

SCHOOL NURSE COLLABORATION TO PROVIDE EVIDENCE BASED
FLOURIDE VARNISH FOR HIGH CARIES RISK STUDENTS AND
REFERRAL FOR RESTORATIVE DENTAL CARE

by

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A Scholarly Project submitted in partial fulfillment
of the requirements for the degree

of

Doctor of Nursing Practice

in

Family and Individual

MONTANA STATE UNIVERSITY
Bozeman, Montana

April 2016

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ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Laura Larsson and committee members Dr. Jane Gillette, Dr. Elizabeth Kinion, and Dr. Stacy Stellflug. Their patience, support, and guidance of this project has been immensely appreciated and valued. I would also like to recognize those who assisted in the project including the Billings Public School nurses, especially Ms. Melissa Archilla and Ms. Sue Cannon; McKinley school staff; Ms. Bridgette Schramper with Sealants for Schools; and Ms. Melissa Utley, RDH and Dr. Charles Blackburn from the Ronald McDonald Care Mobile. Your assistance made this project a reality and your expertise was invaluable. Finally I would like to thank my family for their patience, flexibility and support over the last three years as I pursued my dream of becoming a Family Nurse Practitioner with a Doctorate in Nursing. Thank you.

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ABSTRACT

Despite improvements in public health dentistry, low-income children continue to experience dental caries at higher rates than their counterparts. Commonly cited factors that impede low-income families from obtaining dental care include difficulty getting time off from work, lack of transportation or childcare, and lack of knowledge regarding the importance of oral health care. Community-based approaches to reduce caries rates, such as school-based dental sealant programs, are gaining popularity. School nurses can have an instrumental role in improving oral health access within their schools by collaborating with personnel from these programs to perform assessments, case-finding, and fluoride varnish application with increased frequency. Utilizing dental sealant program screening data from a low-income elementary school, school nurses identified students at highest risk for dental caries (N = 98) and offered a repeat application of fluoride varnish six months following the initial screening and application. In addition, school nurses utilized the screening data to identify students with untreated decay (N = 49). Those students who had not obtained professional dental care following the initial screening were offered referral to an onsite mobile dental van for professional restorative care. The results of this project indicated that school nurses can successfully enhance fluoride protection and improve access to preventive and professional oral health care for children attending low-income schools.

CHAPTER 1

INTRODUCTION

The most common chronic disease of childhood is dental caries, commonly referred to as tooth decay. Dental caries are the result of a multifactorial disease process that cause the destruction of tooth enamel and can lead to tooth destruction. Untreated dental caries can cause pain with eating and speaking, and make concentrating in school more difficult (Okunseri, Gonzalez, & Hodgson, 2015). At its most severe, untreated caries can lead to infection and ultimately death (Shweta & Prakash, 2013).

Dental caries is a preventable disease yet nearly 56% of children aged two to eight living in the United States experience decay (Dye, Thornton-Evans, Li & Iafolla, 2015). Several barriers exist that impede access to dental care including limited availability of dental resources, lack of awareness of need for care, cost, and fear of dental procedures (United States Department of Health and Human Services [HHS], 2011.). Disparities in oral health care exist for persons with lower levels of education and income, the disabled, and persons from certain ethnic groups including African Americans, Hispanics, American Indians, and Alaska Natives (Centers for Disease Control and Prevention [CDC], 2013a). These disparities in oral health have prompted the authors of Healthy People 2020 (a ten year agenda for improving the Nation's health) to prioritize oral health as a leading health indicator (2011). Leading health indicators are select high-priority issues that are used to “assess the health of the nation, facilitate collaboration across sectors, and motivate action at the national, state, and community levels to improve the

health of the U.S. population” (HHS, 2011). Through Healthy People 2020 the government seeks to reduce oral health diseases and improve access to preventive services and dental care.

Modern day approaches to dental care emphasize caries prevention through risk assessment and use of evidence-based caries prevention strategies such as dental sealants and fluoride varnish. Two evidence-based interventions to reduce tooth decay are supported by Healthy People 2020, community water fluoridation and school-based dental sealant programs (2011). Despite water fluoridation being considered one of the top public health achievements of the 20th century (CDC, 2015a), most Montana cities do not fluoridate drinking water ranking Montana 47th in the United States for providing optimally fluoridated drinking water.

In contrast, an estimated 55% of Montana third grade students had sealants compared to just 32% of the U.S. third grade population (Montana Department of Health and Human Services [MT DPHHS], 2015). One reason for this success is Sprout Oral Health’s Sealants for Smiles (SFS) program (Crozier, 2014). This not-for-profit program brings volunteer dental professionals into schools who have greater than 50% of students qualifying for the National School Lunch Program. Volunteer dental professionals provide a visual oral health exam, place sealants on newly erupted first and second molars, and apply fluoride varnish (FV) to students’ teeth. An opportunity exists for school nurses to supplement the effectiveness of the SFS program and enhance fluoride protection by applying FV to students’ teeth between SFS visits in order to achieve the optimal frequency of treatments. Additionally, sealant programs can provide screening

data to school nurses who can case-manage students with unmet dental needs and assist them to obtain professional dental care.

Significance

Montana children experience higher decay rates than the general U.S. population. In 2014, 65% of Montana third grade students had decay experience, compared to 52% of the general U.S. third grade population (MT DPHHS, 2015). Disparities exist for children living in poverty with nearly one in four children aged six to nine, having untreated caries (Dye, Li, & Thornton-Evans, 2012). This holds true in Montana, as children attending the lowest income schools had a significantly higher prevalence of decay experience and untreated decay compared to children from higher income schools. Eighty-eight percent of third grade students attending Montana's lowest income schools had decay experience and 60% had untreated dental caries compared to 45% and 9.7% in the highest income schools (MT DPHHS, 2015). In addition, American Indian students experienced significantly higher caries rates than students of other ethnic backgrounds with 92.3% of American Indian third graders having decay experience and 56.4% having untreated decay compared to Caucasian students with 58.1% and 18.5%, respectively (MT DPHHS, 2015). Providing evidence-based preventative oral health care in low-income school settings and in schools with significant American Indian enrollment has the potential to reduce disparities in oral health care and improve the oral health of many underserved students.

