al. (2011) and discuss dental hygiene students' experiences (Keselyak et al., 2011). The Miles of Smiles target population included four Title I schools, located in one school district. The highest percentages of students were Hispanic resulting in Spanish as the most common language (Simmer-Beck et al., 2011). Consent forms were given to parents and had to be returned prior to the child receiving treatment. All children, even those who did not qualify for free or reduced lunch, were eligible for oral health services (Simmer-Beck et al., 2011). The 2003 Kansas Dental Practice Act allowed dental hygienists with

an extended access license to provide preventive services without supervision by a dentist (Simmer-Beck et al., 2011). New state regulations allowed increased access to oral healthcare for underserved populations, while the role of the dental hygienist was expanded (Simmer-Beck et al., 2011). Dental hygiene students, under the supervision of faculty, utilized expanded state regulations and provided oral health services to 339 underserved children during the school year 2008 to 2009. Summary of services included: 350 prophylaxis, 272 bitewing radiographs, 302 dental sealants, 342 fluoride varnish, 339 oral health education and nutrition counseling; 214 children were referred to a dentist for active decay (Simmer-Beck et al., 2011).

Prior to dental hygiene students providing care to 339 underserved children, students were required to review current research on target populations. Following the review students were asked to create a document describing the mission statement of what and how dental hygiene students could help with fulfilling the mission (Keselyak et al., 2011). The Miles of Smiles clinical rotations involved dental hygiene students to provide preventive treatments two times, within one week during the fall semester, and one rotation in the spring.

Self-reflection journals were assigned after clinical rotations to document personal experiences (Keselyak et al., 2011). These data were analyzed using qualitative methods and five key topics from the dental hygiene student's self-reflection journals were acknowledged by faculty (Keselyak et al., 2011). First, students identified an increased skill development in caring for children within diverse populations. Second, an increased awareness within the local community and additional identification of roles a dental hygienist may fulfill in public health. Third, students enjoyed service-learning due

to a more relaxed atmosphere compared to dental hygiene school. Fourth, students had opportunities to gain experiences in providing a variety of preventive oral health services using portable equipment. Fifth, students acknowledge increased competences in problem solving, organization and compassion (Keselyak et al., 2011). Service-learning experiences within entry-level curriculum provide students with increased skill development and community awareness. Furthermore, dental hygiene students learn to work collaboratively with other health care professionals and ultimately gain personal satisfaction in providing care for underserved populations (Keselyak et al., 2011).

Summary of Chapter 2

Disparities in caries reduction and access to care continues to be evident in low-income children (Bloom et al., 2013; Dye et al., 2007; Dye et al., 2012; USDHHS, 2000). Fluoride and dental sealants have strong evidence supporting caries reduction for all children (Ahovuo-Saloranta et al., 2013; Assunção et al., 2014; Gooch et al., 2009; USDHHS, 2000). School-based dental sealant programs were developed to address disparities in caries prevalence and increase access to care for low-income children. The ASTDD, (2014), CDC (2013b), CDC (2013c); USDHHS (2000) recommend the use of SBDSP's due to strong evidence supporting dental sealants efficacy in caries reduction. A study reviewed by the CDC (2013c) identified increased sealant prevalence for all children within a SBDSP, thereby reducing the disparity of lower sealant prevalence associated with low-income children. The ASTDD (2014) provided information for best practice approaches for SBDSP's. Examples of well-established SBDSP were identified for dental professionals with a vested interest in starting a SBDSP (ASTDD, 2014). Keselyak et al., (2011); Simmer-Beck et al. (2011) identified SBDSP's as providing a

two-fold benefit; dental hygiene students gain skills in school-based service learning and low-income children benefit from preventive oral health services. The Department of Dental Hygiene at ISU implemented the Bengal Smiles SBDSP as a two-fold beneficial program.

Evaluation of the Bengal Smiles SBDSP may provide quantitative data utilized by the Idaho Oral Health Project (Idaho Department of Health and Welfare, 2014) and the ASTDD (2014). Additionally, evaluation of programs ensures quality oral health services are provided to address the needs of low-income children in Southeast Idaho (CDC, 2013b; CDC, 2013d). Therefore, the purpose of this study is to evaluate the effectiveness of a school-based dental sealant program based on the rate of decay, dental sealant placement, dental sealant retention, dental sealant decay rate, and referral treatment at 12 months after program implementation.

Chapter 3 Methodology

The current quasi-experimental study evaluated the effectiveness of a school-based dental sealant program on decay rate, dental sealant placement, dental sealant retention rate, dental sealant decay rate, and treatment referral rates. The following sections provide an overview of the study that includes a description of the design, sample population, context of the study, data collection methods and instruments utilized for the study, limitations of the study, and proposed statistical analysis.

Design

Overview of study. In the spring of 2014, the ISU Department of Dental Hygiene implemented a school-based dental sealant program called Bengal Smiles. Under the supervision of faculty, dental hygiene students screened children at a Southeast Idaho Title 1 elementary school for dental caries and dental sealant placement. When dental sealants were indicated, dental hygiene students provided the treatment under faculty supervision. In the fall of 2014, an ISU Department of Dental Hygiene community outreach coordinator and the principal investigator reevaluated children with active lesions who required a dental referral. Follow-up with the parents of children with continued active dental caries were initiated by elementary school administrators and staff members who had access to parent contact information. Children initially treated in the spring 2014 Bengal Smiles program (still attending the Southeast Idaho Title 1 elementary school) were reevaluated and received new preventive treatments as indicated in the spring of 2015. Bengal Smiles reevaluations included screenings for decay rate, dental sealant retention, dental sealant decay rate, and the need for dental sealant placement.

The null hypotheses tested in this study were:

- 1) There is no statistically significant difference in the decay rate at baseline and at 12 months after implementation of a school-based dental sealant program.
- 2) There is no statistically significant difference in the dental sealant placement rate at baseline and at 12 months after implementation of a school-based dental sealant program.
- 3) There is no statistically significant difference in the dental sealant retention rate at baseline and at 12 months after implementation of a school-based dental sealant program.
- 5) There is no statistically significant difference in the referral treatment rate at baseline, six months, and at 12 months after implementation of a school-based dental sealant program.

The research question examined in this study was: (1) What is the dental sealant decay rate at 12 months after implementation of a school-based dental sealant program?

Research design. A quasi-experimental research design with no randomization was selected for this study. Quasi-experimental designs are often used in community-based participatory research (Perrin, 2015). This type of design allowed a means to test the null hypotheses on decay rate, dental sealant placement, dental sealant retention, and dental sealant decay rate by using a t-test to analyze data collected at baseline and 12 months (LoBiondo-Wood & Haber, 2006). Additionally, the null hypothesis for referral treatment rate was tested by utilizing an ANOVA statistical analysis on data collected at baseline, six month, and 12 month periods (LoBiondo-Wood & Haber, 2006).

Research Context

The Department of Dental Hygiene at Idaho State University (ISU) implemented a school-based dental sealant program called Bengal Smiles in the spring of 2014. The Bengal Smiles program was aimed at providing oral health preventive care to low-income children in a Southeast Idaho Title 1 elementary school. A program planning needs assessment identified caries prevalence for third graders in Idaho was 61.8%, which is 12.8% higher than the Healthy People 2020 goal (Idaho Department of Health and Welfare, 2014). Additionally, an evaluation of ethnicity revealed a predominately Caucasian city with Non-Hispanic blacks accounting for .8% of the population and Hispanic accounting for 14.6% of the population in Pocatello (The U.S. Census Bureau, 2009-2013). Furthermore, an assessment of the federal poverty level revealed 12.4% of Pocatello Idaho families as having incomes below the federal poverty level (FPL). Pocatello has a greater percentage of its people below the FPL as compared to the entire states 11% average (The U.S. Census Bureau, 2009-2013). Findings from these data support the need for school-based dental sealant programs in Pocatello Idaho.

Implementation of the sealant program followed the recommendations of the ASTDD (2014), CDC (2013c), and USDHHS (2000), to provide increased access to preventive oral health services for low-income children at Title 1 elementary schools. Portable equipment and supplies were made available by grant funding through the Ronald McDonald House of Charities of Idaho and Idaho Power. Following the recommendation by Assunção et al. (2014) for the use of resin-based dental sealant materials, Ultraseal XT® hydro was utilized for dental sealant placement.

ISU dental hygiene students gained service-learning experiences by providing oral health education, dental sealant placement, and fluoride varnish applications under faculty supervision. Additionally, the students gained experience in using indices for dental screenings. The American Dental Education Association (ADEA, 2004) identified community involvement (CM) competencies for dental hygiene students to meet prior to entrance into the dental hygiene profession. The Bengal Smiles program allowed students to meet competency: CM.2 Provide screening, referral, and educational services that allow clients to access the resources of the health care system. CM.3 Provide community oral health services in a variety of settings (ADEA, 2004).

Research Participants

Sample description. The target population (N=282) were children ages 6-12 at a Southeast Idaho Title 1 elementary school. The sample (n=54) consisted of children ages 7-12 with oral health care at a Southeast Idaho Title 1 elementary school. A nonprobability convenience sample was utilized for this study due to the need for specific demographic characteristics (Perrin, 2015). Sample selection criteria included children ages 6-12 with signed consent forms allowing treatment for preventive oral health services. Children were not required to qualify for free or reduced lunch to be included in the study. Exclusion criteria included children without signed consent forms.

Human subject's protection. The Human Subjects Committee does not require formal approval for the evaluation of the Bengal Smiles program (see Appendix C). The data that will be analyzed for the study are considered assessment of a program and does not require Human Subjects Committee involvement. Although Human Subjects Committee involvement was not required, core values of autonomy and confidentiality

were followed to gain societal trust. Consent forms were created for the Bengal Smiles program allowing parents to choose if children could participate. Information collected was placed in a chart and locked in a filing cabinet at ISU's Department of Dental Hygiene building. Data utilized for the study were kept confidential by replacing children's names with a number. A private room was used for dental screenings and preventive treatments. Information sent home to parents were folded with information contained on the inside and placed in the child's bag containing new dental oral hygiene supplies.

Data Collection

Procedure. In the spring of 2014, the Bengal Smiles program was implemented at a Title 1 elementary school. The procedures for the spring 2014 program are outlined in Table 7.

Table 7

Bengal Smiles Spring 2014 Program Procedures

Spring 2014	
1	The community health coordinator initiated contact with Title 1 schools to determine the best setting for the initial implementation of this program.
2	Parent information, consent and data collection forms were created prior to implementation of the program and approved by the University.
3	Consent forms (see Appendix A) were delivered to the Title 1 school one month prior to the start date.
4	Training for faculty and students on the use of the portable equipment was completed prior to program implementation.

