

ADDRESSING PREVENTIVE ORAL HEALTH FOR PREGNANT
WOMEN, CHILDBEARING AGE FEMALES & CHILDREN
AGE ZERO TO SIX IN PRIMARY CARE

by

Abrianna Lee Johnson

A scholarly project submitted in partial fulfillment
of the requirements for the degree

of

Doctor of Nursing Practice

in

Family and Individual Health

MONTANA STATE UNIVERSITY
Bozeman, Montana

May 2017

©COPYRIGHT

by

Abrianna Lee Johnson

2017

All Rights Reserved

ACKNOWLEDGEMENT

The Dr. Helen Jacobsen Lee Endowment supported research conducted in this publication

Lead Statistician:

Kenneth Flagg, M.S.

Director:

Lillian Lin, Ph.D.

Contributions from:

Jordan Schupbach, M.S.

Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number P20GM103474. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

TABLE OF CONTENTS

1. INTRODUCTION	1
Background	1
Significance of Problem	5
Purpose	7
Strategic Initiatives	8
2. LITERATURE REVIEW	9
Databases Searched and Key Terms	9
Supporting Evidence	9
Theoretical Constructs.....	14
3. METHODS	18
Protection of Human Subjects.....	18
Interventions and Implementation.....	18
Setting	18
Planning	19
Design and Procedure.....	21
Patient Questionnaire	22
Provider Questionnaire	22
Quantitative Tools.....	22
Interventions	23
4. OUTCOMES	25
5. DISCUSSION	32
Limitations.....	34
Budgetary Implications for Society and Primary Care Practice	35
Leadership Role.....	36
Recommendations	37
APPENDICES	39
APPENDIX A: Patient Handout	40
APPENDIX B: Preventing Cavities and Gum Disease.....	43

TABLE OF CONTENTS – CONTINUED

APPENDIX C: Oral Health Questionnaires.....	49
APPENDIX D: Statistical Anyalsis	56
REFERENCES	59

LIST OF TABLES

Table	Page
1. Table of the raw pre-seminar and post-seminar knowledge test scores and the pre-seminar to post-seminar score increase for each of the six nurses.	26

LIST OF FIGURES

Figure	Page
1. Nurse test score plot. The plot depicts the six nurses' scores on the pre-seminar test and the post-seminar test. There is a dotted line connecting each nurse's score improvement from the pretest to the posttest.	27
2. Heatmap of Nurse Knowledge Assessment Responses. Overview of the results of correct and incorrect answers by each nurse before and after the seminar.	27
3. Plot of Proportion of Adults with Good Oral Health Behaviors. The y-axis is the percent of overall good behaviors.	28
4. Heatmap of Pregnant and Childbearing Age Females Survey Response. Overview of the good or bad oral health behaviors indicated by color.	29
5. Plot of Proportion of Pediatric Patients with Good Oral Health Behaviors. The y-axis is the percent of overall good behaviors.	30
6. Heatmap of Pediatric Survey Responses. Overview of the good or bad oral health behaviors indicated by color. Blanks represent items not applicable to that patient due to age or not having teeth.	31

ABSTRACT

Most oral health disease is preventable despite the availability of effective prevention and treatment (Nathe, 2016). Oral health conditions are becoming a silent epidemic and during pregnancy the risk increases for oral disease (Qualis Health, 2015; Vamos, Walsh, Thompson, Daley, Detman, & DeBate, 2015). About 40% of pregnant women have a varying form of periodontal disease (Lief et al., 2004). The social impact on school-age children substantially affects their academics, as more than 51 million school hours are lost each year due to dental related illnesses (U.S. Department of Health and Human Services, 2003). The purpose of this project was to educate providers, nurses, and patients in a primary care clinic on the importance of oral health care and to create simple referral process for at risk patients. The author gave a pretest on oral health best practice to seven primary care nurses. After the pretest, the author gave an oral health education seminar. The nurses took a posttest based on content from the educational seminar. Patients who met the inclusion criteria were given oral health surveys to determine oral health status and need for referral to a dentist. Six of the seven nurses completed the seminar and testing showing a higher post-seminar test score. The V-statistic of 21 showed a p-value of 0.0178 suggesting strong evidence the nurses' scores tended to be higher after the seminar. Of the nineteen adults surveyed regarding their oral health status, 62% showed good oral health behaviors. Of the eleven pediatric patients surveyed regarding their oral health status, 75% answered positive oral health behaviors. The literature supported the value of oral health education in primary care. Awareness was created in the clinic with the use of posters and educational packets given to all participating patients. There is a great need for preventive oral health education to primary care providers, pregnant women, childbearing age females, and parents of children. Current research on the value of preventive oral health education and dental care is needed in primary care.

INTRODUCTION

Background

Oral health plays a vital role in the overall health and well-being of a pregnant woman, her unborn child, and family (American Academy of Pediatric Dentistry, 2014; Brown, 2008; Kloetzel, Huebner, & Milgrom, 2011; Kumar & Samelson, 2009; Michalowicz, Hodges, & Diangelis, 2006; Qualis Health, 2015;). Most oral health disease is preventable despite the availability of effective prevention and treatment (Nathe, 2016). Oral health conditions are becoming a silent epidemic, and during pregnancy the risk increases for oral disease (Qualis Health, 2015; Vamos, Walsh, Thompson, Daley, Detman, & DeBate, 2015). Little improvement has been shown in the nation's oral health status data over the past two decades (Nathe, 2016). Moreover, for some, oral health status has declined (Nathe, 2016). The Surgeon General brought attention to the importance of changing attitudes and beliefs among health care providers as well as the need for creating interdisciplinary collaborations (Kloetzel, Huebner, & Milgrom, 2011; Nathe, 2016; U.S. Department of Health and Human Services, 2003), and further called for elimination of oral health disparities, promotion of oral health, and increasing the quality of life through a national oral health plan (U.S. Department of Health and Human Services, 2003). Healthy People 2020 offers a goal to "Prevent and control oral and craniofacial diseases, conditions, and injuries, and improve access to preventive services and dental care" (Office of Disease Prevention and Health Promotion, 2014).

The social impact of oral health on school-age children substantially affects their academics, as more than 51 million school hours are lost each year due to dental related illnesses (U.S. Department of Health and Human Services, 2003). Employed adults lose 164 million hours of work each year due to dental disease and two thirds of adults have not visited a dentist in the past 12 months (Qualis Health, 2015; U.S. Department of Health and Human Services, 2003). Over 108 million children and adults lack dental insurance, which is over 2.5 times the number who lack medical insurance (U.S. Department of Health and Human Services, 2003). Thus, implementation of preventive oral health education and provider patient collaboration in medical healthcare settings is crucial (Qualis Health, 2016b; National Interprofessional Initiative on Oral Health, 2016). Providers are challenged to implement evidence based oral health care practice into daily office visits. Oral guidelines are not being translated into primary care practice (Qualis Health, 2015). About 40% of pregnant women independent of race have a varying form of periodontal disease (Lieff, Boggess, Murtha, Jared, Madianos, Moss K, et al., 2004; Lachat, Solnik, Nana, & Citron, 2011; Kloetzel, Huebner, & Milgrom, 2011; Vamos et al., 2015). In a descriptive study of 35,267 women participants, those who did not receive dental care were 15% more likely to have a preterm birth (Hwang, Smith, McCormick, & Barfield, 2011). It costs society about five billion dollars a year for preterm births in the United States alone (Goldie, 2003).

Primary care practices that specialize in Family Practice are an ideal health care venue to promote early intervention, as Americans are more likely to visit a primary care provider than a dentist (California Dental Association, 2010; Qualis Health, 2015;

Teanpaisan et al., 2012). The primary care provider who specializes in Family Medicine has completed residency in that specialty focusing on acute and chronic diseases (American Academy of Family Physicians, 2016). Primary care is typically the first point of contact a person has with the healthcare system and is where people receive care for their everyday health needs such as annual wellness exams (American Academy of Family Physicians, 2016; Ping & Ling, 2012). Primary care providers are on the frontline to screen high-risk patients for periodontal disease and educate them on good oral health behaviors (Qualis Health, 2015). Primary care practices provide health promotion, disease prevention, health maintenance, counselling, patient education, diagnosis and treatment of acute and chronic illnesses (American Academy of Family Physicians, 2016; Ping & Ling, 2012). These providers have a fundamental role in helping patients achieve higher quality of life, better health outcomes, cost-effective care and an enhanced health status (American Academy of Family Physicians, 2016; Ping & Ling, 2012).

Anticipatory guidelines for oral health in children should be used by primary care providers. Examples of such guidelines include:

(a) the first dental visit to occur within six months of eruption of the first tooth and no later than 12 months of age (American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006);

(b) oral health education is based on the child's developmental needs (Qualis Health, 2015; American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006);

(c) infants and young children should be provided with a balanced diet (Qualis Health, 2015; American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006);

(d) unrestricted and at-will intake of sugary liquids during the day or while in bed should be discouraged (American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006);

(e) infants should finish their bedtime and naptime bottle before going to bed (American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011);

(f) unrestricted, at-will nocturnal breastfeeding after eruption of the child's first tooth can lead to an increased risk of caries (American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006; Task Force on Periodontal Treatment of Pregnant Women, 2004);

(g) low-cost fluoride treatments should be provided to children (Qualis Health, 2015; American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006; American Dental Association, 2016; Nathe, 2016);

(h) children should be encouraged to drink from a cup by their first birthday (American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006);

(i) proper oral hygiene practices should be implemented after the first tooth eruption (Qualis Health, 2015; American Academy of Pediatric Dentistry, 2014; American Academy of Pediatric Directors, 2011; New York State Health Department, 2006; American Dental Association, 2016; Nathe, 2016).

Primary care practitioners should provide guidance to the family on tobacco cessation and alcohol reduction that is critical for good oral health (Qualis Health, 2015).

Primary care practitioners should also address oral health during prenatal visits and translate the research evidence into practice (Duff, Johnson, Dahlen, 2014; Hwang, Smith, McCormick, & Barfield, 2011). Practitioners should conduct oral health assessments and reduce the risk for oral health disease through early intervention of preventive strategies (Qualis Health, 2015). Primary care providers should develop relationships with dental providers to be able to refer patients to dentists once a potential

oral health problem has been identified in the primary care clinic (Qualis Health, 2015; U.S. Department of Health and Human Services, 2003).

Significance of Problem

Periodontal disease is a destructive inflammatory condition of the gingiva and bone that supports teeth (Boggess et al., 2011; Duff, Johnson, Dahlen, 2014; Lief, Boggess, Murtha, Jared, Madianos, Moss K, et al., 2004). It is most commonly associated with a gram-negative anaerobic infection of these structures. The fluid that bathes the tooth at the gingival margin, known as gingival crevicular fluid, often contains inflammatory mediators and oral pathogens associated with periodontal disease (Boggess & Edelstein, 2006). The mechanisms underlying this destructive process involves both direct tissue damage resulting from plaque bacterial products, and indirect damage through bacterial induction of the host inflammatory and immune responses (Boggess & Edelstein, 2006). Destructive periodontal disease affects up to 15% of the population of childbearing age, with a relatively high proportion of pregnant women demonstrating some degree of periodontal disease (Boggess & Edelstein, 2006).