Purpose

The aim of this scholarly project was to implement a collaborative interdisciplinary quality improvement project for school nurses to enhance preventive oral health care and reduce oral health inequities experienced by students attending low-income schools. Two goals were established. First to enhance fluoride protection through school-nurse applied FV and second to improve access to preventive and professional oral health care for children attending a low-income elementary school. Two specific interventions were implemented to achieve these goals. First students at highest risk for dental caries were identified and offered follow-up FV application five months following the initial application by SFS. Second, students with untreated decay who had not sought professional dental care five months following the initial SFS screening were referred for professional treatment aboard the Ronald McDonald Care Mobile (RMCM) brought onsite to the school.

CHAPTER 2

LITERATURE REVIEW

A detailed review of literature was conducted utilizing PubMed, CINAHL, Cochrane Library, and Google Scholar with regard to the etiology of dental caries, the impact of untreated decay, caries risk assessment, the role of fluoride in caries protection, the effectiveness of fluoride varnish, and its efficacy in school-based settings. Chapter two will summarize these findings.

Etiology of Dental Caries

Dental caries, otherwise known as tooth decay, result from a multi-factorial disease process that causes destruction of tooth enamel. Bacteria colonize on the tooth surfaces as a bacterial biofilm (dental plaque) and produce acidic by-products from the fermentation of dietary carbohydrates (Selwitz, Ismail, & Pitts, 2007). The acids produced by bacterial fermentation of carbohydrates result in demineralization of tooth enamel (Selwitz et al., 2007). Saliva, in the absence of carbohydrates, works as a buffer allowing for remineralization of the tooth surfaces (Selwitz et al., 2007). This demineralization/remineralization process takes place throughout the day, however frequent ingestion of carbohydrates does not allow time for the remineralization process to occur. Carious lesions develop when acidic biofilm remains on the tooth surface for long periods of time. The dissolution of minerals in the tooth surface leads to the formation of opaque white (white spot lesions) or brown spots on teeth, otherwise known

as caries (Okunseri et al., 2015). Left untreated these lesions can progress from the enamel layer of the tooth (non-cavitated), into the root surface (cavitated) leading to tooth destruction (Selwitz et al., 2007).

Untreated Decay

Untreated tooth decay can progress causing pain, discomfort and suffering and can lead to problems eating, speaking, socializing, and learning (Okunseri et al., 2015). Jackson, Vann, Kotch, Pahel, and Lee (2011), found that children with poor oral health missed more school days and had poorer school performance than children with very good or excellent oral health. Untreated decay can also increase the cost of dental care, especially in young children, who may require sedation in order to complete restorative dental work. At its most severe, untreated dental decay can lead to abscesses and cellulitis requiring urgent surgical intervention and hospitalization. In 2012 over 2,000 Montana Emergency Department (ED) visits were due to non-traumatic dental conditions, resulting in \$750,000 annual cost for treatment (Custis, 2014). The majority of these visits were related to dental caries and abscessed teeth, both preventable conditions with regular dental care (Custis, 2014). Nationally, 900,000 ED dental related visits occurred in 2009, with nearly 13,000 requiring hospital inpatient stays (Seu, Hall, & Moy, 2012). Emergency department visits for dental issues rose 41% between 2001 and 2008, especially among those aged 18 to 44, uninsured, and African Americans (Lee, Lewis, Saltzman, & Starks, 2012), suggesting that community access to dental care is worsening over time and that case-finding for high priority groups must be initiated.

Caries Risk

All children are at risk for developing dental caries, however some factors place children at higher risk than others. Caries result when an imbalance of risk factors and protective factors occur. Risk factors include: previous decay experience; low fluoride exposure; low-income status; high levels of cariogenic bacteria; frequent exposure to dietary sugars and refined carbohydrates; inappropriate bottle feeding; low saliva flow; tooth enamel defects; lack of access to dental care; lack of parental knowledge regarding oral health; and having a mother or caregiver with high levels of cariogenic bacteria or poor maternal oral health (American Academy of Pediatric Dentistry [AAPD], 2014; Chou, Cantor, Zakher, Mitchell, & Pappas, 2013; HHS, 2000). Protective factors include: drinking optimally-fluoridated water or using fluoride supplements, brushing daily with fluoridated toothpaste, receiving topical fluoride from a health professional, and identifying a regular source of dental care/dental home (AAPD, 2014a).

Several caries risk assessment tools have been developed to assist both dental and non-dental professionals in identifying children who may be at higher risk for developing caries, as well as to assist in developing an individualized plan of care with a focus on prevention (Hurlbutt & Young, 2014). Frequently mentioned risk assessment guidelines reported in literature are the AAPD Caries Risk Assessment Tool, the Caries Management by Risk Assessment (CAMBRA) developed by the California Dental Association, the American Dental Association (ADA) Caries Risk Assessment forms, and the Cariogram (Tellez, Gomez, Pretty, Ellwood, & Ismail, 2013). All four tools vary in the number of factors assessed, however the four systems all identify these etiologic risk

factors as significant for future caries development: caries experience; visible plaque; inadequate fluoride exposure; diet; salivary flow; and overall general health conditions (Tellez et al., 2013). Of these risk factors, previous caries experience is the greatest predictive variable for development of new dental caries (AAPD, 2014; Li & Wang, 2002; Motohashi et al., 2006; Vanobbergen, Martens, Lesaffre, Bogaerts, & Declerck, 2001; Zero, 2001).

Fluoride

The significant role of fluoride in the reduction of dental caries is well supported in the literature. Fluoride is a naturally occurring mineral that is released from rocks into soil, water and air (CDC, 2015a). Beginning in the 1930s researchers first correlated caries reduction with children living in communities with naturally occurring fluoride in drinking water (Dean, 1940). Since 1945, community water fluoridation began in hundreds of cities as a means to provide the public with the benefits of fluoride and has since been named one of the greatest public health achievements of the 20th Century (CDC, 2015a). Fluoride benefits all persons across the lifespan (CDC, 2015a), and safely helps to strengthen and rebuild tooth enamel, protecting teeth from the acidic by-products of carbohydrate fermentation by oral bacteria (CDC, 2015a). Fluoride works both systemically, through the ingestion of fluoridated water or fluoride supplement tablets, and topically, in the form of toothpastes, rinses and professionally applied gels, foams, and varnishes. Topically applied fluoride varnish can arrest and potentially reverse early enamel carious lesions (Autio-Gold & Courts, 2001).