- 5 Inventory and purchase of additional items needed for the sealant program was completed prior to program implementation.
- 6 A dental hygiene student procures the child from class and walks them to a private area designated for the dental sealant program. To help put the children at ease; dental hygiene students greeted the child with a smile and informed the child of what procedures would take place.
- 7 The child was laid back in the portable dental chair and a screening for dental decay, dental restorations, dental sealant placement, and identification of teeth that would benefit from a dental sealant was completed.
- 8 Dental findings were recorded in the SEALS child-level data collection form (see Appendix B) by another dental hygiene student and placed in a file with the child's name and identification number. Files are locked in a mobile filing storage. Data transferred into the excel file does not have the child's name only the identification number.
- 9 Either one or two instructors were present to supervise and verify the findings. Once all of the data were documented, a decayed, missing, filled teeth (DMFT) index score was calculated and an instructor verified the calculations and signed the form.
- 10 Dental sealants were placed according to the manufacturer's instructions (see sealant placement table)

- 11 Following dental sealant treatment, disclosing solution was placed on the child's teeth to collect a personal hygiene performance (PHP) score and provide oral hygiene instructions for plaque removal.
- 12 Fluoride varnish was applied as an additional preventive measure before the child is walked back to the classroom.
- 13 All children received a bag with a toothbrush, toothpaste, floss, and a letter for parents. The parent letter provided information on the treatment received and a need for dental referral if possible dental caries were identified.

The Bengal Smiles program uses Ultraseal XT® hydro dental sealant since the product can have slight moisture on the tooth structure and still be effective. The slight moisture capability is especially beneficial to a community program utilizing portable equipment, which is more challenging to use than stationary equipment. Dental sealants are placed following the manufacturer's instructions (see Table 8).

Table 8

Ultraseal XT® Hydro Dental Sealant Placement Procedure

Ultraseal XT Hydro Dental Sealant 53% filled, light-cure, radiopaque, methacrylate-based, thixotropic resin sealant	
1	Attach blue Micro® tip to Ultra-Etch® 35%
2	Attach Inspiral® Brush tip to UltraSeal XT® hydro syringe
3	Clean Fissures
4	Isolate teeth being treated with cotton rolls and dri-aids. Four handed dentistry was utilized to ensure proper placement.
5	Apply etch to fissures for 20 seconds

- 6 Thoroughly rinse and dry.
- 7 Express a small drop of UltraSeal XT® hydro to the brush tip prior to applying intraorally. Express a small drop of UltraSeal XT® hydro through the helical tip channel to the brush.
- 8 Using a painting action followed by a light agitation with the brush tips, apply resin to deep fissures. Avoid pooling resin.
- 9 Light cure with Coltolux® LED Curing Light on standard power for 20 seconds or 3 seconds on Xtra power mode.
- 10 Check margins and adjust occlusion if necessary.

Children who received referrals for identified oral health needs were reevaluated in the Fall of 2014. The procedures followed for the reevaluations are outlined in Table 9.

Table 9

Referral Treatment Reevaluations in the Fall of 2014

Fall 2014
▪ Children with referrals for possible dental caries were reevaluated to identify if treatment had been received. ▪ A community outreach coordinator and a principal investigator screened children for dental caries, dental restorations, missing teeth, dental sealant placement and dental sealant retention. ▪ The data were recorded on a new SEALS child-level data collection form and compared to the information collected previously. ▪ The Principal of the school was given a list of children with a continued need of a referral. The front office staff made phone calls to parents

utilizing a script informing parents of children's needs (see Appendix E).

The Bengal Smiles program collected 12 month data in the Spring of 2015. The procedures for data collection were similar to baseline except additional examination of dental sealant retention and dental sealant decay were assessed (see Table 10).

Table 10

Bengal Smiles Spring 2015 Program Procedures.

SPRING 2015	
1	Children initially screened one year ago were reevaluated by a dental hygiene student for dental caries, dental restorations, missing teeth, dental sealant prevalence, dental sealant retention, and dental sealant decay rate.
2	The data were recorded by a second dental hygiene student on a new SEALS child-level data collection form and compared to the information collected previously. An instructor supervised the screenings and verified findings and data recordings.
3	Children screened in the fall of 2014 with continued possible dental caries, had a letter sent home and received a follow-up phone call to his or her parents.
4	Dental hygiene students provided children with preventive dental care again if indicated.

- 5 Under supervision, dental hygiene students placed Ultraseal XT® hydro dental sealants on occlusal pit and fissures of molar and premolar teeth as indicated (see UltraSeal XT® hydro).
- 6 Following dental sealant treatment, disclosing solution was placed on the child's teeth to collect a personal hygiene performance (PHP) score and provide oral hygiene instructions for plaque removal.
- 7 Fluoride varnish was applied as an additional preventive measure before the child is walked back to the classroom.
- 8 All children received a bag with a toothbrush, toothpaste, floss, and a letter for parents. The parent letter provided information on the treatment received and a need for dental referral if possible dental caries is identified.

Instruments

Prior to data collection, the Community Outreach Coordinator and Principal Investigator, who supervised the dental hygiene students, were calibrated to establish intra-rater and inter-rater reliability.

- To establish intra-rater and inter-rater reliability, six children were screened for dental caries, dental restorations, dental sealant retention, and dental sealants with decay. Findings were recorded on the SEALS child-level data collection form.
- The Community Outreach Coordinator and Principal Investigator each completed the screening for all six children independent of each other to establish a baseline for intra-rater reliability for both examiners.

- One week later, follow up screenings were completed by both examiners independent of each other. Data at baseline and one week were compared to reveal a 93.8 % agreement of intra-rater reliability for the Community Outreach Coordinator and 93.4% intra-rater reliability for the Principle Investigator.
- All data (baseline and one week) collected between examiners were analyzed to reveal a 91.9% agreement of inter-rater reliability between examiners.

Data collections for the Bengal Smiles program were performed with a dental mouth mirror, dental explorer, compressed air, and dental loops with light. If the child's teeth were cold sensitive 2x2 gauze was used to dry the teeth instead of the compressed air. Information from the screenings were recorded on a SEALS child-level data collection form. SEALS forms are commonly used in community oral health programs and can be found on the Seal America website (Carter, 2011). Additionally, the data from the SEALS form were entered into an Excel file. Calculations from the excel file were completed to establish decay rates, dental sealant placement, dental sealant retention rates, dental sealant decay, and dental referral treatment rates.

To address several Spanish speaking families at Greenacres elementary, parent information letters were written in English and Spanish. The parent letter contained information about what oral health care was provided and had three areas that could be checked according to the child's needs. The first area that could be checked was the child should be seen by a dentist as soon as possible for urgent needs. The second was the child should be seen for a more complete dental examination for possible early signs of decay.

The third area that could be checked was for children without signs of decay and a recommendation was made to continue regular six month check-ups with the family dentist.

Limitations

Limitations occur in all types of research. Identification of the limitations allow for recognition of possible problem areas, which can results in bias, and allow for detection of areas in need for further research (Jacobsen, 2012). Possible limiting factors of the study include:

- Non-probability convenience sample. Although a sample of convenience may not be generalizable, the study does provide valuable information for evaluation of this program.
- No standardization for evaluation of school-based dental sealant programs had been established. The use of various data collection methods could decrease the generalizability of the findings. However, information from the study will benefit the assessment of the Bengal Smiles program.
- A quasi- experimental one group research design does not allow for control of the dependent variables and could bias the results.

Proposed Statistical Analysis

A t-test with $p \leq .05$ will be utilized for the statistical analysis of data collected on decay rates, dental sealant placement rates, dental sealant retention rates, and dental sealant decay rates at baseline and 12 months. An ANOVA statistical test with $p \leq .05$ will be used to analyze referral treatment rates at baseline, 6 months and 12 months.

Summary of Chapter 3

The quasi-experimental will collect data by performing dental screenings on children at a Southeast Idaho Title 1 elementary school for decay rates, dental sealant placement rates and dental sealant decay rates at baseline and 12 month intervals. Treatment referral rates were collected at baseline, six month, and 12 month intervals. The aim of the study was to evaluate how the school-based dental sealant program affected the oral health of children in a Southeast Idaho Title 1 elementary school.

Findings from this study will contribute to the assessment of the Bengal Smiles program and influence the enhancement of the program. As the Bengal Smiles program expands, information gained in the study could provide valuable information for future stakeholders. This study also has implications for providing statistical information that may be used by public health organizations such as the Idaho Oral Health Project and the ASTDD (2014)

Results and discussion will be reported in the form of a manuscript to be submitted for publication in the Journal of Public Health Dentistry. The remaining sections of the thesis reflect the manuscript specifications outlined in the author guidelines contained in Appendix D.

References

- Ahovuo-Saloranta, A., Forss, H., Walsh, T., Hiiri, A., Nordblad, A., Mäkelä, M., & Worthington, H. V. (2013). Dental sealants for preventing dental decay in the permanent teeth. *Cochrane Database of Systematic Reviews*, 2013 (3). doi: 10.1002/14651858.CD001830.pub4.
- American Academy of Pediatric Dentistry. (2010). Definition of dental home. *Reference Manual*, 35(6), 13-14. Retrieved from http://www.aapd.org/media/Policies_Guidelines/D_DentalHome.pdf
- American Dental Education Association. (2004). Competencies for the entry into the profession of dental hygiene. *Journal of Dental Education*, 68(7), 745-749.
- American Dental Hygienists' Association (2007). *National dental hygiene research agenda*. Retrieved from http://www.adha.org/resources-docs/7834_NDHRA_Statements.pdf
- American Dental Hygienists' Association. (2012). *Facts about the dental hygiene workforce in the United States*. Retrieved from http://www.adha.org/resources-docs/75118_Facts_About_the_Dental_Hygiene_Workforce.pdf
- Association of State and Territorial Dental Directors. (2014). *Best practice approaches for state and community oral health programs*. Retrieved from <http://www.astdd.org/best-practices/>
- Assunção, I.V., Costa, G. F., & Borges, B. C. (2014). Systematic review of noninvasive treatments to arrest dentin noncavitated caries lesions. *World Journal of Clinical Cases*, 2(5), 137-141. doi: 10.12998/wjcc.v2.i5.137

Beauchamp, J., Caufield, P. W., Crall, J. J., Donly, K., Feigal, R., Gooch, B., ...