Pregnant women have multiple hormone fluctuations during pregnancy (Boggess et al., 2011; Vamos et al., 2015). This creates the optimal environment for women to experience dental decay and other gum diseases that may have a negative impact on the pregnancy (Boggess et al., 2011). Poor maternal oral health may lead to restricted oral intake of nutritious food that pregnant women need for their developing baby and may increase the risk of infants developing early childhood caries after birth (Lief, Boggess,

Murtha, Jared, Madianos, Moss K, et al., 2004; Qualis Health, 2015). The causal mechanism of periodontal disease-associated with adverse pregnancy outcomes is poorly understood, although maternal or fetal inflammatory responses to oral pathogens may be involved, thus periodontal diseases appears to be a potential risk factor for preterm birth (Duff, Johnson, Dahlen, 2014).

Periodontal disease is a multifactorial disease in which oral bacteria such as *Mutans Streptococcus* (*S. mutans*) adheres to the tooth enamel and causes demineralization of the tooth surface, gingiva, and supportive bone structure (Mahat, Lyons, & Bowne, 2014; Boggess & Edelstein, 2006). Ingestion of foods and liquids with high sugar content decreases the oral pH thus increasing *S. mutans* presence (Mahat, Lyons, & Bowne, 2014). *Streptococcus mutans* can be easily transferred from mother to child and this vertical transmission is the main mode of acquisition of *S. mutans* in children (Alves et al., 2009; Carletto-Korber, Gonzalez-Ittig, Jimenez, & Cornejo, 2010; da Silva Bastos Vde et al., 2015; Katre & Damle, 2013; Li, Caufield, Dasanayake, & Vermund, 2005; Teanpaisan, Chaethong, Piwat, & Thitasomakul, 2012; Mitchel, 2009; Vamos et al., 2015). Early childhood caries (ECC) incidence doubles when the mother has high *S. mutans* levels in her saliva and her children attain ECC at an earlier age (Alves et al., 2009; Li, Caufield, Dasanayake, & Vermund, 2005; Douglass, Li, & Tinanoff, 2008; Chaffee, Gansky, Weintraub, Featherstone, & Ramos-Gomez, 2014; Lynch et al., 2015; Vamos et al., 2015).

ECC is a pathologic process influenced by oral bacteria flora, *S. mutans*, in the mouths of children as young as three months (Leong, Gussy, Barrow, de Silva-

Sanigorski, & Waters, 2013; Twetman, 2008). Pregnant women who become more knowledgeable about good oral health behaviors are more likely to pass the positive behaviors onto their children (Cibulka, Forney, Goodwin, Lazaroff, Sarabia, 2011). Early childhood caries is one of the most expensive yet, preventable childhood diseases (Hwang, Smith, McCormick, & Barfield, 2011; Mahat, Lyons, & Bowne, 2014; Siegler, Deloache, & Eisenberg, 2006; Teanpaisan, Chaethong, Piwat, & Thitasomakul, 2012).

The barriers of low socioeconomic status and access to health care must be addressed to successfully implement a positive change for low income patients. Between fifty and sixty percent of low-income children have early childhood caries compared to those who are not of low socioeconomic status (Mahat, Lyons, & Bowne, 2014; Qualis Health, 2015). The earlier in age a child acquires *S. mutans* correlates with higher number of decayed or missing teeth during childhood (Lynch et al., 2015; Ortiz et al., 2014; Plonka et al., 2013). Young children who acquire ECC have additional negative health impacts such as pain, poor eating, poor weight gain, eating difficulties, impaired speech development, decreased school, and fear of dentists (American Dental Association, 2016; Krisdapong, Somkotra, & Kueakulpipat, 2014; Leong, Gussy, Barrow, de Silva-Sanigorski, & Waters, 2013; Ortiz et al., 2014; Qualis Health, 2015; U.S. Department of Health and Human Services, 2003).

Purpose

The purpose of this project was to educate providers, nurses, and patients in a primary care clinic on the importance of oral health care and to create simple referral

process for at risk patients. The patients included in the project were pregnant women, childbearing age females, and parents of children ages zero to six.

Strategic Initiatives

The following strategic initiatives addressed the purpose of this improvement project and provided direction for future improvements: 1.) The author will educate primary care providers and nurses who see pregnant women, childbearing aged women, and children age zero to six about the American Dental Association best practice recommendations for oral health; 2.) The author will create a simple and seamless referral process to be used by the primary care provider for the at-risk pregnant women, childbearing age female, and children to seek the appropriate dental care within his or her community.

LITERATURE REVIEW

Databases Searched and Key Terms

The databases searched included CINAHL, Cochrane, Joanna Briggs Institute EBP Database, Medline, and PubMed. Inclusion criteria for this project included articles that were written in English and were randomized controlled trials, meta-analyses, systematic reviews, comparative studies, or observational studies, published within the past fifteen years. Pilot trial studies were not included. Articles were identified using the search terms: prenatal oral health, streptococcus mutans, streptococcus mutans dental, early childhood caries, perinatal oral health, oral health education, and pediatric oral health.

Supporting Evidence

Providers who administer prenatal care in the primary care setting and pregnant women who receive prenatal care in a primary care setting need education on best practice recommendations for oral health. There is a great need for oral health education to providers and pregnant women. While most health care professionals agree on the importance of good oral health in every stage of life, it is not being addressed (Duff, Johnson, Dahlen, 2014; Giglio, Lanni, Laskin, & Giglio, 2013; Jiang et al., 2013). Whether due to misconceptions or lack of knowledge, health care providers are performing inadequate oral care for these patients (Alamoudi, 2012; American Academy of Pediatric Dentistry, 2014; Boggess et al., 2011). Recommendations to increase oral

health care during pregnancy and infancy should include improved advocacy of the established oral health care guidelines (Kloetzel, Huebner, & Milgrom, 2011; Rainchuso, 2013; U.S. Department of Health and Human Services, 2003).

Dentists overwhelmingly agree that women should receive routine preventive dental care during pregnancy, that dental treatment should be part of prenatal care, and that it is necessary to consult an obstetrician before procedures such as a root canal (George et al., 2012; Zanata, Fernandes, & Navarro, 2008). Most dentists agreed that the second trimester is the ideal time for any procedures and advised delayed elective treatments such as teeth whitening until after pregnancy (Morgan, Crall, Goldenberg, & Schulkin, 2009; Michalowicz, Hodges, & Diangelis, 2006; Zanata, Fernandes, & Navarro, 2008).

Primary care practitioners advised patients half of the time to visit dentists during pregnancy (Morgan, Crall, Goldenberg, & Schulkin, 2009; Wilder, Robinson, Jared, Lieff, & Boggess, 2006). In multiple studies, examined by George and colleagues, midwives felt unqualified to assess oral health or ask specific questions thus, did not refer their pregnant patients to dentists (George et al., 2012). Most obstetricians were unfamiliar with oral health guidelines and felt unqualified to recognize symptoms of periodontal disease, although 81% saw importance of routine dental care during pregnancy (George et al., 2012; Morgan, Crall, Goldenberg, & Schulkin, 2009).

A large educational gap exists in providers' understanding of best practice guidelines regarding oral health (Kloetzel, Huebner, & Milgrom, 2011; Morgan, Crall, Goldenberg, & Schulkin, 2009; Vamos et al., 2015). Obstetricians felt a lack of dentists

willing to treat pregnant women was due to concern about safety of procedures and medication administration, yet the literature shows that routine dental visits are safe during pregnancy (Morgan, Crall, Goldenberg, & Schulkin, 2009; Ahtari, Georgakopoulou, & Afentoulide, 2012; American Congress of Obstetricians and Gynecologists, 2006). A collaborative effort needs to occur among all health care providers to better treat the patient's overall health, not only the specifics of one's profession (Qualis Health, 2015; Vamos et al., 2015; U.S. Department of Health and Human Services, 2003; Kloetzel, Huebner, & Milgrom, 2011). Health care professionals are responsible for the well-being of patients, and an interdisciplinary approach will better ensure accomplishment of this task. (Bogges & Edelstein, 2006; Rainchuso, 2013; Task Force on Periodontal Treatment of Pregnant Women, 2004).

A teachable moment for addressing oral health occurs during the annual exam for women who want to become pregnant within the next years' time and at a prenatal appointment (Hallas et al., 2015). During such appointments, providers can educate the women on the importance of oral health, adverse outcomes linked to periodontal disease, as well as preventing early childhood caries (ECC) for future children (California Dental Association, 2010; Cibulka, Forney, Goodwin, Lazaroff, Sarabia, 2011; Hallas et al., 2015). Promoting preventative oral health behaviors in pregnant woman will have positive impacts not only for them, but for their future children (Vamos et al., 2015).

Educating mothers about *S. mutans* is also important. A mother is the main source of vertical streptococcus mutans transmission to a child (Alves et al., 2009; Carletto-Korber, Gonzalez-Ittig, Jimenez, & Cornejo, 2010; da Silva Bastos Vde et al., 2015;

Katre & Damle, 2013; Li, Caufield, Dasanayake, & Vermund, 2005; Mitchel, 2009; Teanpaisan, Chaethong, Piwat, & Thitasomakul, 2012; Vamos et al., 2015). Transmission occurs by sharing spoons to taste infant's food, kissing a child on the mouth, and cleaning a dropped pacifier by using one's own saliva, thus introducing the cariogenic bacteria in the child's mouth (American Academy of Pediatric Dentistry, 2014; Duff, Johnson, Dahlen, 2014; Li, Caufield, Dasanayake, & Vermund, 2005; Wan et al., 2003).

When the mother has high levels of *S. mutans*, colonization of *S. mutans* in the child's mouth is more likely (Camacho, Perez, Perez, & Zepeda, 2009). Infants acquire *S. mutans* from their mother's at or near six months of age when their first tooth erupts (Goldie, 2003; Boggess & Edelstein, 2006; Duff, Johnson, Dahlen, 2014; Li, Caufield, Dasanayake, & Vermund, 2005), yet studies state *S. mutans* can colonize in a preterm infant by both vertical and horizontal transmission (Goldie, 2003).

Most women do not seek dental care during pregnancy and two-thirds do not receive a professional dental cleaning during pregnancy (Hwang et al., 2011). Considering the knowledge deficit of both the provider and the mother, prevention strategies for ECC and poor oral health are of highest importance (American Academy of Pediatric Dentistry, 2014). Women who become more knowledgeable about good oral health behaviors are more likely to pass the positive behaviors onto their children (Cibulka, Forney, Goodwin, Lazaroff, Sarabia, 2011). Greater awareness and training in perinatal oral health education are needed for providers to facilitate a change in their scope of practice to include oral health (Lachat, Solnik, Nana, & Citron, 2011; Kloetzel, Huebner, & Milgrom, 2011; Office of Disease Prevention and Health Promotion, 2014;

Ping & Ling, 2012; Nathe, 2016; U.S. Department of Health and Human Services, 2003; Vamos et al., 2015). There is an urgent need for education, training, and practice guidelines for dentist and prenatal care practitioners in perinatal oral health.