While fluoride is beneficial for caries protection, ingestion of large quantities of fluoride while teeth are developing can lead to dental fluorosis. Dental fluorosis is a term used to describe changes in the appearance of tooth enamel resulting from systemic ingestion of high levels of fluoride. Dental fluorosis can range from mild (scattered white spots on the tooth surface) to severe (large white spots on the tooth surface, leading to rough pitted surfaces (CDC, 2015b). Minimal levels of fluoride are ingested with topical application of FV, and when applied two to four times yearly, FV is unlikely to cause dental fluorosis (Association of State & Territorial Dental Directors [ASTDD], 2014).

According to 2012 statistics, 32% of Montanans received fluoridated drinking water, ranking Montana 47th in the United States for providing optimally fluoridated drinking water (CDC 2012). Yellowstone County, the setting for this scholarly project, does not provide community water fluoridation and naturally occurring fluoride within the city water supply is reported to be 0.5 ppm protection (Montana Department of Environmental Quality, 2010). This is less than the recommended level of 0.7 ppm for optimal caries protection (HHS, 2015). To achieve adequate fluoridation and caries protection, children may be prescribed fluoride supplements, or receive other topical fluorides such as mouth rinses, gels, and varnish.

Fluoride Varnish

Fluoride varnish is a topical preparation of fluoride, commonly used in oral health outreach and prevention programs, due to its safety and ease of application compared with other fluoride vehicles (Bader, 2001). Fluoride varnish can be applied by both dental and non-dental professionals to reduce dental caries in children (Beltrán-Aguilar,

Goldstein, & Lockwood, 2000; Weyant et al., 2013). It is “painted” onto tooth surfaces, taking an average of 1 to 4 minutes to apply per child (Beltrán-Aguilar et al., 2000), and sets immediately upon contact with saliva, resulting in a prolonged adherence to tooth enamel. While the exact mechanism of action is unknown, it is thought that the prolonged contact of fluoride interacts with tooth enamel to form fluoroapatite, which permanently binds to the enamel. Fluoroapatite is much less susceptible to the effects of acids than enamel (Carey, 2014).

Marinho, Worthington, Walsh, and Clarkson (2013) conducted a systematic review of literature to determine the effectiveness of FV in preventing dental caries in children and adolescents compared to placebo, or no intervention. Their original Cochrane Review was published in 2002, and reviewed again in 2013. The authors reviewed 22 trials with 12,455 participants (9595 used in analyses) and concluded the use of FV compared to placebo or no treatment provided a 43% reduction in decayed, missing and filled tooth surfaces (DMFS) in permanent dentition (95% CI 30% to 57%; $P < 0.001$), and a 37% reduction in DMFS was noted in primary dentition (95% CI 24% to 51%; $P < 0.001$) compared to placebo and no treatment.

Several studies have examined the ideal frequency of application for FV. The random controlled trial (RCT) by Weintraub, et.al. (2006) found twice yearly application of FV was more beneficial than one application, and one application was preferable to none. These findings are consistent with the Cochrane review conducted by Marinho, et al. (2013) who found FV treatments applied two to four times yearly either in primary or

permanent dentition, were associated with substantial reduction in caries for all caries risk groups compared to other sources of fluoride.

School-based Fluoride Varnish

School-based FV programs have been utilized in Europe and Canada for several years, and some programs are underway in the United States. Studies reviewing the efficacy of school-based FV programs have primarily shown efficacy, with one study showing differing results. A 3-year RCT conducted in Sweden by Moberg, Petersson, Lith, and Birkhed (2005) found students who received FV every six months was effective for prevention of caries, especially in low socio-economic communities. Another RCT conducted with Brazilian school children compared the efficacy of FV in preventing caries in high-caries risk children and found those receiving FV twice yearly showed a preventive fraction of 49% versus the control group which had a 31% reduction. The results of this study may have been limited due to large attrition rates related to the mobile and transient nature of the participating population (Arruda et al., 2012). The Clark County Dental Health Initiative in Kentucky began twice yearly FV application by volunteer dentists, hygienists, and community members to children in preschool through fifth grade (Mann, 2013). A 73% reduction in decay rates was noted after five years (Mann, 2013). This program was one of five programs across the nation to be awarded the Model Practice Award by the National Association of County and City Health Officials (Mann, 2013). School-based programs that offer twice yearly application for at least two years combined with counseling are more likely to demonstrate benefits and reduce caries risk compared to stand alone events (ASTDD, 2014).

The findings of one study stand in contrast to most others. A two-year double blinded RCT, conducted in children ages 2-5 years attending preschool in Athens, Greece, found no significant difference in caries prevalence or increment with biannual FV compared to placebo (Agouropoulos et al., 2014). Both groups also received oral health education and supervised tooth brushing with fluoridated toothpaste (Agouropoulos et al., 2014). One limitation of this study was the fact that 0.9% sodium fluoride varnish was used. In the United States 5% sodium fluoride varnish preparations are the most commonly used; a solution more than five times as concentrated as that used in the Agouropoulos study.

Based on the findings of the review of literature, the intervention for this project subscribed to the biannual fluoride varnish recommendation with 5% sodium fluoride varnish for high caries risk students.

CHAPTER 3

METHODS

Theoretical Framework

School nursing goes beyond caring for children with playground injuries. The role of the school nurse is to keep students healthy, safe, and ready to learn (National Association of School Nurses [NASN], 2011). The NASN recently published the Framework for 21st Century School Nursing Practice (see Figure 1) as a means to define the holistic and complex nature of the role of school nurse and to guide school nurse practice and research (NASN, 2016). The architects of the framework defined five key principles of school nursing: care coordination; leadership; public health; quality improvement; and standards of practice (NASN, 2016). The authors of the model proposed that school nurses who practice within these five key areas will deliver comprehensive student-centered care, ultimately supporting student health and academic success (NASN, 2016). Each of the five principles of the framework were used in the completion of the scholarly project.

The first principle, care coordination, is defined as “(the) deliberate organization of patient care activities between two or more participants...to facilitate the delivery of care” (American Nurses Association, 2012). School nurses coordinate care between families, students, medical professionals and school staff to ensure student health and safety while at school. Twelve components of care coordination are practiced by school nurses including: case management; chronic disease management; collaborative

communication; direct care; education; interdisciplinary teams; motivational interviewing/counseling; nursing delegation; student care plans; student-centered care; student self-empowerment; and transition planning.