Simonsen, R. (2008). *Journal of the American Dental Association*, 139(3), 257-268. Retrieved from [http://jada.ada.org/article/S0002-8177\(14\)61434-3/pdf](http://jada.ada.org/article/S0002-8177(14)61434-3/pdf)

Broadbent, J. M., & Thomson, W. M. (2005). For debate: Problems with the DMF index pertinent to dental caries data analysis. *Community Dentistry and Oral Epidemiology*, 33, 400–409. doi: 10.1111/j.1600-0528.2005.00259.x

Bloom, B., Jones, L. I., & Freeman, G. (2013). Summary health statistics for U.S. children: National health interview survey, 2012. *Vital and Health Statistics*, 10(258), 1-89. Retrieved from http://www.cdc.gov/nchs/data/series/sr_10/sr10_250.pdf

Brown, D. W. (2009). The dawn of healthy people 2020: A brief look back at its beginnings. *Preventive Medicine* 48(1), 94-95. Retrieved from <https://www-clinicalkey-com.libpublic3.library.isu.edu/#!/content/playContent/1-s2.0-S0091743508005598>

Carter, N. (2011). *Seal America: The prevention invention*. Retrieved from <http://www.mchoralhealth.org/Seal/index.html>

Commission on Dental Accreditation. (2010). Accreditation standards for dental education programs. Chicago: American Dental Association.

Centers for Disease Control and Prevention. (2010). *Synopses of State and Territorial Dental Public Health Programs: Trends*. Retrieved from <http://apps.nccd.cdc.gov/synopses/ProgramDataV.asp?ProgramID=6>

Centers for Disease Control and Prevention. (2010). *Oral health indicators*. Retrieved

from <http://www.cdc.gov/nohss/index.htm>

Centers for Disease Control and Prevention. (2011). *Oral health program strategic plan 2011-2014*. Atlanta, GA: Centers for Disease Control and Prevention, Division of Oral Health. Retrieved from

http://www.cdc.gov/oralhealth/pdfs/oral_health_strategic_plan.pdf

Center for Disease Control and Prevention. (2013a). *Guide to community preventive services. Community task force members*. Retrieved from

<http://www.thecommunityguide.org/about/task-force-members.html>

Centers for Disease Control and Prevention. (2013b). *Guide to community preventive services. Preventing dental caries: school-based dental sealant delivery programs*. Retrieved from

<http://www.thecommunityguide.org/oral/supportingmaterials/RRschoolsealant.html>

Centers for Disease Control and Prevention. (2013c). *Guide to community preventive services. Task force finding and rational statement*. Retrieved from

<http://www.thecommunityguide.org/oral/supportingmaterials/RRschoolsealant.html>

Centers for Disease Control and Prevention. (2013d). *School based dental sealant programs*. Retrieved from

http://www.cdc.gov/OralHealth/dental_sealant_program/

Centers for Disease Control and Prevention (2014). *CDC organization*. Retrieved from

<http://www.cdc.gov/about/organization/cio.htm>

- Çolak, H., Dülgergil, C. T., Dalli, M., & Hamidi, M. M. (2013). Early childhood caries update: A review of causes, diagnoses, and treatments. *Journal of Natural Science, Biology and Medicine*, 4(1), 29-38. doi: 10.4103/0976-9668,107257
- Dawkins, E., Michimi, A., Ellis-Griffith, G., Peterson, T., Carter, D., & English, G. (2013). Dental caries among children visiting a mobile dental clinic in South Central Kentucky: a pooled cross-sectional study. *BMC Oral Health*, 13, 19. doi: 10.1186/1472-6831-13-19
- Detty, A. M.R., & Oza-Frank, R. (2014). Oral health status and academic performance among Ohio third-graders, 2009-2010. *Journal of Public Health Dentistry*, 74, 336–342. doi: 10.1111/jphd.12063
- Devlin, D., & Henshaw. M. (2011). Improving access to preventive dental services through a school-based dental sealant program. *The Journal of Dental Hygiene*, 85(3), 211-219. Retrieved from <http://web.b.ebscohost.com.libpublic3.library.isu.edu/ehost/pdfviewer/pdfviewer?sid=b161da04-99d7-4bf8-8c04-aac0c8d4123b%40sessionmgr114&vid=3&hid=116>
- Dye, B. A., Li, X., Thornton-Evans, G. (2012). *Oral health disparities as determined by selected Healthy People 2020 oral health objectives for the United States, 2009-2010* (NCHS data Brief No. 104). Hyattsville, MD: National Center for Health Statistics.
- Dye, B. A., Tan, S., Smith, V., Lewis, B. G., Baker, L. K., & Thornton-Evans, G. (2007). Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital and Health Statistics*, 11(248).

Fontana, M., Platt, J. A., Eckert, G. J., González-Cabezas, C., Yoder, D. T., Zero, D. T., ... Peters, M. C. (2014). Monitoring of sound and carious surfaces under sealants over 44 months. *Journal of Dental Research*, 93(11), 1070-1075. Retrieved from <http://jdr.sagepub.com.libpublic3.library.isu.edu/content/93/11/1070.full.pdf+html>

Gooch, B. F., Griffin, S. O., Gray, S. K., Kohn, W. G., Rozier, M. S., Fontana, M., ... Zero, D. T. (2009). Preventing dental caries through school-based sealant programs: Updated recommendations and reviews of evidence. *The Journal of the American Dental Association*, 140(11), 1356-1365.
doi: 10.14219/jada.archive.2009.0070

Griffin, S. O., Barker, L. K., Wei, L., Li, C., Albuquerque, M. S., & Gooch, B. F. (2014). Use of dental care and effective preventive services in preventing tooth decay among U.S. children and adolescents- medical expenditure panel survey, United States, 2003-2009 and national health and nutrition examination survey, United States, 2005-2010. *MMWR* 63(2), 54-60. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/su6302a9.htm?s_cid=su6302a9_w

Idaho Department of Health and Welfare, Division of Public Health. (2014). *Idaho smiled survey 2013 report*. Retrieved from <http://healthandwelfare.idaho.gov/Portals/0/Health/Disease/Oral%20Health/Smile%20Survey2013ReportFINAL2014.pdf>

Jacobsen, K. H. (2012). *Introduction to health research methods: A practical guide*. Sudbury, MA: Jones & Bartlett Learning, LLC.

- Keselyak, N. T., Simmer-beck, M., & Gadbury-amyot, C. (2011). Extending oral health care services to underserved children through a school-based collaboration: Part 2 - the student experience. *Journal of Dental Hygiene*, 85(3), 193-203. Retrieved from <http://web.b.ebscohost.com/libpublic3.library.isu.edu/ehost/pdfviewer/pdfviewer?sid=b161da04-99d7-4bf8-8c04-aac0c8d4123b%40sessionmgr114&vid=7&hid=116>
- Kinney, J., & Mariotti, A. (2010). Evaluating scientific methodologies: Understanding the indices used for plaque and gingivitis evaluation in oral care clinical trials. *Dimensions of Dental Hygiene*. Retrieved from <http://www.dimensionsofdentalhygiene.com/print.aspx?id=8034>
- Kirch, W. (2008). Internet. In *Encyclopedia of Public Health*. (Vol. 2, pp. 298). New York, NY: Springer
- Kurman, P. (2013). Clinical evaluation of the retention of different pit and fissure dental sealants: A1-year study. *Journal of Clinical Pediatric Dentistry*, 6(3), 183-187. doi: 10.5005/jp-journals-10005-1215
- LoBiondo-Wood, G., & Haber, J. (2006). *Nursing research: Methods and critical appraisal for evidence-based practice*. St. Louis, MO: Mosby Inc.
- National Oral Health Surveillance System. (2011). *Dental sealants. Percentage of 3rd grade students with dental sealants on at least one permanent molar*. Retrieved from <http://apps.nccd.cdc.gov/nohss/IndicatorV.asp?Indicator=1>
- Oral Health in America. (2015). *Smiles across America*. Retrieved from <http://www.oralhealthamerica.org/smiles.html>

- Perrin, K. M. (2015). *Principles of evaluation and research for health care providers*. Burlington, MA: Jones & Bartlett Learning.
- Pew Center on the States. (2010). *The cost of delay: State dental policies fail one in five children* (Report). Philadelphia, PA. Retrieved from <http://www.pewtrusts.org/~media/legacy/uploadedfiles/CostofDelaywebpdf.pdf>
- Seigal, M. D., & Detty, A. M. (2010). Do school-based dental sealant programs reach higher risk children? *Journal of Public Health Dentistry*, 70, 181-187. doi: 10.1111/j.1752-7325.2009.00162.x
- Seth, S. (2011). Glass ionomer cement and resin-based fissure dental sealants are equally effective in caries prevention. *Journal of the American Dental Association*, 142(5), 551-552. doi: 10.14219/jada.archive.2011.0225
- Simmer-beck, M., Gadbury-amyt, C. C., Ferris, H., Voelker, M. A., Keselyak, N. T., Eplee, H., ... Galemore, C. (2011). Extending oral health Care services to underserved children through a school-based collaboration: Part 1 - a descriptive overview. *Journal Of Dental Hygiene*, 85(3), 181-192. Retrieved from <http://web.b.ebscohost.com.libpublic3.library.isu.edu/ehost/pdfviewer/pdfviewer?sid=b161da04-99d7-4bf8-8c04-aac0c8d4123b%40sessionmgr114&vid=5&hid=116>
- Smith, T., & Packer, M. (1971). Scoring patient hygiene performance by observation of selected tooth surfaces. *HSMHA Health Reports*, 86(4), 341-346. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1937132/>
- Truman, B. I., Smith-Akin, K., Hinman, A. R., Gebbie, K. M., Brownson, R., Novick, L. F., ... Zaza, S. (2000). Developing the guide to community preventive services-

overview and rationale. *American Journal of Preventive Medicine* 18(1S), 18-26.

Retrieved from http://www.thecommunityguide.org/library/ajpm357_d.pdf

Ultradent. (2014). Ultra Seal® XT hydro: Hydrophilic pit and fissure sealant. Retrieved from <https://www.ultradent.com/en-us/Dental-Products-Supplies/PreventHygiene/Pit-and-Fissure-Sealants/UltraSeal-XT-hydro-hydrophilic-sealant/Pages/default.aspx>

U.S. Bureau of Labor Statistics. (2014). *Occupational Outlook Handbook*. Retrieved from <http://www.bls.gov/ooh/healthcare/dentists.htm>

U.S. Census Bureau. (2014). *State and county quick facts*. Retrieved from <http://quickfacts.census.gov/qfd/states/16/1664090.html>

U.S. Department of Education (2014). *Programs: Improving basic programs operated by local educational agencies (Title 1, Part A)*. Retrieved from <http://www2.ed.gov/programs/titleiparta/index.html>

U.S. Department of Health and Human Services. (2000). *Oral health in America: A report of the Surgeon General*. Rockville, MD: U. S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institute of Health, 2000. Retrieved from <http://www.surgeongeneral.gov/library/oralhealth/>

U.S. Department of Health and Human Services. (2003). *National call to action to promote oral Health: A public-private partnership under the leadership of the Office of the Surgeon General*. Rockville, MD: U. S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental and Craniofacial Research. NIH Publication No. 02-2650.