The promotion of early detection, treatment, and education of periodontal disease in young women before and during pregnancy may decrease adverse pregnancy outcomes and early childhood caries. Periodontal disease is a chronic oral infection commonly identified in pregnant women, and has recently been recognized as a risk factor for preterm birth, preeclampsia, spontaneous abortion, stillbirth, and second-trimester miscarriage (Lieff et al., 2004; Vamos et al., 2015). In one study, about half of women did not realize periodontal disease and caries were oral infections and 11.9% did not realize the seriousness of the disease (Boggess et al., 2011). Cibulka and colleagues (2011) found that many women do not understand the association between periodontal disease and low birth weight or prematurity, nor did the women think it was advisable to see the dentist during pregnancy. Jiang et al (2013) recommended women who are planning to conceive go to a dentist for evaluation of their oral health before conception. Women who did not receive dental care during pregnancy or who did not have teeth cleaned during pregnancy were at slightly higher risk for preterm delivery (Hwang, Smith, McCormick, & Barfield, 2011). Although many factors contribute to premature births or low-weight infants, poor oral health has been linked to adverse pregnancy outcomes (Boggess et al., 2011; Hwang, Smith, McCormick, & Barfield, 2011; Huck, Tenenbaum, & Davideau, 2011; Jiang et al., 2013; Kloetzel, Huebner, & Milgrom, 2011; Rainchuso, 2013; Vamos et al., 2015).

It is important to note that there is conflicting research concerning periodontal disease and pre-term births. Srinivas and Parry (2012) found that an expecting mother's overall lifestyle choices affect pregnancy outcomes. In a randomized controlled trial, there was no significant difference between the control group and the experimental group, who received periodontal therapy during pregnancy, to reduce the rate of preterm births (Offenbacher & Beck, 2009). The promotion of early detection and treatments of periodontal disease in child-bearing aged women before, during, and after pregnancy was advised to be prudent for prevention of ECC and adverse pregnancy outcomes (American Academy of Pediatric Directors, 2011; da Silva Bastos Vde et al., 2015; Huck, Tenenbaum, & Davideau, 2011; New York State Health Department, 2006).

Most oral disease is preventable despite effective prevention and treatment methods available, there is still an outstanding number of patients with oral health problems (Nathe, 2016). Early childhood caries is one of the most expensive childhood diseases and fifty percent of low income children have dental caries (Mahat, Lyons, & Browne, 2014). The parent is the main source *S. mutans* transmission to a child. Parents who become more knowledgeable about good oral health behaviors are more likely to pass the positive behaviors onto their children (Cibulka *et al*, 2011).

Theoretical Constructs

Dr. Jean Watson's Theory of Human Caring (Wagner, 2010) and Urie Bronfenbrenner's theory of the Ecological models of Human Development (Bronfenbrenner, 1994) guided the conceptual framework for this clinical improvement

project. The two major elements of Watson's theory guiding this project are the cultivation of sensitivity to self and others and developing and sustaining a helping, trusting, authentic, caring relationship (Alligood, 2013). Watson's grand theory placed an emphasis on the caring human relationships and required the nurse or provider to have an instilled and deeply spirited connection within themselves and with the patient (Alligood, 2013).

Enhancing open communication between provider and patient, Watson's theory valued the relationship and trust between a patient and a provider. Another aspect of this component is to practice non-judgmental attitudes (Current Nursing, 2012). This is an important component within this practice improvement project as the participants can be sensitive to their oral health status.

Watson's model is based in the context of caring for nursing practice and contains core principles directly relevant to the identification of patients with oral health disparities (Current Nursing, 2012). This theory allows the nursing professional to be flexible, adaptable, and unique when attempting to achieve, foster, and gain an authentic caring-healing relationship to create an optimal learning environment for both the provider and patient. Oral health status can be a very personal topic and should be handled with compassion for adult patients.

Urie Bronfenbrenner's theory of the Ecological models of Human Development suggests that to understand human development; one needs to consider the entire ecological system in which he or she matures (Bronfenbrenner, 1994; Gauvain & Cole, 2000). Bronfenbrenner's framework concentrates on the subsystems of the human ecological niche, as well as the ways in which the five subsystems interact and influence one another (Bronfenbrenner, 1994; Cunningham & Rosenbaum, 2015; Gauvain & Cole,

2000). The microsystem, the innermost circle, relates to that development of humans within a family and the school environment. The microsystem includes the child and the immediate environment in which they interact (Bronfenbrenner, 1994; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2007; Cunningham & Rosenbaum, 2015; Gauvain & Cole, 2000). Moving outward, the next circle represents the mesosystem, identifying culture, commerce, economy, and knowledge system influences. The next system is the exosystem, this system identifies external interactions such as family and friends, neighbors, and extended family. The fourth circle represents the macrosystem which includes one's culture, sub culture and social class (Bronfenbrenner, 1994; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2007; Cunningham & Rosenbaum, 2015; Gauvain & Cole, 2000). The outermost circle, the chronosystem, represents change or consistency over time (Bronfenbrenner, 1994). All five layers of Urie Bronfenbrenner's theory of the Ecological models of Human Development interact mutually; however, the ones within the microsystem affect the child's development most noticeably (Bronfenbrenner, 1994; Cunningham & Rosenbaum, 2015).

This theory plays an important role on the development of society in general. The impact of the environment creates the foundation of which a human matures into a grown adult. By changing the process at the primary care clinic through giving handouts and addressing preventive oral health, that will have the most impact on the child as described by the Bronfenbrenner Ecological theory. The practice change addressing preventive oral health care in the primary care office may allow the mother to have an increased understanding of preventive oral health care; and in turn, may have a positive influence

on the child oral health prompted by the Surgeon General's Report call to action (U.S. Department of Health and Human Services, 2003). The preventive oral health education to the parent will affect the child's microsystem making the most impact on the child's development. Thus, possibly reducing dental caries rates among children.

In this project, the primary care providers and patients are being educated on preventive oral health. This directly affects the child's microsystem and mesosystem, which in turn, should have the most impact on the child. The exosystem, macrosystem, and chronosystem play a smaller role in this project as it takes time to see the transformation in oral health habits at home. Thus, the microsystem and mesosystem will play the larger role for this project directly affecting the child's future oral health habits.

METHODS

Protection of Human Subjects

The Institutional Review Board of Montana State University approved the study proposal. Voluntary informed consent was obtained from the participants and no personal identifiers were collected. Participants' anonymity was protected by not including any form of protected health information in published outcomes. The nature of the project had very limited potential to cause physical or psychological harm to its participants, and this was supported by IRB approval. During data collection, any paperwork with potential identifiable information did not leave the clinic premise.

Interventions and Implementation

Setting

The setting of interest was a semi-rural family practice clinic in a western state that serves childbearing age females, pregnant women, and children age zero to six. The clinic typically cares for eighty to ninety pregnant women per year, and nearly one thousand children age zero to six per year. Childbearing age females seen in the clinic averages about one hundred and fifty examinations per year. The family practice clinic culture is one that strives for excellence in improving the overall health of their patients. There is value placed on the continuous improvement of quality and safety.

The clinic providers included seven physicians, board certified in family medicine, and seven baccalaureate prepared registered nurses. Ancillary staff included one licensed practical nurse and two certified medical assistants who weigh patients, take

vital signs, or find charts. Eight clerical staff answer phone calls, sort mail, and schedule patients to be seen in the primary care clinic. Five clinical laboratory personnel assist with blood draws, sputum collection, other patient lab requests in the primary care clinic. In the primary care clinic, there is also one radiology technician who assists with all radiographs.

Planning

Prior to implementing the project, the author received permission from the primary care clinic and buy-in from the primary care staff. The author met with the clinic director to create a timeline for the project and identify reasonable interventions to be completed, after obtaining approval and clearance from the Institutional Review Board of Montana State University. The original timeline was to be completed late spring 2016 and early summer 2016, however data collection was completed during the late summer and early fall 2016 due to a change in clinic locations from the original project site.

The educational information for the primary care staff and the patients was based on the American Dental Association standards and patient education materials from the American Dental Association. The change activities directly address the absence of oral health education among the primary care professions and the community. The promotion of the early detection, treatment, and education of periodontal disease in women before and during pregnancy may decrease adverse pregnancy outcomes and early childhood caries.

The author and the Clinic Director met in June 2016. The project purpose, timeline, initiatives, and needs of the nursing staff were discussed. The Clinic Director

was supportive of the project. The author created a Power Point presentation with audio, based on the recommendations of the American Dental Association and the Smiles for Life curriculum for the staff. The author also created a twenty-question quiz titled “Provider Test” to be administered to the staff prior to watching the education program and again following the presentation as a posttest. (See appendix C).

Early in July 2016, the Clinic Director facilitated a meeting of the author, the director, and the nursing staff to discuss the project initiatives, the educational seminar, and implementation of oral health education to the patients. The Clinic Director and the nursing staff determined the most efficient and effective methods of involving patients in the project. This project was implemented into the current workflow of the clinic without much change or disruption to their customary routine of care.

It was determined that all patients who met the inclusion criteria of being a pregnant woman, childbearing age female or parents of children age zero to six, be given the suitable survey and the oral health education packet. Childbearing age females and pregnant women completed the oral health surveys titled “Adult Oral Health Questionnaire.” Parents accompanying young patients less than six years old were given the “Pediatric Oral Health Questionnaire.” (See appendix C). After the surveys were completed, they were left in the room for a nurse to retrieve, then placed in a designated folder at the nurses’ station for the author to collect at the end of the data collection period.

The Smiles for Life curriculum (Smiles for Life, 2016), served as the foundation for the questions on the Provider Test. The author developed a Power Point presentation with audio for staff to watch at their convenience. This approach allowed the staff to

receive the oral health education individually and eliminate the difficulty of coordinating all schedules for a single educational presentation. The author emailed the presentation to the clinic director and nursing staff with the understanding that the staff would take the pretest before watching the presentation. Due to technology difficulties at the clinic, the author loaned her laptop computer to the clinic to facilitate availability of the educational seminar.

Prior to watching the oral health education program, all registered nurses and licensed practical nurses were instructed to select a pseudonym or number for use on both pretest and the posttest. Seven nurses completed the pretest, then watched the presentation and completed the posttest. They were instructed to email the author with questions or concerns regarding the presentation. The nursing staff had two weeks to complete the testing and the educational seminar.

The collection of patient data began in August 2016. Nursing staff facilitated data collection of patients who met the project criteria and voluntarily participated in the project. Pregnant women, childbearing age females, and parents of children ages zero to six were given oral health surveys by nursing staff to complete prior to seeing the provider. The patient received oral health education by the nurse including a packet of oral health education materials created by the author prior to the survey completion.

Design and Procedure

Two survey tools, the “Adult Oral Health Questionnaire” and “Pediatric Oral Health Questionnaire,” were used in this healthcare improvement project to gather

evidence on the state of oral health education for both providers and patients. (See appendix C) The questions were created for this project from the Smiles for Life curriculum (Smiles for Life, 2016). Each questionnaire was clearly marked with a statement of voluntary consent.