Several of the care coordination components were operationalized during the planning, implementation, and evaluation of this scholarly project. School nurses collaborated with an interdisciplinary team of dental professionals from the SFS program as well as the local Ronald McDonald Care Mobile (RMCM), a mobile dental van that provides professional preventive and restorative oral health care to children in seven eastern Montana counties, regardless of the family's ability to pay. This collaboration allowed for the identification of high-risk students for whom school nurses provided oral health education, and direct care via application of FV. Students identified as having unmet dental needs were case-managed and those who did not receive private follow-up care were referred to RMCM for professional dental treatment. Utilization of these care coordination components were vital to the development and success of this school-based collaborative oral health program aimed at enhancing optimal fluoride protection and improving access to preventive and professional oral health care faced by children attending low-income schools.

Leadership, the second principle, has been defined as the school nurse's ability to guide and oversee school health policies, programs, and the provision of health services (NASN, 2016). School nurses exemplify leadership through several roles including: advocate; change agent; lifelong learner; and systems-level leader (NASN, 2016). For this project, school nurses worked as change agents to improve oral health services for

students, and acted as systems-level leaders to coordinate care between SFS and the RCMC, as well as school staff. The participating school nurses also engaged in the role of lifelong learners, through participation in professional development and the successful completion of the Smiles for Life National Oral Health Curriculum. Smiles for Life is a national oral health curriculum designed to enhance oral health education for primary care providers and promote the integration of oral health and primary care (Clark et al., 2010). This program advanced the nurses' oral health knowledge as well as the skills needed for FV application.

School nursing is rooted in the foundations of community/public health, the third principle. The framework authors defined public health as "improving student health, prevention of injury, promotion of healthy lifestyles, and identification of students at risk to ensure all students are healthy, safe, and ready to learn" (NASN, 2015a). School nurse roles that exemplify public health are: improving access to care; disease prevention; health equity; risk reduction; screening/referral/and follow-up; and surveillance. Staff involved in this project identified that children attending low-income schools were at risk for oral health disparities and that improving oral health care is a national priority issue. The scholarly project established a process for screening, case-management, and referral for oral health needs. School-located preventive and restorative care improved oral health equity and reduced adverse effects of poor oral health for students.

The framework authors cited the Agency for Healthcare Research and Quality's definition of quality improvement, the fourth principle, as "a continuous and systematic process that leads to measureable improvements and outcomes" (2014). School nurses

practice quality improvement through documentation/data collection, evaluation, meaningful health outcomes, and research. Prior to this project oral health data was not being collected on students. This project quantified the number of students with highest caries risk as well as students with unmet dental needs. This data was essential to document current needs and to identify students who would benefit from FV application and referral for professional dental care. This data can be used to evaluate the effectiveness of the ongoing oral health promotion as well as to identify areas for improvement.

Standards of practice are the fifth and final principle of the Framework for 21st Century School Nursing Practice. Standards of practice are defined by the authors as “a competent level of nursing practice and professional performance common to and expected of all school nurses” (NASN, 2015a). School nurses, practicing within their scope of practice, utilizing clinical practice guidelines, and implementing evidence-based practice, provide the best possible nursing care with the best possible outcomes (NASN, 2016). Prior to this project, FV was applied annually during the SFS dental screening. This project identified that biannual application of FV is evidence-based and application by school nurses was within the scope and standards of nursing practice.

School nurses have many roles in keeping students healthy, safe, and ready to learn. This framework effectively described the principles of school nursing, and the role school nurses having in improving health, and reducing health inequities in school populations.