Retrieved from

<http://www.surgeongeneral.gov/library/calls/oralhealth/nationalcalltoaction.html>

U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion. (2013). *Healthy people 2020*. Washington, DC. Retrieved from <http://www.healthypeople.gov/2020/faqs.asp>x.

U.S. Department of Health and Human Services. (2014). *Healthy People 2020 Leading Health Indicators: Progress Update*. Retrieved from <http://www.healthypeople.gov/2020/leading-health-indicators/Healthy-People-2020-Leading-Health-Indicators%3A-Progress-Update>

Watson, S. (2014). *About health: Restoration definition*. Retrieved from <http://dentistry.about.com/od/termsanddefinitions/g/restorations.htm>

Appendix A Informed Consent Form



BENGAL SMILES

SCHOOL-BASED DENTAL SEALANT PROGRAM

ISU DEPARTMENT OF DENTAL HYGIENE

A dental sealant program is being offered in your child's school. This program prevents tooth decay by placing a thin plastic coating, called a sealant, on the chewing surfaces of the teeth. A dental screening will be completed to determine if sealants are appropriate for your child's teeth. Dental sealant placement is non-invasive and does not require anesthesia (shots). The charge for dental sealants can be \$30-40 per tooth in a dental office and is offered for free at the Bengal Smiles program.

Free dental sealants for 2nd – 5th grade students will be provided by senior dental hygiene students from Idaho State University. The Bengal Smiles program is part of required Community Dental Health course in the dental hygiene program. Dental hygiene students are given an opportunity to provide a valuable service to the community, while meeting competencies needed for graduation. All student activities are supervised by the course instructor Karen Portillo, RDH, MSDH and ISU graduate student Rachelle Williams, RDH.

Children's personal information is kept confidential. Promoting oral health to Idaho children is important to the ISU Department of Dental Hygiene. Data collected from the Bengal Smiles program will contribute to statistical information needed for the Idaho Oral Health Project, evaluation of the benefits of school-based dental sealant programs and assessment of the Bengal Smiles program. No child's name is used for the statistical report.

Please indicate your choice below and return this form to school with you child the following school day.

- ☐ **YES** I want my child to have **free dental sealants**.
- ☐ **NO** I do not want my child to have sealants.

Name of Student _____

Name of Teacher _____

Childs Information: Age _____ Birth date _____ [] Male [] Female

Date _____ Parent/Guardian (signature) _____

Parents Phone: Home _____ Work _____

Please provide phone numbers so we can reach you if we note any dental concerns with your child. No third party will be given your number.

Health History Information for Children Participating in the Bengal Smiles Program

Child's Name

If you responded yes for participation in the Bengal Smiles program, please complete below information and send it with your child's consent form tomorrow. All information is kept confidential. Statistical information does not report a child's name.

Select all that apply to your child:

- ☐ White ☐ Black or African American ☐ Hispanic ☐ Asian/Pacific Islander
☐ Native American ☐ Other

Please answer the following questions:

1. Is your child currently under a physician's care? ☐ **Yes** ☐ **No**
2. Is your child currently taking any medications? ☐ **Yes** ☐ **No**
3. Has your child ever had any allergic reactions? ☐ **Yes** ☐ **No**

Please explain any YES answers: _____

4. Does your child have a dentist? ☐ **Yes** ☐ **No** Name _____

5. Is your child eligible for the free/reduced cost lunch program at school?

☐ **Yes** ☐ **No**

6. My child's most recent dental visit was within the last:

☐ **6 months** ☐ **12 months** ☐ **3 years** ☐ **5 years** ☐ **Has never seen dentist**

All students are eligible – even if they have dental insurance. No payment is required from you or your dental insurance plan.

7. How do you pay for your child's dental care? (check all that apply)

- ☐ **Self** ☐ **Medicaid / Title XIX** ☐ **hawk-I** ☐ **Private dental insurance**
☐ **Other**

Appendix B Data Collection Form

T	S	R	Q	P	O	N	M	L	K
---	---	---	---	---	---	---	---	---	---

III. Preventive Services – Mark the teeth where sealants were placed with an **S** and surfaces sealed

2	3	4	5	12	13	14	15
31	30	29	28	21	20	19	18

Yes/No Oral Hygiene Instruction was given. If yes describe: _____

Yes/No Referral was recommended. If yes please describe: _____

Yes/ No Fluoride varnish treatment provided. If no explain why: _____

Student/Provider Signature: _____ Date: ____/____/____

Faculty Signature: _____ Date: ____/____/____

III. Follow-Up – Mark sealed teeth with a **TR (Total Retention)**, **PR (Partial Retention)**, or **NR (Not Retained)**

2	3	4	5	12	13	14	15	Evaluator (student) Signature
								Date: ____/____/____
31	30	29	28	21	20	19	18	

Yes/No Referral was recommended. If yes describe: _____

Faculty Signature: _____ Date: ____/____/____

Appendix C Author Guidelines

Author Guidelines

Journal of Public Health Dentistry Instructions for Contributors

The *Journal of Public Health Dentistry* (JPHD) is devoted to the advancement of public health dentistry through the publication of related research, practice, and policy developments. We publish, after peer review and/or editorial consideration, original research articles, brief reports, systematic reviews, articles addressing new research methods, community action reports, special issues, guest editorials and commentaries, letters to the editor, and book reviews. Regular-length scientific articles should be between 2,500 and 3,500 words in length, with no more than six tables or figures and fewer than 30 references (estimated to be a total of 21 or fewer double-space pages).

Systematic reviews are similar in length but with different expectations regarding references and tables, based on the results of the review. Authors are strongly encouraged to discuss systematic reviews with the editor prior to initiating the review to ensure that they are carried out in accordance with best practices (e.g., QUORUM guidelines) and their length can be accommodated by the Journal.

Brief Communications are 1,000–1,500 words, no more than two tables or figures, an abstract of 150 words or less, and 10 or fewer references. Brief Communications, commentaries, and systematic reviews undergo peer review similar to regular scientific manuscripts.

Community Action Reports, highlighting practice-based programs or policy initiatives, commentaries, and guest editorials of widespread interest to the dental public health community are 1,000–1,500 words.

Special Issues and Supplements to regular issues may be published, the full cost being paid by the authors or sponsoring agency. Contact the editor for further information.

Preparation of Manuscripts

Submissions must be in English and conform to the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. The complete document appears in *Ann Intern Med* 1997; 126(1):36-47; or online at <http://www.acponline.org/journals/resource/unifreqr.htm>.

Authors for whom English is a second language may choose to have their manuscript professionally edited before submission to improve the English. A list of independent suppliers of editing services can be found at

http://authorservices.wiley.com/bauthor/english_language.asp. All services are paid for and arranged by the author, and use of one of these services does not guarantee acceptance or preference for publication.

Submission of Manuscripts

Manuscripts should be submitted through the ScholarOne Manuscripts site at: <http://mc.manuscriptcentral.com/jphd>. Authors will be directed through the submission process at the Website.

Use double-spacing throughout, including title pages, abstract, text, acknowledgments, and references. Begin each of the following sections on separate pages: title page, abstract and key words, text, acknowledgments, references, and individual tables and figures. Number pages

consecutively in the upper right-hand corner of each page, beginning with the title page. Our reference book is Merriam-Webster Collegiate Dictionary, 11th edition (Springfield, MA: Merriam-Webster, 2003).

Format and Style of Scientific Articles

Title Page. To facilitate the masked review process, include a title page giving only the title of the manuscript and not identifying authorship. Authors' names should not appear on any manuscript page.

Abstract. The second page should carry an abstract of no more than 250 words (150 for Brief Communications) consisting of four paragraphs, labeled **Objectives, Methods, Results, and Conclusions**. These sections should describe the problem being addressed in the study, how the study was performed, the salient results (without statistical tests), and what the authors conclude from the results.

Key Words. Below the abstract, provide, and identify as such, three to 10 key words or short phrases that will assist indexers in cross-indexing your article. At least three terms from the medical subject headings (MeSH) list of Index Medicus should be used. The use of MeSH headings greatly facilitates the identification of your article by online search engines and improves the likelihood that interested readers can retrieve your article. Assistance in locating MeSH headings is provided at: <http://www.nlm.nih.gov/mesh/MBrowser.html>

Text. Divide text of scientific articles into sections labeled Introduction, Methods, Results, and Discussion. For other types of articles, consult recent issues of the JPHD for further guidance. All acronyms must be spelled out when they first appear in the text.

Introduction. Clearly state the purpose of the article and summarize the rationale for the study. Give only strictly pertinent references, and do not review the subject extensively.

Methods. Describe your methods clearly and in sufficient detail to allow other workers to reproduce the results. Give references to established methods, including statistical methods; provide references and brief descriptions for methods that have been published but are not well known; describe new or substantially modified methods, give reasons for using them, and evaluate their limitations. When reporting investigations involving human subjects, indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation.

Results. Present results in logical sequence in the text, tables, and illustrations. Do not repeat in the text all the data in the tables or figures; rather emphasize or summarize only important observations.

Discussion. Emphasize the new and important aspects of the study and conclusions that follow from them, particularly as these relate to public health. Do not repeat in detail data given in the Results section. Include in the Discussion the implications of the findings and their limitations, and relate the observations to other relevant studies. Avoid unqualified statements and conclusions not well supported by your data. State new hypotheses when warranted, but clearly label them as such. Include recommendations when appropriate.

Acknowledgments. Acknowledge only persons who have made substantive contributions to the study. Obtain written permission from persons acknowledged by name, because readers may infer their endorsement of the data and conclusions. A description of sources of funding, financial disclosure, and the role of sponsors must be included in this section

Conflicts of Interest. Include this section as part of Acknowledgements, but only if the authors have personal financial interests related to the subject matters discussed in the manuscript.

Footnotes and Appendices. Except in tables and figures, footnotes should not be used. Appendices may be placed on the JPHD website by Blackwell after consultation with the editor.