Patient Questionnaire

The “Adult Oral Health Questionnaire” consisted of eleven questions and the “Pediatric Oral Health Questionnaire” entailed sixteen questions all adapted from the Smiles for Life curriculum (Smiles for Life, 2016). (See Appendix C) Parent who brought children in for wellness exams answered the pediatric questionnaire. The surveys were administered after nurses did their intake and reviewed the educational material. The surveys were collected at the end of the participants’ clinic visit by the nursing staff, and placed in a designated folder at the nursing station for the author to retrieve at the end of the data collection period.

Provider Questionnaire

The “Provider/Staff Questionnaire” was comprised of four open-ended questions generated from the Smiles for Life curriculum (Smiles for Life, 2016). (See Appendix C) It was sent in an email to the clinic director who distributed the survey to the primary care providers to be completed before the end of the data collection period.

Quantitative Tools

All pregnant women, childbearing age females, and children age zero to six seen by a provider should have documented in their chart that they received oral health

education, and should be referred to a local dentist as deemed necessary based on exam and oral health history survey by the primary care provider. (See Appendix A, B & C) Being new work flow to the primary care clinic, the provider or the nurse who handed out the education to the participant did not note this in the chart during data collection. The number of surveys returned indicated the number of patients who received education in the primary care clinic.

Interventions

The author solicited ideas from the providers and staff on how they would like to increase awareness of oral health in their practice. The author suggested some possible examples may be (a) replace sugar lollipops for children with sugar free lollipops; (b) provide Oral Health Care brochures in the waiting room and in patient exam rooms; (c) include questions on their health history forms about the patients' oral health status (i.e. Last dental visit, mouth pain, bleeding gums, etc.); or (d) provide a referral to a local dentist if needed. The practice had the option of selecting one or all the options, or they could choose not to implement any of the options.

The process used for the practice improvement project included the primary care nursing staff who completed a twenty-question preventive oral health care pretest prior to the fifteen-minute educational seminar (American Dental Association, 2016c). The author provided an educational seminar using materials from the American Dental Association (American Dental Association, 2016c), Smiles for Life curriculum (Smiles for Life, 2016), and from Oral Health in Primary Care report (Qualis Health, 2015).

Convenience sampling was used for ease and time during the data collection. The nurse roomed the patient and followed the primary care clinic rooming protocol. The nurse provided each patient who met the inclusion criteria with preventive oral health education and appropriate patient survey at the end of the rooming process. This allowed for time for survey completion prior to their time with the provider. Consent was determined by patients or parents completing the questionnaire given, and was explained by nurses who took patients to an exam room for wellness exam. The patient was to leave the survey on the counter in the exam room when completed. Watson's carative factor of cultivation of sensitivity to self and others was implemented in this phase by administering the patient survey in this manner, which gave the patient time to complete it in privacy.

Before leaving the room, the nurse provided the patient a packet of oral health education materials and resources for local dentists. Once the provider completed the wellness exam, the nurse retrieved the survey and placed it in a secure envelope at the nurses' station. The survey was implemented at wellness visits for a total of 19 patients meeting adult inclusion criteria and 11 patients meeting the inclusion pediatrics criteria. Data collection took place from August 1st, 2016 and ending October 1st, 2016.

OUTCOMES

The purpose of this project was to educate providers, nurses, and patients in a primary care clinic on the importance of oral health care and to create simple referral process for at risk patients. Prior to formal project implementation, but after consultation of the author, the clinic director, and nursing staff; they discontinued the use of sugary lollipops used as prizes for seeing the doctor, and replaced them with stickers and other smile maker toys. This group also decided to place oral health preventive care posters in the exam, procedure, and waiting rooms for patients to view while waiting to be seen by his or her primary care provider. (See Appendix A & B). These were unexpected positive outcomes of this project.

Data were collected from August 2016 and October 2016. During that period, 18 of 39 eligible women aged 18-40 years old, 1 of 71 pregnant females, and 11 parents of 158 children age zero to six years completed the appropriate Oral Health Questionnaire. Data were analyzed per recommendations of Dr. L. Lin, with the assistance of MSU Statistical Graduate Students K. Flagg and J. Schupbach. (See Appendix D) The Medical Doctors at the primary care clinic did not take the pre-and posttest due to not having adequate time in their schedules during working hours.

Each nurse was given the same twenty question pre-seminar and post-seminar test. All the questions were multiple choice with one exact right answer. No nurses answered all twenty questions correctly on either test. However, one nurse missed just one questions on the posttest. All six nurses who participated in the seminar and who completed the pre-and posttest attained a higher post-seminar test score on the “Provider

Test.” (See appendix C) Six of the seven nurses completed the oral health education seminar. Post-seminar scores were generally higher than pre-seminar scores (Figure 1 and Table1). The average pre-seminar score was 10.00 and the average post-seminar score was 16.17. All nurses increased their score after the seminar with a minimum increase of 2.00 and an average increase of 6.17. Tests are based out of 20 possible points. Question 11 was missed by all nurses who scored 19 or above on the posttest (Figure 2). All nurses correctly answered questions 1, 3, 7, 9, 10, 13, 16, 19, and 20 after the seminar. (See Appendix C)

The Wilcoxon signed rank test was used to analyze the nurse test data. This test was preferential to the paired t-test to infer if over half of the participants did see a score increase after the seminar; a paired t-test is difficult to use with a low number of participants since it is an assumption of a normal distribution (Flagg, Lin, & Schupbach, 2017). The V-statistic of 21 showed a p-value of 0.0178 suggesting strong evidence the nurses’ scores tended to be higher after the seminar.

Nurse	Pre	Post	Score Increase
Nurse 1	8	19	11
Nurse 2	13	15	2
Nurse 3	10	19	9
Nurse 4	11	14	3
Nurse 5	9	19	10
Nurse 6	9	11	2

Table 1. Table of the raw pre-seminar and post-seminar knowledge test scores and the pre-seminar to post-seminar score increase for each of the six nurses.

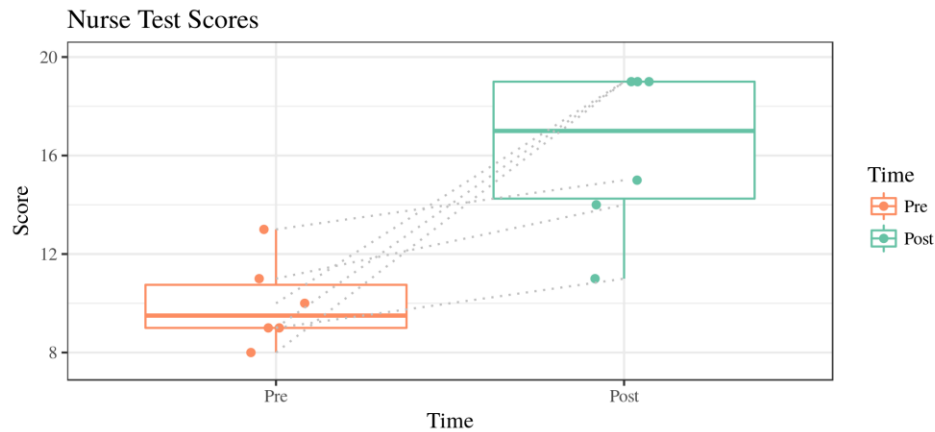


Figure 1. Nurse test score plot. The plot depicts the six nurses' scores on the pre-seminar test and the post-seminar test. There is a dotted line connecting each nurse's score improvement from the pretest to the posttest.

A heat map is a visual display of all patients' answers to the questionnaire in one graph (Flagg, Lin, & Schupbach, 2017). The reader can see how each question was answered across the spectrum of all patients in one graph. The graph depicts incorrect responses as orange, correct as green, and the reader can easily see the improvement at a glance (Figure 2).

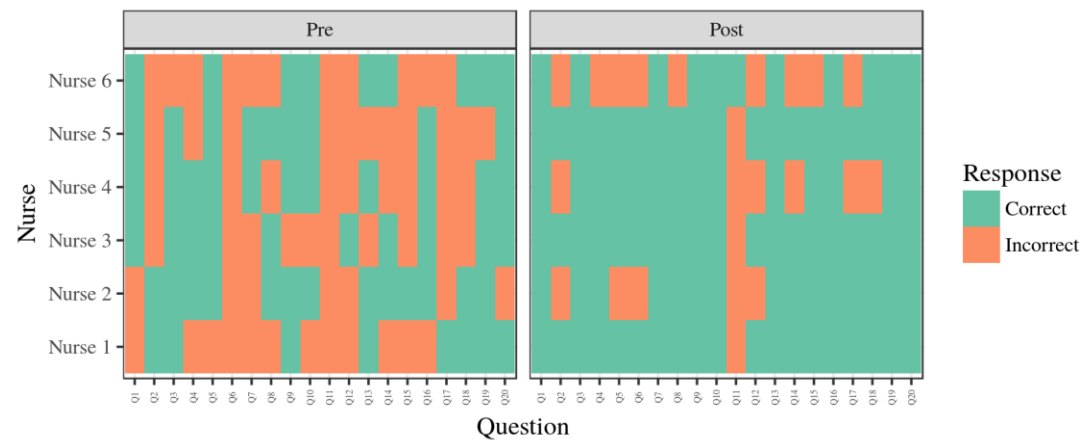


Figure 2. Heatmap of Nurse Knowledge Assessment Responses. Overview of the results of correct and incorrect answers by each nurse before and after the seminar.

Nineteen eligible adult patients completed the “Adult Oral Health Questionnaire.” One of the adult participants identified as pregnant at the time when the survey was completed. All adult participants were analyzed as a single sample group. The questionnaire asked the patient’s age, and included 10 items about oral health and current oral health habits. Responses to these questions were categorized as either associated with good oral health or not.

All 19 pregnant and childbearing age females surveyed received the same 11 question oral health survey titled “Adult Oral Health Questionnaire.” None of the patients indicated having all good oral behaviors. Patient 1 indicated two poor oral health habits in contrast to patient 8 with seven poor oral habits. Depicted in Figure 3, 63% or 12 participants showed good oral health behaviors.

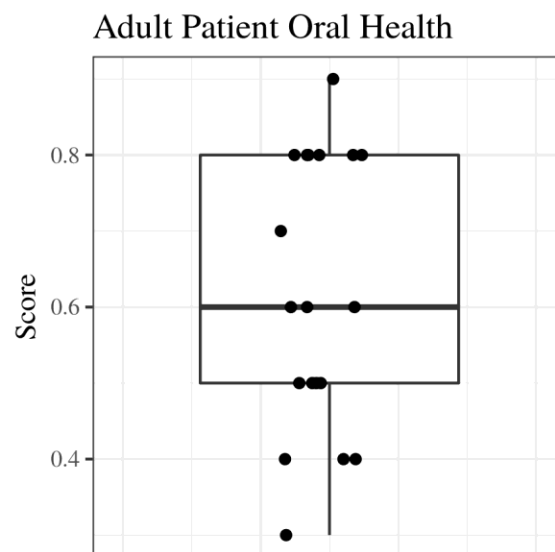


Figure 3. Plot of Proportion of Adults with Good Oral Health Behaviors. The y-axis is the percent of overall good behaviors.