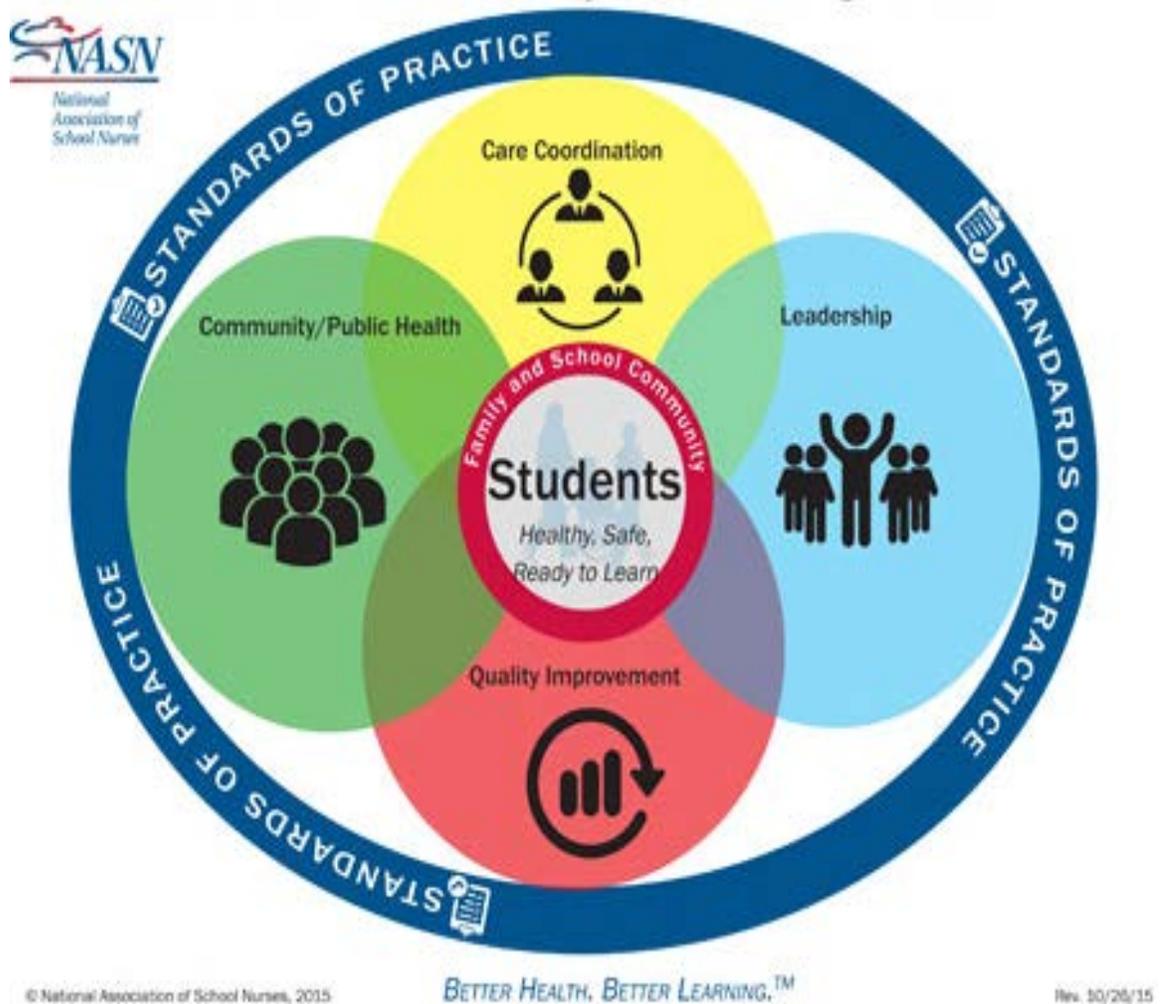


Figure 1. Framework for 21st Century School Nursing Practice.TM

Ethical Issues

Prior to implementation, project approval was granted by school district administration, the elementary school principal, and the Montana State University Institutional Review Board (MT032715-FC). A parental consent form for FV application for students was developed and approved by the Institutional Review Board. In addition, the Institutional Review Board asked that an assent form be developed to ensure

voluntary participation of students. Prior to FV application the school nurse read the assent form aloud to the student, explaining the purpose of the study, the procedure, potential side effects, and informed students that participation was voluntary, confidential, and lack of participation would not impact their school performance. Students indicated their willingness to participate by signing the assent form. No students refused participation. Students were reminded that they had the right to withdraw from participation at any point during the procedure. No students withdrew from the program.

Setting

The setting for this project was a low-income Title 1 urban school in Yellowstone County, Montana. The school had an enrollment of 325 students in kindergarten through 5th grades; 70% of whom participated in the free and reduced lunch program in 2015 (Montana Office of Public Instruction). The students are served by a team of four registered nurses who have responsibility for seven elementary schools, one middle school, and one high school. School nurses are at the school intermittently throughout the day for scheduled student needs.

The school had participated with the SFS dental program for the past two years, but there had been no coordination of care between SFS and the school nurses until this point. Therefore no case management of student dental needs had been occurring. We began this collaborative project by having the participating nurses' complete modules from the Smiles for Life curriculum to review the importance of primary and secondary interventions with school-aged children and learn the procedure for applying FV. Next,

the DNP student and the dentist from the SFS program collaborated to develop a standing order which gave the school nurses who had completed the required Smiles for Life oral health modules permission to apply FV. The standing order identified criteria for student participation, the prescription for FV, as well as the procedure for FV application (See Appendix 1). By collaborating with the SFS dentist, school administrators, and nurses the intervention setting was fully developed and ready for the student-directed interventions.

Interventions

Two student directed interventions were developed for this project and took place five months following the initial SFS screening which occurred in December 2014. Based on national and state trends showing higher rates of dental caries in low-income populations, as well as the lack of optimally fluoridated community water, we expected a large number of students would benefit from FV application. To determine the intervention population, the ASTDD recommendations for FV application were considered (2014). The ASTDD recommends against community-based fluoride varnish programs based exclusively on low-income status alone, instead recommending dental caries experience, or other risk factors be considered to achieve optimal outcomes. Since caries experience has been shown to be the greatest predictive variable for development of new dental caries (AAPD, 2014; Li & Wang, 2002; Motohashi et al., 2006; Vanobbergen et al., 2001; Zero, 2001), this variable was used to identify students at highest risk. As a result, the first intervention offered a repeat application of FV applied by school nurses to high-risk students following the initial application by SFS.

The second intervention was designed to identify students with untreated caries from the initial December 2014 SFS screening, and refer students who had not received professional dental care five months following the initial screening. The RMCM mobile dental van, which provided professional dental care for all students was brought onsite to the school eliminating potential parental barriers for obtaining oral health care such as transportation barriers, trouble getting time off from work, and inability to pay for dental care.

Procedure

The project began in April 2015 with a retrospective chart review from the SFS screening; held December 12, 2014. During this December event, the SFS volunteer dentist and hygienists performed a dental screening exam and then applied dental sealants and FV. They also collected demographic including: grade; teacher; age; race; family report of Healthy Montana Kids participation; dental home; having seen the dentist within the past year, and reported screening data including: past restorations or missing teeth due to decay; whether or not the student had untreated decay; and if FV or sealants were applied during the screening. This demographic and screening data was shared with the school nurses who conducted the retrospective chart review in April 2015. Students with caries experience or untreated decay were identified as high-risk. These high-risk students were sent home with a parental consent for the school nurse to apply FV during May 2015. Consents for high-risk students with untreated decay also contained an

additional item to assess if the dental referral had been completed since the initial December 2014 screening.

In May 2015 the high-risk students whose parents had consented to follow-up FV treatment were brought by groups of two to three students into the nurse office and read the assent form. School nurses counseled assenting students regarding the importance of twice daily brushing and gave students the opportunity to practice tooth brushing on a mouth model. Students sat in a chair facing the nurse for application. Teeth were quickly dried with a gauze pad, and school nurses “painted” on the 5% sodium FV. Students were given a cup of water to rinse their teeth following application, and were counseled to wait to brush their teeth until the following morning. Students returned to class following FV application and were given a dental “goody bag” containing a toothbrush, toothpaste, a chart to encourage twice daily teeth brushing, and a note to parents to inform them that the FV application had occurred.

Parents and caregivers of high-risk children with untreated decay, who indicated their child had not received dental care since the December 2014 screening, were phoned by the school nurses to assess their interest in having the child receive professional dental care by the RMCM which would be onsite at the school in the coming weeks. Those who agreed to referral were sent home with RMCM consent forms. Students were then scheduled to be seen at the RMCM (parked onsite) and were accompanied to and from the classroom by school staff including nurses, teachers and the principal. Students received professional dental care from a registered dental hygienist and dentist who staffed the RMCM.