References. References for research manuscripts are in general limited to no more than 30; for brief communications please limit to ten or fewer. The author(s) must verify cited references against the original documents. JPHD uses the “Vancouver” style and information can be found at the Uniform Requirements page and well as some examples at (http://www.nlm.nih.gov/bsd/uniform_requirements.html).

Identify references in text, tables, and legends by Arabic numerals in parentheses; number consecutively in the order in which they are first mentioned in the text. Avoid using abstracts as references. Abstracts not published in the periodical literature (e.g., printed only in an annual meeting program) may be cited only as written communications in parentheses in the text. “Unpublished observations” and “personal communications” may not be used as references, although references to written, not oral, communications may be inserted (in parentheses) in the text. For papers accepted but not yet published; designate the journal and add “in press.” Information from manuscripts submitted but not yet accepted should be cited in the text as “unpublished observations” (in parentheses). Acceptable forms of references are based on an ANSI standard style adapted by the National Library of Medicine and authors are encouraged to refer to the examples of reference styles provided in the Uniform Requirements. Systematic reviews do not have a specific limitation on number of references.

Tables. Type each table on a separate page. Number tables with an Arabic numeral consecutively and supply a brief title for each. Explain in footnotes all nonstandard abbreviations used in each table. (Please refer to the JPHD, Volume 60, No. 4, page 347-8 to confirm these characters if you plan to use these symbols).

Illustrations and Legends. Submit the required number of complete sets of figures. Figures should be of a high standard and if necessary, professionally drawn. Label each figure indicating the number of the figure. Cite each figure in the text in consecutive order. Type or print out legends for illustrations using double spacing, starting on a separate page, with Arabic numerals corresponding to the illustrations. When symbols, arrows, numbers, or letters are used to identify parts of the illustrations, identify and explain each one clearly in the legend. Explain the internal scale and identify the method of staining in photomicrographs. The Journal cannot reproduce color images or figures.

Photographs of People. The Journal of Public Health Dentistry follows current HIPAA guidelines for the protection of patient/subject privacy. If an individual pictured in a digital image or photograph can be identified, his or her permission is required to publish the image. The corresponding author may submit a letter signed the patient authorizing the Journal of Public Health Dentistry to publish the image/photo. Or, a form provided by the Journal of Public Health Dentistry (available [here](#) or by clicking the “instructions and Forms” link in Manuscript Central) may be downloaded for your use. The approval must be received by the Editorial Office prior to final acceptance of the manuscript for publication. Otherwise, the image/photo must be altered such that the individual cannot be identified (black bars over eyes, tattoos, scars, etc.). The Journal of Public Health Dentistry will not publish patient photographs that will in any way allow the patient to be identified, unless the patient has given their express consent.

Publication

Prior and Duplicate Publication. Manuscripts are not accepted for consideration if they are based on work that has been or will be published or submitted elsewhere before appearing in the JPHD. Exceptions are consistent with the policy on duplicate or redundant publication developed by the International Committee of Medical Journal Editors *Ann Intern Med* 1997; 126(1):36-47; or online at <http://www.acponline.org/journals/resource/unifreq.htm>. Copies of any closely related manuscripts should be submitted to the editor along with the manuscript that is to be considered by the JPHD.

Authorship

All persons designated as authors should qualify for authorship. Each author should have participated sufficiently in the work to take public responsibility for the content. Authorship credit should be based only on substantial contributions to: (1) conception and design, or analysis and interpretation of the data; and to (2) drafting the article or revising it critically for important intellectual content; and on (3) final approval of the version to be published. Conditions 1, 2, and 3 must all be met. The editor may ask for verification of these conditions for each author.

Copyright Issues

JPHD encourages the posting of manuscripts resulting from NIH-funded research to PubMed Central (www.pubmedcentral.nih.gov) in order to promote public access to critical research findings. Authors whose manuscripts are accepted for publication in JPHD may post the final, edited version of the manuscript as soon as the printed journal version is distributed.

Submission of Manuscripts and Correspondence

Manuscripts should be submitted through the ScholarOne Manuscripts site at: <http://mc.manuscriptcentral.com/jphd>. Follow the guidelines for submitting at the site. Questions on manuscript submission, cover letters, and copyright assignments should be directed to the journal administrator at: ssteil@associationcentral.org. Questions regarding the appropriateness of articles for the journal or questions about the review and acceptance process should be directed to the editor at: rjw1@dental.pitt.edu.

A covering letter, signed by all authors, should be mailed or FAXED (217-529-9120) to be received at the same time as the manuscript. A scanned copy of a signed letter, sent electronically as a PDF, is also acceptable. It should include (1) information on prior or duplicate publication or submission elsewhere of any part of the work as defined in the Uniform Requirements; (2) a statement of financial or other relationships that might lead to a conflict of interest; (3) a statement that the manuscript has been read and approved by all the authors, that the requirements for authorship have been met, and that each author believes that the manuscript represents honest work; and (4) the name, address, and telephone number of the corresponding author who is responsible for communicating with the other authors about revisions and final approval of the proofs. A scanned copy of the signed letter may be sent electronically or mailed to the journal administrator at above address.

Manuscript Submitted Previously to Another Journal

If a manuscript recently underwent peer review by another journal, authors should disclose this

information. They should include either the previous critique or a cover letter with the new submission that explains how the authors have modified the manuscript to address the previous (outside) critique.

Review and Action

Manuscripts are acknowledged upon receipt, reviewed by the editorial staff, and if they meet minimal publication criteria, are sent to at least two outside referees for a blind review. Accepted manuscripts are examined and editorial revisions likely will be made to add clarity and to conform to the JPHD style. Authors will be sent proofs prior to printing. Upon acceptance, papers become the permanent property of the JPHD and may not be reproduced by any means, in whole or in part, without the written consent of the editor.

Peer Reviewer Nominations

The editor selects the reviewers for each submission and encourages recommendations for reviewers from submitting authors. Thus, during the submission process, authors may nominate 2 to 4 external referees to review their manuscript (please provide at least their name and email address). The best reviewers are authors of publications on which your research builds and which you cite. Peer reviewers must have a publishing track in the area the manuscript deals with.

When suggesting peer reviewers, conflicts of interests should be avoided, that is, suggested referees should not:

- be from the same department or (ideally) the same university;
- have been a research supervisor or graduate student of one of the authors within the past five years;
- have collaborated with one of the authors within the past five years or have plans to collaborate in the immediate future;
- be employees of non-academic organizations with which one of the authors has collaborated within the past five years; or
- be in any other kind of potential conflict of interest situation (eg, personal, financial).

We ask applicants not to contact suggested referees in advance. The editor reserves the right to send the manuscript to other referees.

Reporting Guidelines for Specific Study Designs

Authors are encouraged to consult best practice guidelines relevant for their research design.

Research reports frequently omit important information.

Randomized Controlled Clinical Trials (RCTs) are highly encouraged and should be reported in accordance with the CONSORT statement (<http://www.consort-statement.org/>).

A diagram illustrating the flow of participants through the trial is required (<http://www.consort-statement.org/index.aspx?o=1077>). Please complete and include the CONSORT checklist with the submission.

In accordance with recommendations from the ICMJE (Uniform Requirements) it is strongly recommended that RCTs be registered in a WHO accredited trial registry (this is mandatory for industry sponsored trials). Please mention the International Standard Randomized Controlled Trial Number (ISRCTN) (or a comparable trial identifier) at the end of the abstract (in brackets), as well as when you first mention the acronym of a RCT in the manuscript.

Reporting guidelines have also been developed for a number of other study designs and as

JPHD encourages reviewers to use these guidelines during the peer review process, authors are well advised to use these checklists as well during research planning and manuscript preparation. Examples include:

for observational epidemiology studies the STROBE guidelines (<http://www.strobe-statement.org/>)

and for meta-analysis and systematic reviews the QUORUM statement, (Lancet. 1999 Nov 27;354(9193):1896-900).

Early View

The Journal is part of the Wiley Interscience Early View service. Articles are published on a regular basis online in advance of their appearance in a print issue. These articles are fully peer reviewed, edited, and complete—they only lack page numbers and volume/issue details—and are considered fully published from the date they first appear online. This date is shown with the article in the online table of contents. Because Early View articles are considered fully complete, please bear in mind that changes cannot be made to an article after the online publication date even if it is still yet to appear in print.

The articles are available as full text HTML or PDF and can be cited as references by using their Digital Object Identifier (DOI) numbers. For more information on DOIs, please see <http://www.doi.org/faq.html>.

To view all the articles currently available, please visit the journal homepage at <http://onlinelibrary.wiley.com/doi/10.1111/jphd.2008.9999.issue-9999/issuetoc>. Upon print publication, the article will be removed from the Early View area and will appear instead in the relevant online issue, complete with page numbers and volume/issue details. No other changes will be made.

The implementation of Early View for JPHD represents our commitment to publishing articles as soon as possible for readers, reducing time to publication considerably without sacrificing quality or completeness.

NIH Policy

Wiley-Blackwell supports authors by posting the accepted version of articles by NIH grant-holders to PubMed Central. The accepted version is the version that incorporates all amendments made during peer review, but prior to the publisher's copy-editing and typesetting. This accepted version will be made publicly available 12 months after publication in the journal. The NIH mandate applies to all articles based on research that has been wholly or partially funded by the NIH and that are accepted for publication on or after April 7, 2008. For more information about the NIH's Public Access Policy, visit <http://publicaccess.nih.gov>.

Wiley-Blackwell also offers its [OnlineOpen and Funded Access](#) services. Upon payment of the OnlineOpen or Funded Access fee, we will deposit the published version of the article into PubMed Central, with public availability in PubMed Central and on the journal's website immediately upon publication.

Copyright

If your paper is accepted, the author identified as the formal corresponding author for the paper will receive an email prompting them to login into Author Services; where via the Wiley Author Licensing Service (WALS) they will be able to complete the license agreement on behalf of all authors on the paper.

For authors signing the Copyright Assignment Form

If the OnlineOpen option is not selected the corresponding author will be presented with the copyright form to sign. The terms and conditions of the copyright form can be previewed [here](#).

Terms and Conditions [PE to add existing non-standard license PDF to OTIS and provide link from Online Library once live]. Please do not complete this PDF until you are prompted to login into Author Services as described above.

Note to Contributors on Deposit of Accepted Version

Funder arrangements

Certain funders, including the NIH, members of the Research Councils UK (RCUK) and Wellcome Trust require deposit of the Accepted Version in a repository after an embargo period. Details of funding arrangements are set out at the following website: <http://www.wiley.com/go/funderstatement>. Please contact the Journal production editor if you have additional funding requirements.