Fifteen of 19 patients (78.95%) responded “no,” to having bleeding or red gums. Seventeen participants answered they consumed carbohydrates, indicating a poor oral health habit. Another high poor oral health response, 42% or 8 respondents indicate a history of cavities or a current cavity in the mouth. Sixteen of 19 patients (84.21%) indicated their children did not have cavities. Fourteen of 19 participants had seen their dentist in the past year independent of insurance status. Of the 19 participants, nine responded to question 10 as having no dental insurance. An assumption cannot be made that a patient without dental insurance does not seek dental care on an annual basis.

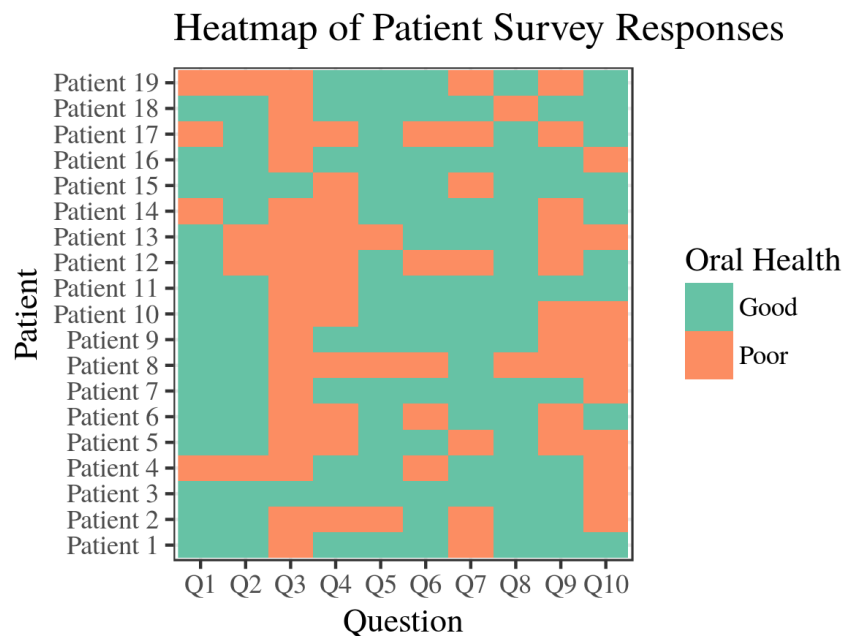


Figure 4. Heatmap of Pregnant and Childbearing Age Females Survey Response. Overview of the good or bad oral health behaviors indicated by color.

All 11 pediatric patients’ age two months to six years old received the same 16 question oral health survey titled “Pediatric Oral Health Questionnaire,” that his or her

parent completed. The questionnaire included the patient's age and 15 items about oral health and habits; responses to 13 of these items were categorized as either associated with good oral health or not. Parents of 11 patients completed the questionnaire. Nine of the 11 pediatric patients had teeth, thus the entire questionnaire applied to them. Of the 11 pediatric patients surveyed regarding their oral health status, 75% or eight patients had positive oral health behaviors. See figure 5 below.

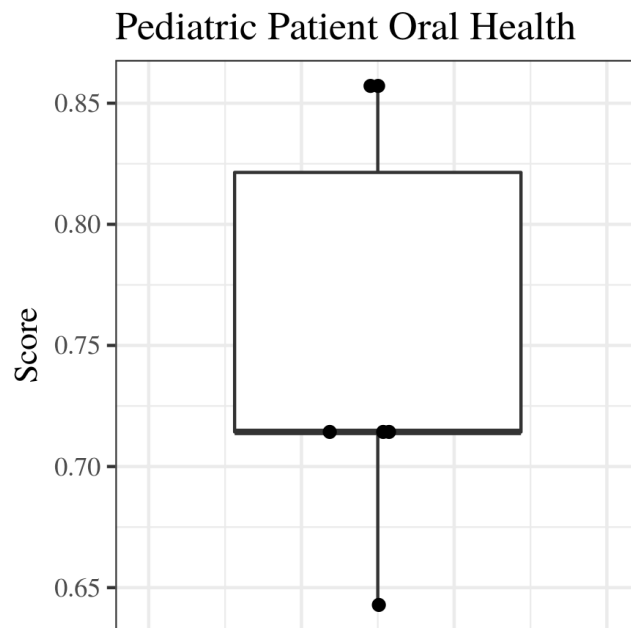


Figure 5. Plot of Proportion of Pediatric Patients with Good Oral Health Behaviors. The y-axis is the percent of overall good behaviors.

Question 2 stated, “Has your child seen the dentist in the past year?” and results were that 53% or five of nine patients had seen the dentist in the past year. In question 4, 78% or nine pediatric patients surveyed did not have a cavity or history of cavities, indicating good oral health behavior. The reporting of cavities was self-observation or from previous dental visits, not from an examination in the primary care office visit. All

nine parents responded to question 5, “Has the mother/primary caregiver had active/untreated cavities in the past year?” that they did not have active or untreated cavities.

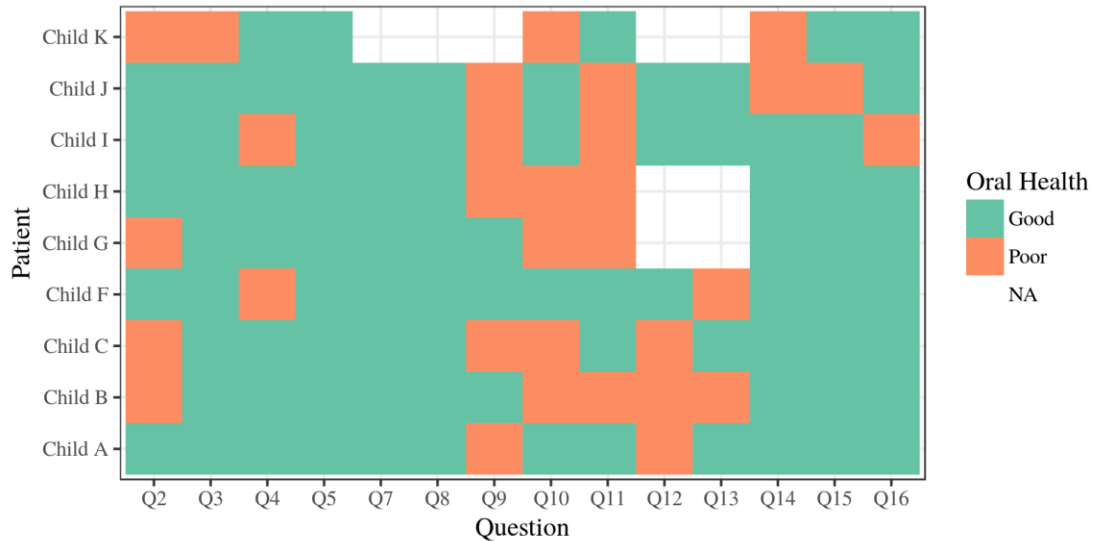


Figure 6. Heatmap of Pediatric Survey Responses. Overview of the good or bad oral health behaviors indicated by color. Blanks represent items not applicable to that patient due to age or not having teeth.

Since the proportion of adults who took the survey and reported good oral health behaviors did not indicate if their child was one of the pediatric survey response, no assumptions can be made between these two surveys. However, it is important to note that 100% of the adult participants had no self-reported cavities in their mouths currently; reflecting in a high proportion of good oral health behaviors passed to their children based on the survey results.

DISCUSSION

A recurrent theme found throughout this practice improvement change was the profound lack of oral health education given to parents at their child's wellness exam, to patients at their adult wellness exams, and to providers throughout his or her career and schooling. It was demonstrated that oral health was a topic overlooked in primary care clinic wellness visits, prenatal exams, and higher education institutions.

The practice improvement project met with a multitude of difficulties, struggles, and successes. Coordinating all staff nurse schedules for the educational seminar proved impossible. The director was the most flexible, being at work every workday of the week, and could easily attend an educational seminar when it was planned. After the author recorded a lecture on preventive oral health, the primary care staff could watch it at their leisure, eliminating the need to coordinate all schedules. The clinic director continues to have access to the recorded power point for future reference.

All nursing staff showed improvement in their oral health knowledge, and can now educate their patients as deemed necessary. Once the data collection began, the process went rather smoothly for the first two months. Towards the end of the practice improvement project, in October 2016, the onset of influenza season resulted in competition for staff nurses' time. Thus, a lower proportion of patients were surveyed than who were eligible. Although a lower proportion of patients received the surveys than were eligible, some conclusions can be drawn from the results.

The strengths of the project were; 1) Six of seven nurses completed oral health education; 2) Oral health education materials were displayed throughout the clinic; 3)

Sugary laden lollipops were replaced with stickers and small toys; 4) Patients expressed appreciation for the packets of education materials; 5) The staff and patients appreciated the list of dentists who will see lower-income population. Due to time constraints of the project, the referral process was not initiated to its full potential. Instead, the list of dentists in the local area were included in the educational packets given to all patients who participated in the survey.

The findings of the project were not consistent with best practice in preventive oral health. Primary care providers were unaware of the best practice recommendations for preventive oral health, and needed education to properly care for the patients. Additionally, many pregnant women, childbearing age females, and parents of children age zero to six were unaware of the importance of oral health. Most did not know when or where to seek dental care. There were not major differences between the literature and the results of this project.

The importance of including oral health preventive care in primary care is often over-looked. Oral health education resources are now readily available online such as the “Smiles for Life Curriculum” (Smiles for Life, 2016). National reports such as the 2000 Surgeon General’s oral health report called for the elimination of oral health disparities, promotion of oral health, and increasing the quality of life through a national oral health plan (U.S. Department of Health and Human Services, 2003). Healthy People 2020 has a goal to “Prevent and control oral and craniofacial diseases, conditions, and injuries, and improve access to preventive services and dental care” (Office of Disease Prevention and Health Promotion, 2014). The findings from this project suggest that when primary care

providers receive information about preventive oral health care, they may change their behavior, and begin addressing oral health during well child and prenatal visits regarding preventive oral health care.

Oral health education on oral health behavior changes and screenings for parent may impact their families in a positive manner. Resources, posters, and brochures need to be available to parents at wellness exams of their children. Previous educational programs have noted the importance of such activities as part of a medical provider's educational training (Slade, Rozier, Zeldin & Margolis, 2007; Grant, Roberts, Brown, & Quinoñez, 2007). Hands-on training is an important step in alleviating anxiety towards performing an activity and clarifying any possible barriers towards accomplishing it (McKenzie, Neiger & Thackeray, 2009). Thus, teaching the providers more about oral health will result in higher compliance to passing that onto the patient.

Limitations

Four limitations of this project were data collection occurred at one clinic, the sample was a convenience sample, the small sample size, and retention of information learned. Time constraints for the implementation of this project, as well as the project design, did not allow for collection of a larger sample size, multiple clinic sites, or a randomized sample. While conclusions might be applicable to other clinical situations, they are specific to this practice improvement project at a specific primary care clinic. Future projects could include expanding to more clinics that fit the criteria and random sampling of staff and patients. Retention could be investigated by doing a follow up test with the nurses six months' post educational seminar.