CHAPTER 4

RESULTS

The initial SFS screening in December of 2014 included 175 students. By the April 2015 intervention some students moved out of the school district ($n= 14$, 8% of the original sample). These students were deleted from the database used for analysis, thus reducing the total number of participants to 161. Screening data was analyzed with SPSS (IBM Corporation, 2012) for frequencies and correlations.

Boys ($n = 81$) and girls ($n = 80$) participated about equally in the screening. Kindergarten students has the lowest participation ($n = 16$) and second grade ($n = 35$) had the highest participation. Of students whose parents reported race, 132 students were Caucasian, 18 American Indian, four Hispanic, and three were African American (See Table 1). Over half the participants (50.9%) were enrolled with Healthy Montana Kids, Montana's Medicaid program. Sixty-three percent of students reported having a dental home, and 65.2% of students had seen a dentist in the past year.

School nurses identified high-risk students as those who had caries experience ($n = 98$). These 98 high-risk students, representing 60.9% of the SFS participants (See Table 2), comprised the first intervention group for this oral health improvement project. School nurses identified 49 students, or 30.4% of the SFS participants as having untreated decay.

Table 1. Age, Race, Gender of Sealants for Schools Screening

PARTICIPANTS		STUDENTS	PERCENTAGE
GRADE	K	16	9.9
	1	30	18.6
	2	35	21.7
	3	20	12.4
	4	30	18.6
	5	30	18.6
GENDER	Male	81	50.3
	Female	80	49.7
RACE	Caucasian	132	82.0
	American Indian	16	11.2
	Hispanic	4	2.5
	African American	3	1.9
	No response	4	2.5

Table 2. High Caries Risk Students per Grade.

PARTICIPANTS	HIGH CARIES RISK STUDENTS		PERCENT WITHIN GRADE
GRADE	0	6	37.5
	1	17	56.7
	2	23	65.7
	3	16	80
	4	17	56.7
	5	19	63.3
	Total 98		

Chi-square testing indicated a significant relationship between gender and high-risk designation with 70.4% of male participants ($n = 57$) being designated high-risk compared to 51.2% of female ($n = 41$) participants ($X^2_{(1, N=161)} = 6.18, p = .013$). Minority status and high-risk designation showed a trend towards significance ($X^2_{(1, N=157)} = 3.22, p = .073$) with a greater proportion of American Indian ($n = 14, 77.8\%$), African American ($n = 2, 66.7\%$), and Hispanic students ($n = 3, 75.0\%$) designated high-risk than Caucasian students ($n = 75, 56.8\%$) (See Table 3).

Table 3. High-Risk Status by Self-Reported Race/Ethnicity.

PARTICIPANTS		NUMBER OF HIGH-RISK STUDENTS	% WITHIN RACE
RACE	Caucasian	75	56.8
	American Indian	14	77.8
	Hispanic	3	75.0
	African American	2	66.7

Students who reported having a dental home were less likely to have untreated decay 24.5% compared to 44.4% of students who did not report having a dental home ($X^2_{(1, N=129)} = 4.15, p = .042$), and students who had seen the dentist within the past year were less likely to have untreated decay than those who had not ($X^2_{(1, N=131)} = 1.67, p = .196$), however the relationship was not significant (See Table 4).

Table 4. Untreated Decay by Dental Home/Attendance.

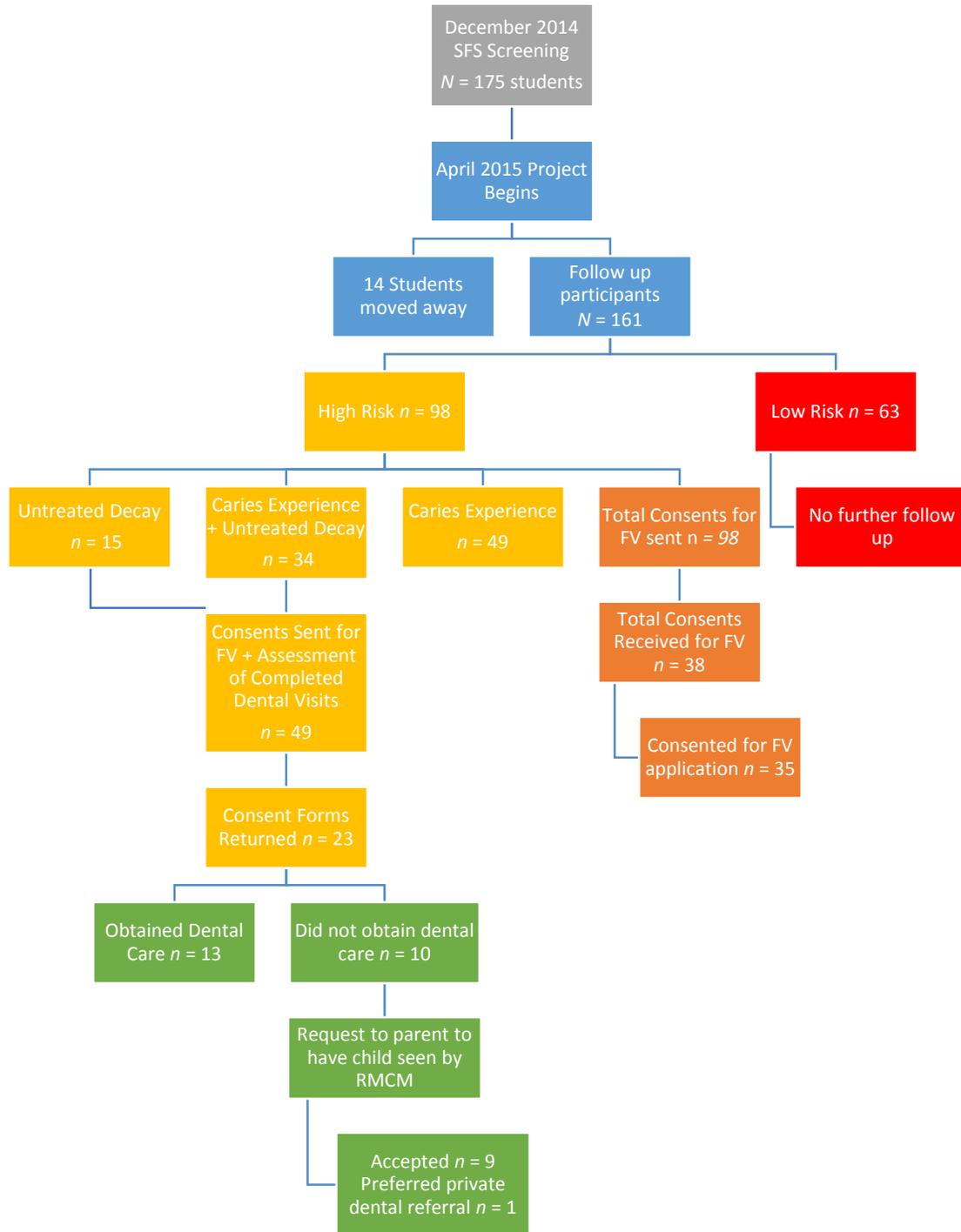
PARTICIPANTS		% OF STUDENTS WITH UNTREATED CARIES
DENTAL HOME	Yes	24.5
	No	44.4
DENTAL ATTENDANCE PAST YEAR	Yes	25.7
	No	38.5