Institutions

Wiley has arrangements with certain academic institutions to permit the deposit of the Accepted Version in the institutional repository after an embargo period. Details of such arrangements are set out at the following website: <http://www.wiley.com/go/funderstatement>

For authors choosing OnlineOpen

If the OnlineOpen option is selected the corresponding author will have a choice of the following Creative Commons License Open Access Agreements (OAA):

Creative Commons Attribution License OAA

Creative Commons Attribution Non-Commercial License OAA

Creative Commons Attribution Non-Commercial -NoDerivs License OAA

To preview the terms and conditions of these open access agreements please visit the Copyright FAQs hosted on Wiley Author Services http://authorservices.wiley.com/bauthor/faqs_copyright.asp and visit <http://www.wileyopenaccess.com/details/content/12f25db4c87/Copyright--License.html>.

If you select the OnlineOpen option and your research is funded by The Wellcome Trust and members of the Research Councils UK (RCUK) you will be given the opportunity to publish your article under a CC-BY license supporting you in complying with Wellcome Trust and Research Councils UK requirements. For more information on this policy and the Journal's compliant self-archiving policy, please visit: <http://www.wiley.com/go/funderstatement>

Title Page of Manuscript

AN EVALUATION OF A SCHOOL-BASED DENTAL SEALANT PROGRAM

Manuscript Abstract

Objectives: To evaluate the effectiveness of Bengal Smiles, a school-based dental sealant program and assess outcomes related to the Healthy People 2020 oral health objectives.

Methods: A needs assessment identified high caries prevalence in Idaho children and supported the need for a school-based dental sealant program at a local Title 1 school. Children (n=32) ages 7-12 were screened by dental hygiene students for active decay, sealant placement, and need for a referral. Sealant retention and sealant decay rates were computed at 12 months using descriptive statistics. Decay rates were analyzed with a t-test for paired samples; whereas, a Chi-Square test was used to determine a difference in referral treatment rates before and after the intervention of administrative staff to contact parents of children in need of dental treatment.

Results: A 16% decrease in active decay was observed; however, there was no statistically significant difference in decay rates ($p=0.21$). Sealant treatments increased prevalence 370%. Sealant retention outcomes were 74% fully retained with 0% decay, 13% partially retained with 25% decay, and 13% no retention with 25% decay. At 6 months 40% of participants referred for dental treatment accessed care. The intervention of contacting parents had no statistically significant effect on increasing dental treatments ($p=0.75$).

Conclusion: Sealant programs can eliminate disparities in accessing oral health care. The Bengal Smiles outcomes of increased sealant prevalence, decreased percentages of decay, and referrals for dental treatment contribute to attaining Healthy People 2020 oral health objectives.

Key Words

Dental caries; caries prevalence, dental caries prevention; dental sealants; pit and fissure sealants; school-based programs; school-based dental sealant programs.

An Evaluation of a School-Based Dental Sealant Program

Introduction

Dental caries is a preventable infectious disease continuing to affect millions of children with low socioeconomic status (1-4). A survey from the *Health Statistics for U.S. Children: National Health Interview Survey 2012* identified four million children with untreated dental needs due to insufficient funds, noting that 21% of uninsured children did not go to the dentist within two years (1). Research from 1960-2014 has established dental sealants as a highly effective means for caries prevention in children of low socioeconomic status; however, millions of low income and uninsured children are not receiving preventive oral health treatments (4,6-9). School-based dental sealant programs provide additional access to preventive dental services and assist in the equality of dental sealant prevalence between low and high income children (10,11).

Historically, the 2000 Surgeon General's Report recommended expanding the number of school-based dental sealant programs as a plan for action to reduce higher caries prevalence and provide equality in oral health care to low-income children (5). Following the Surgeon General's Report, school-based dental sealant programs have gained momentum due to the 2003 National Call to Action, which was designed to address oral health initiatives and meet goals outlined in Healthy People 2010 (12). Sealant programs have been strongly endorsed by organizations and governmental agencies such as the American Dental Association's Council on Scientific Affairs (8), Association of State and Territorial Dental Directors (ASTDD) (13), Centers for Disease Control and Prevention (CDC), Division of Oral Health (14), Oral Health of America's Smiles Across America (15), and the Idaho Oral Health Program (16). Another governmental entity with strong endorsements for school-based dental sealant programs is the

Community Preventive Services Task Force established in 1996 to conduct continuous research needed for public health programs (17). In addition, Healthy People objectives were created to provide guidance to community health programs and governmental agencies for increased oral health care (18).

The Department of Dental Hygiene at Idaho State University applied recommendations from the Seal America guidelines (19) to the development of the Bengal Smiles program. Moreover, recommendations by the CDC (20) and ASTDD (13) were included in the development and implementation of the dental sealant program at a local elementary school. The purpose of this program evaluation was to determine the effectiveness of the Bengal Smiles program based on the rate of decay, dental sealant placement, dental sealant retention, and dental sealant decay at 12 months after program implementation. The secondary intent of the evaluation was to determine if the intervention of a school administrator (at 6 months) would increase the number of referred children accessing oral health care. Findings from the program evaluation will contribute to the body of knowledge by assessing dental hygiene students' ability to provide preventive services to low-income children in a school-based program.

Methods

A needs assessment conducted on children in Idaho, showed caries prevalence of 61.8% for third graders, which is 12.8% higher than the Healthy People 2020 goal (16, 18). Additionally, an assessment of the federal poverty level revealed 12.4% of Pocatello, Idaho families fell below the federal poverty level as compared to 11% for the entire state (21). These data supported the need for school-based dental sealant programs.

The Community Outreach Coordinator for the Department of Dental Hygiene initiated contact with principals of Pocatello Title 1 elementary schools. School-based dental sealant programs frequently target Title 1 schools due to a high prevalence of low-income children often determined by the percentage of children ($\geq 50\%$) who qualified for free or reduced lunch (22). The school with the greatest need was selected and the population was 282 children ages 6-12.

Creation of the Bengal Smiles program (school-based dental sealant program) began by the development of an affiliation agreement, parent information sheets, consent documents, and data collection forms. All forms were approved by the Idaho State University legal counsel prior to program implementation. Additionally, reliability for data collection for program outcomes was established by the Community Outreach Coordinator and the Principal Investigator. Intra-rater and inter-rater reliability with a $>90\%$ agreement was established between examiners by conducting oral health screenings on six children at baseline and one week later for dental caries, dental restorations, dental sealant retention, and dental sealants with decay. Furthermore, the university's Internal Review Board determined the evaluation of the Bengal Smiles program was an assessment of a community oral health program and did not require Human Subjects Committee oversight.

In the fall of 2013, portable equipment and supplies were purchased by grant funding through the Ronald McDonald House of Charities of Idaho and Idaho Power. One month prior to implementation of the sealant program: (1) parent information sheets and consent forms were sent to the Title 1 elementary school (all children ages 6-12 with a signed consent were allowed to participate in the sealant program), (2) faculty and dental hygiene students were trained on the use of the portable dental equipment and data collection forms, (3) inventory and

purchase of additional items needed for the sealant program was completed and a private school room was established as the area to provide oral health services. In the spring of 2014, the Bengal Smiles school-based dental sealant program was implemented. Table 1 reports the Bengal Smiles spring 2014 program procedures. In the fall of 2014, the Community Outreach Coordinator and Principal Investigator reevaluated children with active decay who required a dental referral. Based on the percentage of children who did not receive further care, elementary school administrators were contacted to assist with this situation. Follow-up efforts with the parents of these children were initiated by the school administrative staff with access to parent contact information. Parents were telephoned one time with the utilization of a script provided by the Principal Investigator. When the parent did not answer the call, a letter was mailed to the home address. One year after the Bengal Smiles program was implemented; children were reevaluated and received new preventive treatments during the spring of 2015 (see Table 1).

Dental sealant placement rate, dental sealant retention rate, dental sealant decay, and referral treatment rate at baseline were evaluated using descriptive statistics. Decay rates at baseline and 12 months were analyzed utilizing a t-test for paired samples ($p \leq .05$). A Chi-square ($p \leq .05$) test was employed to analyze the referral treatment rate at 6 months and 12 months.

Results

Table 2 reports the demographic characteristics of the sealant program participants. Participants consisted of 54 children (19% of the total population) who received baseline preventive oral health care at the school; however, 22 children relocated or had no parental

consent for the one year follow-up sealant program, leaving 32/54 children (59%) who completed two cycles (baseline and 12 months) of the sealant program.

Decay rates were examined to determine if the sealant program had a positive effect on the percentage of decay in permanent teeth. Table 3 reports the calculation of participants' permanent tooth decay rate revealing no statistically significant difference ($p=0.21$). Although there was no significant difference in decay rates, notable change in the percentage of participants with active decay occurred from 38% at baseline to 22% at 12 months. Results for active decay and decay rates were reported in percentages, which allowed a means to report findings in the preferred method by the Idaho Oral Health Program (16) and the ASTDD (13), which display reported information in the National Oral Health Surveillance System (23).

The Bengal Smiles program resulted in an increase of dental sealants in child participants from 26 to 122; thereby, showing a 370% increase in sealant prevalence from this program. Increased sealant prevalence in a Title 1 school contributes to the Healthy People 2020 objectives, OH-8 and OH-12: increasing the number of low- income children who received preventive services (dental sealants on molars) during the past year (18).

Table 4 summarizes the dental sealant retention rates ($n=96$) and sealant decay rates at 12 months following the implementation of the school-based dental sealant program. Sealant retention was classified as full retention (sealant covering the entire pit and fissures of the occlusal surface) 74% ($n=72$), partial retention (sealant covering only a portion of the pits and fissures on the occlusal surface) 13% ($n=12$), or no retention (sealant that no longer covers any of the pit and fissures) 13% ($n=12$). Decay rates were computed for each category of sealant retention: fully retained 0% ($n=72$), partially retained 25% ($n=3$), and non-retained 25% ($n=3$).

Referrals of participants with dental needs were evaluated at 6 months and 12 months following implementation of the sealant program. At baseline, 47% (n=15) of participants were referred for treatment of dental needs. At six months, 40% (n=6/15) received treatment, and 60% (n=9/15) did not access oral health care. To address participants' continued dental needs, 67% (n=10/15) were referred (one participant had treatment and also referred for new decay at the six month screening). In comparison, at 12 months, 20% (n=2/10) received treatment and 80% (n=8/10) did not access oral health care. At six months, the researchers enlisted the school administrative staff to contact parents of children with dental needs to determine whether adding this intervention would increase the number of participants receiving oral health care. A chi-square analysis ($p \leq .05$) revealed no statistically significant difference in treatment based on school administration intervention ($p=0.75$).