Furthermore, there was no way to track if any pediatric patient had a connection to an adult survey in this study. Thus, conclusions cannot be drawn from positive or negative oral health behaviors being passed onto children. Considering these limitations, recommendations for further study include to increase the study duration, increase sample size, increase number of clinics participating, create a randomized control study, and use standardized instruments for data collection.

Budgetary Implications for Society and Primary Care Practice

Poor maternal oral health leads to many other health concerns such as malnourishment (Boggess & Edelstein, 2006; U.S. Department of Health and Human Services, 2003), atherosclerosis (Boggess & Edelstein, 2006), rheumatoid arthritis (Boggess & Edelstein, 2006; Kloetzel, Huebner, & Milgrom, 2011), diabetes (Boggess & Edelstein, 2006), potential poor pregnancy outcomes (Qualis Health, 2015; Boggess & Edelstein, 2006), and a child's risk of developing early and severe dental caries (Boggess & Edelstein, 2006; U.S. Department of Health and Human Services, 2003; Kloetzel, Huebner, & Milgrom, 2011).

The social burden and cost of early childhood caries is one of the costliest childhood diseases (Goldie, 2003). There is a lack of research for cost-effective treatment for ECC (Romas-Gomez & Shepard, 1999). The cost of treating ECC without general anesthesia is \$700-\$1000, and with sedation will total upwards of \$2100 (Romas-Gomez & Shepard, 1999). Given current currency and inflation, it would be an even greater

price. Oral health should be of utmost importance to be included in preventive wellness exams due to the cost it has on society.

The cost to primary care clinic was minimal. The focus of the practice change was to increase clinic provider awareness of the importance of oral health care, and the availability of oral health education materials for providers and patients. The major costs of the projects were related to employee time, approximately 30 minutes for participation in the educational seminar, and completion of the survey instruments.

Leadership Role

The clinical director showed great leadership to the author by coordinating the primary care nurses to be able to accommodate this practice improvement project. The director was a clear communicator about expectations, goals, and timelines. Leaders of the practice transformation facilitate the change by identifying and allocating resources to ensure its ongoing success after implementation (Altman, Philips & Manning, 2013).

The top two barriers that hinder evidence-based implementation into practice are lack of time and nursing autonomy (Brown, Wickline, Ecoff, & Glaser, 2009). The responsibility of the leader is to gain buy-in from the providers and staff encouraging the practice change is worth the additional responsibility to complete at each office visit. Without creating a solid foundation of effective leadership and a quality improvement strategy, practice transformation will be next to impossible to create (Hummel, 2016).

Recommendations

This scholarly project addressed an existing practice gap regarding preventive oral health in Primary Care. As reported in the literature, the promotion of the early detection and treatments of periodontal disease in young women before and during pregnancy will be beneficial, especially for women at risk (Huck, Tenenbaum, & Davideau, 2011). Hands-on training is an important step in clarifying any possible barriers towards implementing the prevention of oral health disease in the primary care clinic (McKenzie, Neiger, & Thackeray, 2009). The training can be easily attained by completing the Smiles for Life curriculum. Teaching the providers more about oral health may result in higher compliance to passing that education onto the patient, and in turn promote healthy oral behaviors in the general population. Many patients do not see a dentist annually, but do seek care at their primary care clinic. Therefore, primary care needs to include preventive oral health care into wellness and prenatal exams.

Current research on the value of perinatal oral health education and perinatal dental care with its impact on the unborn child is needed. In addition, curriculum revision should occur at the university level, to ensure future health care professionals will have a strong oral health foundation (Nathe, 2016; U.S. Department of Health and Human Services, 2003). A collaborative effort needs to occur between all health care providers to better care for the patient's overall health.

Future efforts should examine effective dissemination and implementation strategies that translate evidence-based guidelines for oral health in women, childbearing aged females, and parents of children into clinical practice (Vamos et al., 2015).

Regardless of statistical outcomes, this project raised awareness of preventive oral health and its impact on overall health.

APPENDICES

APPENDIX A

PATIENT HANDOUT

For Mom: Tips to Maintain a Healthy Mouth during Pregnancy

- ☞ Brush for 2 minutes twice per day with Fluoride toothpaste
- ☞ Floss daily
- ☞ Choose foods that are low in sugar and nutritious
 - ☞ Raw fruits, vegetables, yogurt, or cheese
- ☞ Visit your dentist. For most women, routine dental visits are safe during pregnancy
- ☞ If you have morning sickness, rinse your mouth with a teaspoon of baking soda mixed with water instead of brushing your teeth directly after vomiting.
 - ☞ Stomach acids repeatedly come into contact with teeth, it can cause tooth enamel to wear away.
- ☞ Drink plenty of water that contains fluoride

It's Never too soon to Care for Your Baby's Oral Health

- ☞ Your baby's 20 primary teeth are present in the jaw at birth
- ☞ Eruption of teeth begins between 4 to 6 months of age.
- ☞ Most children have a full set of 20 primary teeth by the time they are 3 years old. ☞ Tooth decay is the most frequent preventable childhood disease.
- ☞ The most common cause of tooth is frequent exposure of the teeth to sugary drinks.
- ☞ Do not share saliva with the baby by using the same spoon or licking a pacifier to clean it. Tooth decay can begin with cavity-causing bacteria being passed from the mother to the baby.

Dental Homes for all Ages, Incomes, and Insurances

Adult Dental Home Resources:

1. Community Health Partners Dental
Ph: 406-585-8701

Children Dental Home Resources:

1. Gallatin Valley Pediatric Dentistry- Dr. Joel Sayre
Ph: 406-587-2327
2. Community Health Partners Dental
Ph: (406)585-8701
3. Children's Dental Health Center- Dr. Todd Steinmetz
Ph: 406-586-8112

Oral Health affects your Overall Health!



Healthy Teeth and Gums



Cavities



Gum Disease

Dental Cavities

- When you eat **sugary** foods, **bacteria** in the mouth turn the sugar into **acid**. The **acid eats holes** in **teeth** and makes **cavities**. Cavities can lead to serious **infections**.
- The more often you eat sugary foods the more likely cavities will form.

Gum Disease

- **Bleeding gums** are one of the first signs of gum disease.
- If not treated, gum disease can cause teeth to become loose. These teeth often have to be taken out.

Preventing Cavities and Gum Disease

- Eat only **sugar free** snacks between meals.
- **Avoid** sugar containing drinks between meals such as juices and soda. Drink water and milk.



- Clean between your teeth **every day** with **floss** or toothpicks.
- See a dentist **twice a year** for cleanings and check ups.

Cavities and Medications

- Many **medications** make your **mouth dry** which can lead to more **cavities**.
- Medications causing dry mouth include those for depression, high blood pressure, pain, allergies and heart problems.
- If you take medications that cause dry mouth be **very careful to prevent cavities**.
- Ask your dentist or physician about fluoride containing mouthrinses and gels to protect your teeth.
- **Brush** your teeth **twice a day** with a **fluoride** toothpaste.



Your Mouth and Overall Health

- If you are **pregnant**, untreated gum disease may cause you to deliver your baby too early.
- You can pass cavities on to your children. Take care of your teeth to help your children have healthy teeth.
- If you have **diabetes** you are at high risk for gum disease. Gum disease may make it more difficult to control your blood sugar.
- A person with gum disease may be at greater risk for **heart disease**.
- To help prevent **oral cancer** avoid or limit tobacco and alcohol.



APPENDIX B

PREVENTING CAVITIES AND GUM DISEASE

Healthy Smiles



Dental Care Tips for Mom and Baby

The benefits of good dental health begin well before your baby is born so get an early start on a lifetime of healthy smiles by taking good care of your own mouth now.



For Mom: Tips for Maintaining a Healthy Mouth During Pregnancy

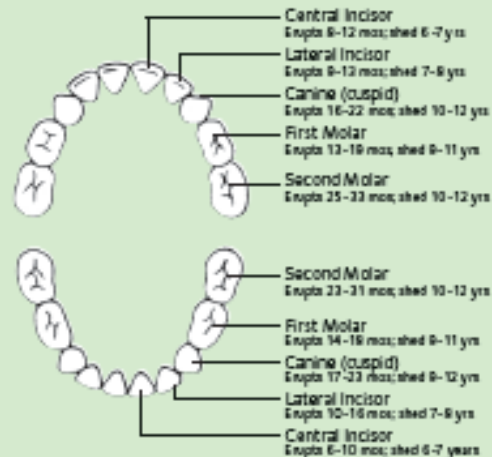
- Brush for two minutes, twice a day with fluoride toothpaste and floss every day.
- Eat healthy foods and follow your physician's advice about diet.
- When you need a snack, choose foods that are low in sugar and nutritious, such as raw fruits and vegetables, yogurt, or cheese.
- Visit your dentist. For most women, routine dental visits are safe during pregnancy.
- Tell your dentist that you are pregnant, about any changes you have noticed in your dental health and about any medications you are taking.
- Your dentist may recommend using a mouth rinse to help control plaque, a sticky substance on your teeth that contains bacteria and can cause gum disease.
- If you are vomiting frequently, try rinsing your mouth with a teaspoon of baking soda mixed with water instead of brushing your teeth directly after vomiting. When stomach acids repeatedly come into contact with teeth, it can cause tooth enamel to wear away.
- Drink plenty of water that contains fluoride.

For Baby: It's Never Too Soon to Start Caring for Your Baby's Dental Health

A baby's 20 primary (baby) teeth are already present in the jaw at birth and usually begin coming through the gums around 4 to 6 months of age. Most children have a full set of 20 primary teeth by the time they are 3 years old. Tooth decay is the most frequent childhood disease, but it's also very preventable. The most common cause of tooth decay in young children is frequent, prolonged exposure of the teeth to sugary drinks. Here are some tips to avoid tooth decay:

- Put only plain water, formula, milk or breast milk in bottles. Avoid filling bottles with liquids such as sweetened water, fruit juice or soft drinks.
- Never put your baby to bed with a bottle. Even when it's breast milk or formula, it can still decay teeth.
- Use clean pacifiers — don't dip them in sugar or honey.
- Try not to share saliva with the baby by using the same spoon or licking a pacifier to clean it. Tooth decay can begin with cavity-causing bacteria being passed from the mother to the baby.
- Keep your baby's gums and teeth clean.

Primary Teeth — Eruption Chart





Tips to Clean Your Baby's Teeth

- Begin cleaning your baby's mouth during the first few days by wiping the gums with a clean, moist gauze pad or washcloth after each feeding.
- When your child's teeth begin to come in until age 3, brush the teeth gently twice a day with a child-size toothbrush and a very small amount of fluoride toothpaste around the size of a grain of rice.
- For children 3 to 6-years-old, brush their teeth twice a day with a pea-sized amount of fluoride toothpaste. Be sure they spit out the toothpaste.
- Until you're comfortable that your child can brush on his or her own, continue to brush your child's teeth twice a day with a child-size toothbrush and a small amount of fluoride toothpaste. When your child has two teeth that touch, you should begin flossing their teeth daily.