Of the 98 high-risk student consent forms sent for FV, 38 were returned by families (38.78% response rate) and 35 consented to have their child receive FV applied by the school nurse (92.1%). All 35 students assented for project participation and received an application of FV. In total 36% of high-risk students received FV meeting the evidence-based biannual application recommendation (Marino, et al., 2013; Weintraub, et al., 2006). Total application time took less than 5 minutes per student and was well tolerated with no adverse effects.

Of the 49 high-risk students with untreated decay, fewer than half returned the required consent forms ($n = 23$, 46.94% response rate). Parents of 13 students (56.52%) indicated their child had been to the dentist and parents of 10 students (43.47%) indicated their child had not yet received follow-up dental care. Of those 10 students, nine families indicated interest in onsite dental care when telephoned. Parents of the tenth student reported they would schedule an appointment with their own dentist. Ronald McDonald Care Mobile consent forms were sent home with the nine students, and school nurses followed up with students to obtain a 100% return rate. All nine consenting students

received professional dental care including dental films, fillings, and tooth extractions onsite at the school by the RMCM. Several students had numerous carious lesions which required subsequent visits to the RMCM. This was managed by the RMCM staff. Time away from the classroom was less than 45 minutes (See Figure 2).

Figure 2. Diagram Depicting Flow of Study Participants through Assessment, Allocation, Follow-up, and Analysis.



CHAPTER 5

DISCUSSION

The findings of this project were consistent with national and state oral health trends. Dental caries were present in the majority of students with nearly 61% of students having decay experience or untreated decay. Of the 20 third grade students who participated in the SFS screening, 80% (n = 16) had decay experience, or untreated decay; much higher than the Montana third grade average of 65% and significantly higher than the U.S. third grade average of 52% (MT DPHHS, 2015). These findings are consistent with statewide findings of greater caries prevalence in low-income school populations (MT DPHHS, 2015).

The majority of the literature reviewed for this project focused on disparities in oral health for minority populations and for those living in poverty. Findings from this study were congruent with those findings. A directional relationship between minority status and high-risk designation was found. All minority students had greater proportions of students with high-risk status than Caucasian students (56.8%), and American Indian students had the greatest designation of high-risk status (77.8%). These findings are consistent with statewide findings which showed greater caries prevalence in Montana third grade American Indian students than Caucasian students (MT DPHHS, 2015).

While the majority of literature highlights significant disparities in oral health for minority and low-income populations, less is known about the relationship between gender and oral health. This study found a significant relationship between gender and

caries-risk with more male (70.4%) students designated high-risk than female (51.2%) students ($X^2_{(1, N=161)} = 6.18, p = .013$). This finding warrants further investigation into factors that may contribute to this discrepancy.

The importance of having an established dental home and regular dental attendance was further confirmed in this study. Students who reported having a dental home ($X^2_{(1, N=129)} = 4.15, p = .042$), or having seen the dentist within the past year ($X^2_{(1, N=131)} = 1.67, p = .196$) had fewer untreated caries than students who did not. These findings underscore the need for more frequent assessment and the importance of ongoing caries prevention practices such as sealants and FV. School nurses can encourage and assist families to establish a dental home, and reinforce the need for regular dental attendance. Providing oral health services at the school can reduce many of the barriers that may impede families from regular dental attendance, and can provide an ongoing easily accessible source of preventive dental care, such as FV.

Limitations

While successful, a few difficulties were encountered during the completion of this scholarly project. The consent process proved to be time consuming for the school nurses. Nurses followed up with teachers and students over several days to receive returned consent forms for both FV application as well as RMCM attendance. Return rates for FV varied greatly by classroom. The highest return rate was a third grade classroom with 83%. In contrast, a fourth grade class who had the largest number of high risk students and consent forms sent out ($n = 11$), had a return rate of 18.18%. Teacher

encouragement to return forms greatly influenced return rates. The teacher of the class with the largest percentage of returned consents attributed her success to a reward system she has in place to encourage timely return of school papers.

A second difficulty encountered in the project was student absenteeism. Nurses reported that several students were absent resulting in the nurses visiting the school each day specifically to see if the student had returned in order complete FV application. While time consuming, the benefit of school nurse administered FV is the ability of nurses to provide case-management and completion of follow-up care when outreach programs would not have the same availability. Often community-based dental programs that provide in-school care are standalone programs offering care on a single day, such as the SFS program. If students are absent, they do not receive treatment. Because application of FV was fast and easy to apply, nurses were able to treat students intermittently throughout a one week period as their schedule allowed, and successfully applied varnish to 100% of consenting students (n = 35).

The school nurses participating in this project serve over 1,100 students in nine schools (Montana Office of Public Instruction, 2012). Nurses travel between several schools throughout their day serving students with various needs including insulin administration, urinary catheterization and enteral feedings. Ultimately the school nurses did not feel they could continue this program given the limited staffing and numerous daily needs of other students. Federal legislation does not mandate school nursing, therefore individual states and school districts independently set standards for school nursing (Nwabuzor, 2007). Montana does not mandate school nursing, therefore no state

funding is afforded to school districts to employ nurses. This has resulted in Montana having school nurse to student ratios greater than the recommended ratio of one nurse for every 750 healthy students and much more than the recommended ratio of one nurse to every 225 students requiring daily professional nursing services (Montana Association of School Nurses, 2015; NASN, 2015b). Adequate school nurse staffing could ensure programs such as this could be successfully implemented and sustained. This is an area for policy research and advocacy.