Discussion

The Healthy People 2020 agenda aims to increase public awareness and involve communities in attaining one of the overarching goals of health equity for all populations within the United States (24). School-based dental sealant programs address health disparities by providing preventive oral health services to all children in a school, regardless of their socioeconomic level. Targeting Title 1 schools has shown to be an effective strategy for providing oral health care to both high and low caries risk children (11). Siegal and Detty (11) identified children in schools with a sealant program were twice as likely to have a dental sealant as compared to children in schools without a sealant program. Further investigation revealed an equality of sealant prevalence between high and low caries risk children attending school-based sealant programs (11). The Bengal Smiles program contributed to children's

preventive health equity at an Idaho Title 1 school with an increased sealant prevalence of over 300 percent.

Increased sealant prevalence in children of all socioeconomic levels is significant in making steps toward reaching Healthy People 2020 objectives, OH-1 and OH-2: regarding the reduction of carious lesions in children and adolescents (18). Over the years researchers have identified dental sealants as the best prevention for carious lesions on sound or noncavitated teeth when sealants are properly placed (5-9). Findings from the Bengal Smiles program support this evidence that well placed and retained sealants prevent caries. Moreover, school-based sealant programs lower caries prevalence and can inadvertently affect academic performance (25). A comparison of yearly achievement tests and state-wide oral health surveys of Ohio third grade children resulted in a statistically significant negative effect on academic performance at schools without sealant programs (25). Outcomes from the Bengal Smiles program support the evidence that children attending school-based sealant programs experience a decrease in the percentage of decay one year after program implementation. Future evaluation of the Bengal Smiles program should determine whether there is a significant difference in decay rates based on longitudinal outcomes and determine the effect of this program on academic performance.

Continued efforts in evaluating sealant and decay prevalence in school-aged children are necessary to monitor the attainment of oral health benchmarks set by Healthy People 2020 objectives (18). Standardization of school-based program outcomes would allow a more efficient means to observe children's oral health (13,26). Seal America's Preventive Intervention guidelines were created for administrators of sealant programs as a strategy to standardize these outcomes (19). The need for consistency is evident when comparing the

Boston Sealant Program evaluation (27) to the Bengal Smiles program evaluation. The Boston Sealant program began each school year with screenings on new second grade students reporting only baseline data and no subsequent data. Comparatively, the Bengal Smiles program followed the same participants throughout the year to determine the direct effect of the sealant program on participants' decay rates. Consistent reporting of outcomes is necessary to compare the effectiveness of sealant programs and helpful to data collection for state oral health programs and the National Oral Health Surveillance System.

Another substantial aspect to children's oral health is related to referring for dental treatment and establishing dental homes. One of the Healthy People 2020 Leading Health Indicators OH-7 aims to increase dental visits for individuals two and older. The OH-7 objective was established to recognize that poor oral health has a detrimental effect on systemic health; therefore, access to dental care is critical to overall health (28). Identifying OH-7 as a leading health indicator raised oral health to a national priority and emphasized actions to reduce access to care disparities. This prioritization was the first time oral health was recognized as a leading health indicator. Unfortunately, the most current data reported a 6% decrease in the percentage of individuals having dental visits from the baseline measurement in 2007, with a 7.2% increase needed to reach the 2020 goal (28). Therefore, dental professionals must prioritize actions for implementing school-based oral health programs, which include dental caries screenings, referrals for dental treatment and follow-up to accessing care, and attainment of the desired benchmark for this objective by the year 2020.

Bengal Smiles included screenings for dental caries and referrals as part of the school-based program. However, the majority of children in need of dental treatment did not access care during the first half of the sealant program. The intervention of school administrative staff

at 6 months did not significantly impact the number of children accessing dental care. Similarly, dental treatment follow-up was identified as a problem in the Miles of Smiles Program, where 89% of the 214 children referred did not receive needed care (29). Although the overall referral treatment rate for the Bengal Smiles program was 50% at 12 months, administrators reflected on this situation and identified barriers to the referral follow-up: (1) local Idaho public schools do not employ school nurses to oversee dental referrals; (2) budget cuts limit school hours for social workers, which decreases availability to oversee dental referrals; and (3) interventions by school staff was not an effective means to ensure access to care.

Seal America provides additional recommendations to administrators of school-based sealant programs for referral and follow-up. Suggestions consist of identifying community resources for dental care including safety net dental clinics, informing parents of dental treatment needs, monitoring referral effectiveness, addressing barriers to dental care and creating a case manager position (19). A case manager is a liaison between families and dental treatment. The roles and responsibilities of this position might entail improving the involvement of parents in the child's oral health care, dental insurance enrollment and usage, identification of dentists who accept publicly funded dental insurance, education on patient etiquette, transportation and translation services, and receipt of follow-up care (19). Case management by a dental hygienist is a viable means to enhance this aspect of a sealant program. Dental hygiene students can be educated to become future case managers by participating in service learning opportunities such as the Bengal Smiles program and gaining experiences with case manager roles and responsibilities. Furthermore, students who engage in

service learning activities gain confidence in providing care for underserved populations and are more likely to volunteer for similar community outreach programs after graduation (30).

Service learning programs in dental and dental hygiene programs provide manpower resources without compensation for oral health program implementation. This cost saving approach is limited by the availability of students to engage in these programs. For instance, community outreach experiences occur during the final semester of the dental hygiene program; therefore, the Bengal Smiles program is operational only during that semester. This limitation might have influenced the attrition rate and as literature has shown, school-based programs implemented throughout the full school year allowed more opportunity for follow up evaluations (11,27,29). In order to sustain the Bengal Smiles program over the entire school year, collaborating with community partners including public health practitioners, and dental hygiene and dental association members is one option. In this instance, a dental hygiene case manager would be beneficial for the recruitment, coordination, and training of volunteers to effectively provide a full year of seamless care. Likewise, the case manager would secure financial resources to sustain and expand the school-based program through community partners and grant funding. For example, the Bengal Smiles program was expanded to another Title 1 elementary school based on financial support from these two resources.

In addition to funding, sustaining initial programs and implementing new programs requires continual recruitment of child participants. The small number of returned consent forms directly impacted the number of children participating in this oral health program. An informal conversation with the school principal and staff revealed that the children had expressed fear of the sealant procedures with the anticipation of feeling pain. Consequently, children's fears were addressed in all second grade classrooms with a presentation at the

elementary school where the expanded Bengal Smiles program was implemented. The impact of the educational sessions in the classrooms resulted in twice as many consent forms being returned and teachers seemed receptive to children missing class time to participate in the sealant program. Parents also play a key role in children participating in school-based programs; therefore, continual recruitment should involve increasing the oral health literacy of parents with presentations at PTA meetings and back-to-school events (19).

Future recommendations to sustain and expand school-based sealant programs would be to conduct a qualitative study on school satisfaction and parent satisfaction. Data collected could identify barriers to accessing oral health care for children in a community. One mechanism to improve treatment rates is to implement a school-based dental clinic manned by supervised dental students, dental residents, or volunteers from the dental association. Elementary schools located in rural areas would benefit from mobile van treatment centers; whereby, children would receive dental treatment in close proximity of their education; thereby, reducing the barrier of transportation.

Conclusions

The Bengal Smiles program provided valuable oral health services to low-income children at a local Title 1 school after its first year of implementation. This program will begin its second year, which will include two Title 1 elementary schools and ongoing program evaluation. Outcomes from the first year of the program showed sealant prevalence was an effective intervention to increase sealant prevalence and decrease active decay. Fully retained dental sealants resulted in no decay at the 12 month evaluation. The secondary intent of this evaluation was to increase the number of children who received recommended oral health care by the intervention of school administrative staff. The intervention did not significantly affect

the referral treatment results; however, half of the children referred for oral health needs received treatment after one year.

Outcomes from the Bengal Smiles program provide evidence that school-based sealant programs eliminate disparities in accessing preventive oral health care and contribute to meeting Healthy People 2020 oral health objectives. Additionally, oral health programs implemented by a university are a cost effective means to sustain a sealant program (13). Service learning experiences provide opportunities for students to gain skills and confidence in providing care to underserved populations (30). Future recommendations for sealant programs would be to employ dental hygienists as case managers to collaborate with community partners, be a liaison between parents and children in need of follow-up care, and oversee sustainability of the program.

Acknowledgements

Funding for the Bengal Smiles program was made possible by Ronald McDonald House of Charities, Idaho Power, and the Department of Dental Hygiene at Idaho State University. The authors would like to acknowledge the principal and administrative staff at Greencare's Elementary School for their support of the sealant program.

References

1. Bloom B, Jones LI, Freeman G. Summary health statistics for U.S. children: national health interview survey, 2012. *Vital Health Stat.* 2013 [cited 2015 Dec 11];10(258): [about 3 p.]. Available from: http://www.cdc.gov/nchs/data/series/sr_10/sr10_250.pdf
2. Dye BA, Tan S, Smith V, Lewis BG, Barker LK, Thornton-Evans G, et al. Trends in oral health status: United States, 1988–1994 and 1999–2004. *National Center for Health Statistics. Vital Health Stat.* 2007; 11(248).
3. Dye BA, Li X, Thornton-Evans G. Oral health disparities as determined by selected Healthy People 2020 oral health objectives for the United States, 2009–2010. *NCHS Data Brief* 2012 Aug;(104):1-8. Hyattsville, MD: National Center for Health Statistics.
4. Griffin SO, Barker LK, Wei L, Li C, Albuquerque MS, Gooch BF. Use of dental care and effective preventive services in preventing tooth decay among U.S. children and adolescents- medical expenditure panel survey, United States, 2003–2009 and national health and nutrition examination survey, United States, 2005–2010. *MMWR Surveill Summ.* 2014;Sep 12;63 Suppl 2:54-60. Available from http://www.cdc.gov/mmwr/preview/mmwrhtml/su6302a9.htm?s_cid=su6302a9_w
5. U.S. Department of Health and Human Services. Oral health in America: A report of the Surgeon General. Rockville, MD: U. S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institute of Health; 2000. [cited 2015 Dec 11]; [about 9 p.]. Available from: <http://profiles.nlm.nih.gov/ps/access/NNBBJT.pdf>
6. Ahovuo-Saloranta A, Forss H, Walsh T, Hiiri A, Nordblad A, Mäkelä M, Worthington HV. Dental sealants for preventing dental decay in the permanent teeth. *Cochrane Database Syst Rev.* 2013 Mar 28;3:CD001830. doi: 10.1002/14651858.CD001830.pub4
7. Assunção IV, Costa GF, Borges BC. Systematic review of noninvasive treatments to arrest dentin noncavitated caries lesions. *World J Clin Cases.* 2014 May 16;2(5):137-41. doi: 10.12998/wjcc.v2.i5.137
8. Beauchamp J, Caufield PW, Crall JJ, Donly K, Feigal R, Gooch, B, et al. Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs. *J Am Dent Assoc.* 2008 Mar [cited 2015 Dec 11];139(3):257-68 [about 9 p.]. Available from: [http://jada.ada.org/article/S0002-8177\(14\)61434-3/pdf](http://jada.ada.org/article/S0002-8177(14)61434-3/pdf)
9. Fontana M, Platt JA, Eckert GJ, González-Cabezas C, Yoder DT, Zero DT, et al. Monitoring of sound and carious surfaces under sealants over 44 months. *J Dent Res.* 2014 Nov [cited 2015 Dec 11];93(11):1070-5 [about 8 p.]. Available from <http://jdr.sagepub.com>