As soon as your child's first tooth appears, it's time to schedule a dental visit. The ADA recommends that the first dental visit take place within six months after the first tooth appears, but no later than a child's first birthday. Don't wait for them to start school or until there's a dental emergency.

Getting into a routine early will put your baby on the right path to a healthy smile from the start.

Enter to Win a \$100 Gift Card!

Simply complete the online survey at MouthHealthy.org/healthysmiles and you'll be entered to win a \$100 gift card to Babies "R" Us. One winner will be randomly selected each month through December 31, 2016.

Thank you to the following sponsors for providing funding for Healthy Smiles from the Start



For more information about taking care of your mouth and teeth, visit MouthHealthy.org, the ADA's website just for patients.





Teething

- Offer a cold, firm, safe teething object like a teething ring or slightly frozen washcloth.
- Rub the gums gently with your clean finger.

Cleaning and Brushing

- After teeth come in, gently clean teeth and gums with a small soft toothbrush or clean damp cloth and a rice-sized amount of toothpaste.

To Keep Teeth Healthy

- If you give your baby a bottle at bedtime or naps give only water. Other liquids can cause decay if left in your baby's mouth while sleeping.
- Ask your dentist or doctor about fluoride drops when your child is 6 months old.
- Make sure that your baby's mouth is checked by age one by a dentist or doctor. Take your baby in sooner if you notice a problem.

Teeth start to come in around the age of 6 months. They help your baby chew food and speak clearly. And, they help shape your baby's face and guide adult teeth into place.



DENTAL CARE FOR BABIES

Teething

Cleaning and Brushing

To Keep Teeth Healthy



DENTAL CARE FOR YOUNG CHILDREN

Brushing

- Brush your child's teeth at least twice a day. Always brush at bedtime.
- Use a small soft toothbrush and a rice-sized amount of toothpaste with fluoride.
- Brush for at least 2 minutes, brushing every surface of every tooth and the tongue.
- Replace the toothbrush every 3 to 4 months.

To Keep Teeth Healthy

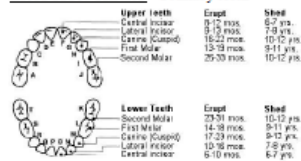
- Lift your child's lip to get a good look at all of the teeth. If you see white or brown spots on your child's teeth, contact your dentist or doctor.
- When you think your child is ready, let her practice brushing her own teeth – around age 4 or 5. Still brush your child's teeth once daily until she is about 6 to 8 years old.
- Take your child for a dental check-up at least once a year.

CARIES RISK ASSESSMENT

Increased caries risk associated with:

- Previous caries
- Developmental defects of teeth
- High parental or sibling caries levels
- Low socioeconomic and education status
- Poor access to health care
- Special health care needs
- Frequent consumption of sugary foods
- Sleeping with bottle
- Inadequate fluoride
- Poor oral hygiene

ERUPTION CHART – Primary teeth



ERUPTION CHART – Permanent teeth



DIET

- Hold infant when feeding
- No bottle propping or bottle to bed
- No ad lib bottles or sippy cups
- Only breast milk/formula in bottle
- Limited number of snacks – no grazing
low sugar or sugar-free examples: fresh fruit/veg, plain cheerios, cheese, crackers
- Only plain milk or water between meals

TEETHING

Signs and Symptoms

- Loose stools are associated with teething.
- Fever, drooling, sleep disturbance, tugging on ears have not been associated with teething and may be physiologic, behavioral or another organic cause.
- A fever of >100.6 should be evaluated for other causes.

Treatment Advice

- Teething rings or cold wash cloths to suck/chew
- Acetaminophen or ibuprofen as needed
- Teething gels are less helpful, taste bad, and at high doses can be dangerous

INFANT/CHILD ORAL EXAM TIPS

Lap to lap method

- Position child on parent's lap facing parent.
- Position your chair so that you are knee to knee with parent.
- Lower child back onto your lap (so that child is still in contact with parent).

Exam table method

- Place child on exam table and have parent hold hands
- Examine child from behind head with the child's head tilted back and mouth opened wide.

What to look for

- Good oral hygiene including pink gums and shiny teeth.
- Closely examine high risk areas, such as gum lines, molar surfaces, and behind the upper central incisors for white or brown spots, cavities and/or defects.
- Any deviation from normal or the presence of plaque indicates increased caries risk and the child should be referred for dental care.

FLUORIDE SUPPLEMENTATION

Consider supplementation for high risk children (see "Caries Risk Assessment"). *JADA* 2010;141(12):1480-89.
 If on city water, determine if water is fluoridated.
 * Visit CDC My Waters Fluoride website for a list of communities with fluoridated water
<http://apps.nccd.cdc.gov/MWF/index.asp>
 If on well water, obtain test kit from local authority, which may be local dental school, public health department, etc. Prescribe fluoride supplementation according to results.

FLUORIDE SUPPLEMENTATION DOSAGE SCHEDULE FOR CHILDREN AT HIGH CARIES RISK:

Patient's age	Level of fluoride found in water		
	<0.30ppm	0.3-0.60ppm	>0.60ppm
0-6 mths	0	0	0
6 mths - 3 yrs	0.25	0	0
3 yrs - 6 yrs	0.50	0.25	0
6 yrs - 16 yrs	1.00	0.50	0

FLUORIDE PRESCRIPTION EXAMPLES

Infant age 6 mos to 3 yrs in an area with <0.3ppm:
 Fluoride 0.25mg/0.5ml solution
 Give 0.5 ml daily
 Swish and swallow, do not give with milk or formula
 Dispense 50 ml. Refill for 1 year

Child age 3-6 yrs in an area with <0.3ppm:
 Fluoride 0.5 mg chewable tab
 1 tab daily
 Chew and swallow, do not give with milk
 Dispense 100 tabs. Refill for 1 year

Fluoride w/ iron & multivitamin for child age 6 mths to 3 yrs in an area with <0.3ppm:
 Multi-vit w/ iron and fluoride 0.25mg/ml
 Give 1 ml daily
 Chew and swallow, do not give with milk or formula
 Dispense 50 ml. Refill for 1 year

MANAGEMENT PRINCIPLES

ACOG: "A dental check up in pregnancy will ensure that your mouth stays healthy. Pregnant women are at increased risk for cavities and gum disease".
 American Dental Association & American Academy of Periodontology support prenatal dental care.

Dental Treatment Timing

Dental treatments can occur during all 3 trimesters

First Trimester: Elective treatment can be delayed if patient or provider prefer until 2nd trimester, however care is safe; urgent care should not be delayed

Second Trimester: Optimal time for treatment; fetus not large, organogenesis complete

Third Trimester: Late in term uncomfortable; position women angled on left side

Dental X-Rays

- Only as needed
- Radiation exposure extremely low
- Use lead apron of abdomen/thyroid
- Avoid retakes

Common Dental Medications

Antibiotics

- Penicillin (FDA Category B)
- Amoxicillin (B)
- Cephalexin (B)
- Erythromycin base (B)
- Clindamycin (B)

Anesthetics

- Lidocaine (B)
- Procaine (C)
- Nitrous Oxide (no rating; literature indicates safe)

Analgesics

- Acetaminophen (B)
- Ibuprofen (B/D*)
- Oxycodone (B/D*)
- Hydrocodone and Codeine (C/D*)
 *avoid in 3rd trimester

Preventive Agents

- Fluoride, Xylitol, Chlorhexidine
- No increased risk during pregnancy

ERUPTION CHART – Permanent teeth

Use chart to describe affected tooth when referring:



DENTAL GUIDELINE RESOURCES:

Oral Health Care During Pregnancy: A National Consensus Statement. 2012. Washington D.C.
 National Maternal and Child Oral Health Resource Center www.mchoralhealth.org/PDFs/OralHealthPregnancyConsensus.pdf

New York Public Health: Oral Health Care During Pregnancy and Early Childhood Practice Guidelines, 2006 www.health.ny.gov/prevention/dental/docs/oral_health_plan.pdf



**CHILD ORAL HEALTH
POCKET CARD**
 Hugh Silk MD, Alan Douglass MD, Joanna Douglass BDS
 Smiles for Life Oral Health Curriculum
www.smilesforlifeoralhealth.org October 2012
 Creation of this product was funded by:
 National Interprofessional Initiative on Oral Health
 The information contained in this card should not substitute for consultation with an oral health expert.

DENTAL TOPICS FOR WELL CHILD CARE VISITS

- 0-2 months:**
 - Diet: Infant feeding (no bottle propping)
- 4 months:**
 - Caries risk assessment
 - If high risk, assess need for fluoride supplementation
 - Diet: Infant feeding (no bottle propping, no bottle to bed)
- 6-9 months:**
 - Fluoride: Prescribe systemic fluoride if needed
 - Diet: Introduce cup; remove bottle by 1 yr.; no ad lib bottle or bottle to bed
 - Oral hygiene: Start brushing as teeth erupt, use smear of fluoride toothpaste
 - Dental screening: assess caries, defects, oral hygiene
- 12+ months:**
 - Ensure regular dental visits from age one year
 - Fluoride: Prescribe systemic fluoride for high risk until age 16; provide fluoride varnish for moderate and high risk q. 6 months
 - Diet: Limit sugar-free snacks & drinks; no bottles; no ad lib sippy cups
 - Oral hygiene: parental supervision, fluoride toothpaste, pea size amount at age two
 - Exam: assess caries, defects, oral hygiene



**PRENATAL ORAL HEALTH
POCKET CARD**
 Hugh Silk MD, Alan Douglass MD, Joanna Douglass BDS
 Smiles for Life Oral Health Curriculum
www.smilesforlifeoralhealth.org October 2012
 Creation of this product was funded by:
 National Interprofessional Initiative on Oral Health
 The information contained in this card should not substitute for consultation with an oral health expert.

PRENATAL ORAL CONDITIONS

- Gingivitis**
 - Mild gum swelling, tenderness, erythema
 - Bleeds easily; reversible; hormonal cause
 - Prevalence: 30-75% in pregnancy
 - Treatment: brush bid, floss, regular dental visits
- Periodontitis**
 - Inflammation of gum, ligaments, bone
 - Plaque plus bacteria plus inflammation
 - Prevalence: 30% of women of childbearing age
 - Associated with preterm labor/low birth weight
 - Treatment: Proper hygiene; deep root scaling
- Caries (caused by S. mutans, sugar, poor hygiene)**
 - Plaque, white spots, brown spots lead to cavities
 - Women pass caries risks to infant postpartum
 - Treatment: Proper hygiene; regular dental visits; prescription xylitol gum postpartum
- Pregnancy granuloma**
 - Erythematous, non-painful, smooth nodule
 - Usually on gingival; bleeds easily
 - Prevalence: 5% of pregnant women
 - Treatment: Observation; recur if excised
- Dental Erosions**
 - Caused by hyperemesis; GERD
 - Treatment: Rinse after vomit, meals with baking soda and water

PREVENTION - CARIES & PERIODONTAL DISEASE

Initial prenatal visit

Ask

- Do you brush/bid; floss daily?
- Do you have a dentist, dental insurance?
- Have you seen the dentist in the past 6 months for a regular check up and cleaning?
- Do you need any treatment completed?