Finally, reduction in caries rates were not able to be realized for this oral health intervention due to the time limitation of this scholarly project. The ASTDD (2014) recommends FV programs are most likely to demonstrate benefits and caries reduction when a minimum of twice per year FV application occurs with counseling over at least two years in at-risk populations.

Implications

Implemented statewide, this nurse-led oral health program aimed at enhancing preventive oral health care and reducing oral health inequities experienced by students attending low-income schools has the potential to reach a large number of high-risk students. Sealants for Smiles served 96 low-income schools across the state of Montana during the 2014-2015 school year and a total of 11,138 students state-wide (B. Schramper, personal communication, February 29, 2016). The lack of adequately fluoridated water in Montana is not anticipated to change in the near future. Offering access to topical fluorides in the school setting can ensure students receive optimal

fluoride protection. School nurses can supplement the effectiveness of the SFS program and enhance fluoride protection by applying FV to students' teeth between SFS visits in order to achieve the optimal frequency of treatments, and case-manage students with unmet dental needs to assist families in obtaining professional dental care.

Consent form return rates could be increased by obtaining consent for ongoing school-nurse applied varnish at the same time as the SFS consent. Over the past three years of SFS participation at the project school, consent form return rates have significantly increased as families have become more familiar with the program. Sealants for Smiles also offers incentives to students and teachers to return consent forms by offering pizza parties to the class with the most returned consents and prizes to teachers with the greatest number of returned consent forms. These steps would help reduce the time the school nurse spends sending out consent forms and following up on missing consent forms. In addition, educating teachers about oral health disparities that exist in low-income schools, and the impact poor oral health has on school performance and attendance, could promote teacher collaboration.

Fluoride varnish for this study was donated by the SFS program. Currently in Montana FV application is a covered Medicaid benefit if delivered by dentists, dental hygienists, physicians, and physician assistants and nurse practitioners, but not by school nurses (MT DPHHS, 2016). To replicate this study in other schools, obtaining FV through donation, grants or scholarships would be necessary. Estimated cost for FV varies by brand with an average cost of \$1 - \$4 per application (Alliance for a Cavity Free Future, 2016.). Schools with onsite health centers staffed by primary care providers

such as Nurse Practitioners could bill insurance for FV application, however these school-based health clinics are rare in Montana. Considering 66% of high-risk designated students in this study reported having Healthy Montana Kids (Montana Medicaid), the majority of fluoride varnish could be reimbursed if nurse practitioners were part of the school health team. The ability to bill for FV application can make programs such as this financially sustainable.

One unexpected outcome that resulted from the success of this project was the establishment of an ongoing partnership between the RMCM and the school. During this project the school was undergoing a major renovation. The RMCM was able to provide grant money to the school to install a “shore line” which provides a 220 watt plug-in for the van rather than relying on generator power. This allows the RMCM to run more efficiently and quietly. As a result the RMCM plans to provide ongoing services at the school on a monthly basis.

Conclusion

This scholarly project was successfully implemented and carried out in a low-income elementary school. School nurses effectively enhanced school-based preventive dental services through evidence-based fluoride varnish application and case management of students with unmet dental needs. This project optimized fluoride protection and reduced inequities in access to preventive and professional oral health care faced by children attending a low-income school. The Framework for 21st Century School Nursing Practice effectively demonstrated how school nurses act as leaders within

their schools and communities, coordinating with community programs to improve access to care for at risk students, keeping students healthy, safe, and ready to learn. The results of this scholarly project demonstrated the importance of nurse-led interventions to improve access to care and reduce health inequities in high-priority populations. This project stands as a model for nurse-led, interdisciplinary collaboration to solve the most intractable problems facing low-income, high-risk children today.

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APPENDIX A

STANDING ORDER FOR SCHOOL-NURSE ADMINISTRATION
OF FLUORIDE VARNISH

**STANDING MEDICAL ORDER FOR SCHOOL NURSE
APPLICATION OF FLUORIDE VARNISH**

_____, **DDS**, dental advisor to the _____ **Oral Health**

Improvement project, authorizes the one-time application of fluoride varnish by school nurses who have completed the relevant Smiles for Life Oral Health Curriculum Modules. Application will begin _____ and conclude by _____.

Program Requirements

School district registered nurses will provide a one-time application of fluoride varnish to students that present with the following:

- A. A signed consent form has been secured from the parent/legal guardian of the child

AND

- B. The child participated in the Sealants for Smiles! dental screening held _____ at _____ Elementary

AND

- C. The student has been identified as having untreated decay and/or past restorations or teeth missing due to decay

Schedule and Dosage

- 1. School nurses will apply a one-time application, as a thin layer, of 5% sodium fluoride varnish to all surfaces of erupted primary or permanent teeth.

Prescription

0.4 mL (unit dose) Sparkle V 5% sodium fluoride varnish.

Pre-application instructions

- 1. Review assent form with student and ask student to sign if willing to participate
- 2. Apply clean gloves

3. Use gauze to dry the teeth as much as possible, which improves adherence of varnish to the tooth surface.
4. Apply varnish to dried teeth, starting in posterior. Apply a thin layer to all tooth surfaces.
5. Apply varnish to anterior teeth last.
6. Fluoride varnish should not be applied if ulcerative gingivitis and stomatitis is present and should not be applied on large open lesions.

Post-application instruction

1. The child may swish and spit water immediately following the varnish application
2. Review the importance of twice daily brushing with student and impact of frequent snacking on healthy teeth.
3. Send take home sheet with student informing parent that fluoride varnish was applied, and to avoid brushing teeth until the next morning
4. There are no restriction to eating or drinking after application.

Adverse reactions

1. Adverse reactions are rare but may include, nausea, vomiting, and dermatitis
2. Allow child to rest until symptoms improve
3. Rinse face with cool water if rash is developing
4. Notify parent if symptoms do not resolve in a timely manner

Storage

Store varnish in a safe location at room temperature. Store out of reach of children.

Signature

Date