10. Dawkins E, Michimi A, Ellis-Griffith G, Peterson T, Carter D, English G. Dental caries among children visiting a mobile dental clinic in South Central Kentucky: a pooled cross-sectional study. *BMC Oral Health*. 2013 May 2;13:19. doi: 10.1186/1472-6831-13-19
11. Seigal MD, Detty AM. Do school-based dental sealant programs reach higher risk children? *J Public Health Dent*. 2010 Summer [cited 2015 Dec 11];70(3):181-7 [about 1 p.]. doi: 10.1111/j.1752-7325.2009.00162.x
12. U.S. Department of Health and Human Services. (2003). National call to action to promote oral Health: A public-private partnership under the leadership of the Office of the Surgeon General. Rockville (MD): National Institute of Dental and Craniofacial Research (US); 2003. Report No.: 03-5303.
13. Association of State and Territorial Dental Directors [Internet]. Reno: The association; c2003 [updated 2015 Mar; cited 2015 Dec 12]. Best practice approaches for state and community oral health programs. Available from: <http://www.astdd.org/docs/bpar-selants-update-03-2015.pdf>
14. Centers for Disease Control and Prevention [Internet]. Atlanta: Centers for Disease Control and Prevention. Division of Oral Health; c2013 [updated 2015 Mar 20; cited 2015 Dec 12]. School based dental sealant programs. Available from: http://www.cdc.gov/OralHealth/dental_sealant_program/
15. Oral Health America [Internet]. Chicago: Oral Health America; c2015 [updated 2015; cited 2015 Dec 13]. Seal Two Million. Available from: <https://oralhealthamerica.org/participate/seal-two-million/>
16. Idaho Department of Health and Welfare, Division of Public Health. Idaho smiles survey 2013 report [Internet]. Boise: Oral Health Program; 2014 [cited 2015 Dec 13]. Available from: <http://healthandwelfare.idaho.gov/Portals/0/Health/Disease/Oral%20Health/Smile%20Survey2013ReportFINAL2014.pdf>
17. Center for Disease Control and Prevention [Internet]. Atlanta: The community guide; c2013. [updated 2015 Aug 25; Cited 2015 Dec 14]. Guide to community preventive services: community task force members. Available from: <http://www.thecommunityguide.org/about/task-force-members.html>
18. U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion [Internet]. Rockville: Office of Disease Prevention and Health Promotion; c2013 [updated 2015 Dec 17; cited 2015 Dec 17]. Healthy people 2020. Available from: <http://www.healthypeople.gov/2020/faqs.aspx>
19. Carter NL; The American Association for Community Dental Programs, The National Maternal and Child Oral Health Resource Center. Seal America: The Prevention

- Invention. 2nd ed., rev. Washington: National Maternal and Child Oral Health Resource Center; 2011. Available from: <http://mchoralhealth.org/seal/index.html>
20. Gooch BF, Griffin SO, Gray SK, Kohn WG, Rozier MS, Fontana M, et al. Preventing dental caries through school-based sealant programs: updated recommendations and reviews of evidence. *J Am Dent Assoc*. 2009 Nov;140(11):1356-65. doi: 10.14219/jada.archive.2009.0070
 21. U.S. Census Bureau. [Internet]. Washington (DC): State and county quick facts. c2014 [cited 2015 Dec 14]. Available from: <http://quickfacts.census.gov/qfd/states/16/1664090.html>
 22. Centers for Disease Control and Prevention. [Internet]. Atlanta: The Community Guide; c2013 [updated 2014 May 27; cited 2015 Dec 14]. Guide to community preventive services. Preventing dental caries: school-based dental sealant delivery programs. Available from: <http://www.thecommunityguide.org/oral/supportingmaterials/RRschoolsealant.html>
 23. National Oral Health Surveillance System [Internet] Atlanta (GA): Division of Oral Health. National Centers for Chronic Disease Prevention and Health Promotion .Centers for Disease Control and Prevention. c2011 [updated 2010 Aug 11; cited 2015 Dec. 14] Dental sealants. Percentage of 3rd grade students with dental sealants on at least one permanent molar. Available from: <http://apps.nccd.cdc.gov/nohss/IndicatorV.asp?Indicator=1>
 24. U.S. Department of Health and Human Services [Internet] Rockville: Office of Disease Prevention Health Promotion. c2014 [cited 2015 Dec 14] About Healthy People. Retrieved from <http://www.healthypeople.gov/2020/About-Healthy-People>
 25. Detty MR, Oza-Frank R. Oral health status and academic performance among Ohio third-graders, 2009-2010. *J Public Health Dent*. 2014 Fall;74(4):336-42. doi: 10.1111/jphd.12063. Epub 2014 Jun 25
 26. Centers for Disease Control and Prevention [Internet]. Atlanta: The Community Guide; c2013c [updated 2014 May 27; cited 2015 Dec 14] Guide to community preventive services. Task force finding and rational statement. Available from <http://www.thecommunityguide.org/oral/supportingmaterials/RRschoolsealant.html>
 27. Devlin D, Henshaw M. Improving access to preventive dental services through a school-based dental sealant program. *J Dent Hyg*. [Internet]. 2011 Summer [cited 2015 Dec 14] ;85(3):211-9. Available from: <http://web.b.ebscohost.com.libpublic3.library.isu.edu/ehost/pdfviewer/pdfviewer?sid=b161da04-99d7-4bf8-8c04-aac0c8d4123b%40sessionmgr114&vid=3&hid=116>
 28. U.S. Department of Health and Human Services [Internet] Rockville: Office of Disease Prevention Health Promotion c2014 [updated 2015 Dec 17; cited 2015 Dec 14].

Healthy People 2020 Leading *Health Indicators: Progress Update*. Available from: <http://www.healthypeople.gov/2020/leading-health-indicators/Healthy-People-2020-Leading-Health-Indicators%3A-Progress-Update>

29. Simmer-beck M, Gadbury-amyot CC, Ferris H, Voelker MA, Keselyak NT, Eplee H, et al. Extending oral health Care services to underserved children through a school-based collaboration: Part 1 - a descriptive overview. *J Dent Hyg.* [Internet]. 2011 summer [cited 2015 Dec 14];85(3):181-92 Available from: <http://web.b.ebscohost.com.libpublic3.library.isu.edu/ehost/pdfviewer/pdfviewer?sid=b161da04-99d7-4bf8-8c04-aac0c8d4123b%40sessionmgr114&vid=5&hid=116>
30. Keselyak NT, Simmer-beck M, Gadbury-amyot C. Extending oral health care services to underserved children through a school-based collaboration: Part 2 - the student experience. *J Dent Hyg.*[Internet]. 2011 Summer [cited 2015 Dec 15];85(3):193-203 Available from: <http://web.b.ebscohost.com.libpublic3.library.isu.edu/ehost/pdfviewer/pdfviewer?sid=b161da04-99d7-4bf8-8c04-aac0c8d4123b%40sessionmgr114&vid=7&hid=116>

Table 1 Bengal Smiles Spring 2014 and Spring 2015 Program Procedures

Procedures
A dental hygiene student obtained the child from class and walked them to a private area designated for the dental sealant program. Screenings for dental decay were performed by a dental hygiene student visually and with the side of an explorer. If an area had a suspicious lesion a Diagnodent was utilized for further identification of active caries.
Additional screenings were performed by the dental hygiene student for dental restorations, dental sealant prevalence, and identification of teeth that would benefit from a dental sealant. Spring 2015 screenings included sealant retention and sealant decay in addition to the previously stated screenings. Dental findings were recorded in the SEALS child-level data collection form.
Either the Community Outreach Coordinator or the Principal Investigator was present to supervise and verify the recorded findings. Once all of the data were documented, a decayed, missing, filled teeth (DMFT) index score was calculated and an instructor verified the calculations and signed the form.
Child participant's information was placed in a file with their name and identification number and was locked in a mobile filing storage. Data transferred into the Excel file for analysis did not have the child's name only the identification number.
Dental sealants were placed by dental hygiene students with Ultraseal XT Hydro dental sealant material according to the manufacturer's instructions. Sealants were examined by the Community Outreach Coordinator or the Principal Investigator for proper placement.
Disclosing solution was placed on the child's teeth to collect a personal hygiene performance (PHP) score and provide oral hygiene instructions for plaque removal.
Fluoride varnish was applied as an additional preventive measure before the child was returned to the classroom.
All children received a bag with a toothbrush, toothpaste, floss, and a letter for parents. The parent letter provided information on the treatment received and a need for dental referral if possible dental caries were identified.

Table 2 Demographics Characteristics of Sealant Program Participants (n=32)

Demographics		n	Percent
Gender	Male	15	47
	Female	17	53
Ethnicity	White	26	81
	Non-White	6	19
Age	7-9	21	66
	10-12	11	34

Table 3 Child Participation Decay Rate

Variable	Baseline	12 month	P
Decay rate			value
Permanent Tooth Decay Rate	5.9	2.5	0.21

Decay rate was computed by dividing the number of decayed permanent posterior teeth by the number of permanent posterior erupted teeth (t-test with a two tailed paired sample $p \leq .05$).

Table 4 Dental Sealant Retention and Sealant Decay Rates

Variable	# sealants retained	% sealants retained	# decayed sealed teeth	% decayed sealed teeth
Full Retention	72	74	0	0
Partial Retention	12	13	3	25
No Retention	12	13	3	25

Measurements were taken on permanent posterior teeth (n=96)