Perform oral exam

- Teeth and gums

Counsel

- Limit sweet snacks/drinks between meals
- Brush twice daily with fluoride toothpaste
- Floss daily
- Healthy gums and teeth help create healthy babies

Refer

- All patients with bleeding gums, cavities, tooth ache, loose teeth, or any other mouth problem
- All women who have not been seen for non-emergent dental care in last 6 months

Caries Risk Factors

- Presence of cavities or multiple fillings
- Poor oral hygiene
- Poor access to dental care/no dental insurance
- Low socio-economic and/or education status
- Inadequate fluoride
- High frequency foods and drinks with sugar
- Special health care needs
- Presence of partial dentures or other appliances
- Xerostomia (medications, disease)

Periodontal Disease Risk Factors

- Poor oral hygiene
- Tobacco use
- Diabetes
- Medications (e.g. anticonvulsants → gum hyperplasia)

ANTIBIOTIC PROPHYLAXIS GUIDELINES FOR ORAL PROCEDURES**

If sending a prenatal patient for an oral procedure who has a heart condition, use AHA guidelines:

At Risk Medical Conditions

Highest Risk

- Acquired valvular dysfunction
- Prosthetic cardiac valves
- Previous bacterial endocarditis
- Congenital heart disease (CHD)
 - Unrepaired cyanotic CHD
 - Completely repaired congenital heart defect during the first 6 months after the procedure
 - Repaired CHD with residual defects
- Cardiac transplantation recipients who develop cardiac valvulopathy

Lower Risk - No longer prophylaxed

- Acquired valvular dysfunction
- Hypertrophic cardiomyopathy
- Mitral valve prolapse with audible regurgitation
- Isolated secundum atrial septal defect
- Previous coronary artery bypass grafting
- Physiologic, functional, or innocent murmurs
- Previous Kawasaki disease w/o valve dysfunction
- Cardiac pacemaker or implanted defibrillator

Prophylaxis also recommended for patients with:

- Total joint replacement
 - In place less than 2 years
 - Immunocompromised patient
 - Previous prosthetic joint infection
- Vascular grafts in place less than 6 months
- Arteriovenous shunt for hemodialysis
- Neurosurgical shunts
- Indwelling catheters

Planned Procedure

Prophylaxis recommended for highest risk patients

- For all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa

Prophylaxis NOT recommended for:

- Local injections through non-infected tissue
- Removable appliance placement
- Oral radiographs
- Orthodontic appliance adjustment
- Shedding of primary teeth
- Bleeding from trauma to the lips/oral mucosa

Antibiotic choices for adults

Give 1 dose only 30 – 60 minutes pre-procedure): Amoxicillin: 2.0 g by mouth

Unable to take oral medication (give 1 dose only 30 – 60 minutes before procedure):

Ampicillin: 2.0 g IV or IM

Cefazolin or Ceftriaxone: 1.0 g IV or IM

Allergic to penicillin (give 1 dose only 30 – 60 minutes before procedure):

Clindamycin: 600 mg by mouth

Azithromycin or clarithromycin: 500 mg by mouth

NOTE: The American Heart Association (AHA) reaffirms that those medical procedures listed as not requiring infectious endocarditis prophylaxis in the 1997 statement remain unchanged and extends this view to **vaginal delivery**, hysterectomy, & tattooing.

**IMPORTANT NOTICE:

The "Antibiotic Prophylaxis Guidelines" above are based on the latest recommendations by the AHA (updated 2007). It is advised to consult the AHA website for more details and for any updates: www.americanheart.org

Smiles for Life
A national oral health curriculum

National Interprofessional Initiative
on Oral Health
Working across
disciplines

APPENDIX C

ORAL HEALTH QUESTIONNAIRES

Adult Oral Health Questionnaire

You are being asked to complete an oral health survey. This is VOLUNTARY. You are not required to answer any questions and may stop at any time. Information gathered is for the purpose of the practice improvement project and is not part of your health record. Thank you.

1. Do your gums bleed or are they red or tender?
2. Have you had nausea and/or vomiting?
3. Do you frequently eat and/or drink carbohydrates?
4. Do you have a history of cavities or do you have cavities now?
5. Do your children have a history of cavities?
6. Has it been over a year since you have seen the dentist?
7. Do you use fluoridated toothpaste?
8. How frequently do you brush your teeth?
9. Do you have plaque on your teeth?
10. Do you have dental insurance?
11. What is your age?

Pediatric Oral Health Questionnaire

You are being asked to complete an oral health survey. This is VOLUNTARY. You are not required to answer any questions and may stop at any time. Answer each question to the best of your ability. It is ok to state you do not know the answer. Information gathered is for the purpose of the practice improvement project and is not part of your health record. Thank you.

1. Does your child have teeth?
2. Has your child seen the dentist in the past year?
3. Does your child have his/her teeth brushed daily with toothpaste?
4. Has the child ever had cavities or fillings?
5. Has the mother/primary caregiver had active/untreated cavities in the past year?
6. What is the age of your child?
7. Does your child brush his/her own teeth or do you brush his or her teeth? How often?
8. How much toothpaste does your child use? Pea size amount or full brush length?
9. Does he/she swallow the toothpaste?
10. Do you floss your child's teeth? How often?
11. Does your child take fluoride drops, tablets or fluoridated toothpaste?
12. Has your child received fluoride treatments at a dental office?
13. Does your child use a pacifier or suck their thumb?
14. Was/is your child put to bed with a bottle?
15. Was/is your child allowed to carry a bottle or cup throughout the day containing something other than plain water?
16. Does your child chew gum with sugar in it?

Provider/Staff Questionnaire

You are being asked to complete an oral health survey. This is VOLUNTARY. You are not required to answer any questions and may stop at any time. Answer each question to the best of your ability. It is ok to state you do not know the answer. Information gathered is for the purpose of the practice improvement project. Thank you.

1. What is your likelihood to counsel your patient on oral health?
2. What is your likelihood to examine your patient's mouth?
3. What is your likelihood to refer your patient to a dentist while pregnant?
4. What is your attitude towards oral health versus overall health?

Provider Test

You are being asked to complete a pre and post-test at the beginning and end of the oral health care educational seminar. This is VOLUNTARY. You are not required to answer any questions and may stop at any time. Information gathered is for the purpose of the seminar evaluation. There is only one right answer for each question. Thank you.

Test ID: _____

1. What percentage of low-income children are affected by dental caries?
 - a) 15%
 - b) 50%
 - c) 25%
 - d) 45%
2. Diabetic patients would see what percentage improvement in glycemic control if their periodontal disease is treated?
 - a) 15-25%
 - b) 5-10%
 - c) 10-20%
 - d) 35-45%
3. What bacteria is a causative agent in gastritis and peptic ulcers found in dental plaque?
 - a) H. Pylori
 - b) Campylobacter jejuni
 - c) E. coli
 - d) Salmonella
4. Which of the following adverse pregnancy outcomes have been associated with periodontal disease?
 - a) Low Birth Weight
 - b) Microcephaly
 - c) Pre-term labor
 - d) A & C
5. The medical home is a great place to control chronic conditions that affect oral health, what agent has been shown to prevent tooth decay in children?
 - a) Xylitol gum
 - b) Fluoride varnish
 - c) Amoxicillin
 - d) B & C
6. What is Early Childhood Caries?
 - a) Dental decay in children from 2–10 years of age
 - b) An infectious, chronic disease
 - c) Deformities in a child's teeth that are caused by excessive fluoride
 - d) Dental decay caused by a lack of fluoride in a child's diet
7. Oral bacteria and dietary sugars are two of the three parts of the "Etiology Triad" of Early Childhood Caries. What is the third part of the triad?
 - a) The enamel and dentine of teeth, which is vulnerable to demineralization
 - b) Bacterial toxins, which attach to the teeth's calcium matrix
 - c) Saliva, which provides a moist environment for the cariogenic oral bacteria
 - d) Genetic predisposition to colonization by cariogenic oral bacteria

8. What is a risk factor for developing Early Childhood Caries?
 - a) High fat diet
 - b) A patient's age
 - c) Excessive levels of fluoride
 - d) Caries in siblings or caretakers
9. How can primary care clinicians prevent Early Childhood Caries?
 - a) Counsel a child's caregivers about the child's diet
 - b) Apply dental sealants to the teeth of young patients
 - c) Prescribe fluoride to every young patient
 - d) Refer children to a dentist at age five
10. What guidance about teething should a primary care clinician provide to a toddler's caregiver?
 - a) Teething can cause ear infections and diarrhea
 - b) The caregiver should bring the toddler to the office if the child starts to drool
 - c) Teething sometimes causes upper respiratory infections
 - d) A child who is teething may be fussy
11. Which of the following is a FALSE statement?
 - a) Gingivitis is very common in pregnancy
 - b) Periodontitis is associated with preterm birth
 - c) Treatment of periodontitis in pregnancy decreases the risk of preterm birth
 - d) Deep root scaling to improve periodontitis is safe during pregnancy
12. Which of the following is a TRUE statement:
 - a) Mothers with caries pass their genetic predisposition for caries on to their babies
 - b) Mothers with caries pass caries-causing bacteria to their babies in utero
 - c) Mothers with caries pass caries-causing bacteria to their infants via saliva transmission
 - d) All of the above
13. A pregnancy granuloma:
 - a) Has malignant potential and should be biopsied
 - b) Should be excised during pregnancy even if asymptomatic to avoid complications
 - c) Can be observed
 - d) Is not likely to recur if excised
14. A pregnant patient asks you for guidance about having dental treatment during her pregnancy. What would you say?
 - a) Dental treatment should only be done during the second and third trimester
 - b) Dental treatment should only be done during the third trimester because organogenesis is complete
 - c) Dental treatment should only be done during the second trimester for comfort and safety reasons
 - d) Dental treatment can be done during any trimester
15. What guidance should you give a pregnant patient about having dental x-rays during her pregnancy?
 - a) Dental x-rays should be avoided during pregnancy
 - b) Dental x-ray should be limited to only one film per pregnancy
 - c) Dental x-rays should be taken as necessary to reach a full diagnosis
 - d) Dental x-rays are rarely needed during pregnancy

16. What oral health guidance should you give a pregnant patient?
- a) Brush twice daily with fluoridated toothpaste
 - b) Use chlorhexidine mouthwash three times per day
 - c) Avoid sugary drinks and snacks between meals
 - d) Take fluoride dietary supplements
 - e) A and C only
17. All of the following conditions can cause worsening gingivitis EXCEPT:
- a) Onset of puberty
 - b) Monthly menses
 - c) Menopause
 - d) Use of oral contraceptives
18. If a pregnant woman has an oral abscess in the first trimester, what should she do regarding its treatment?
- a) Take antibiotics and pain medication only and wait until her second trimester to see the dentist
 - b) Avoid x-rays for further diagnosis
 - c) Have the tooth treated or extracted under local anesthesia immediately
 - d) Delay definitive treatment until after delivering her baby
19. Amalgam restorations placed during pregnancy can lead to which negative outcome in the fetus?
- a) Birth defects
 - b) Neurologic sequelae
 - c) Spontaneous abortions
 - d) None of the above
20. What could pregnant women do after vomiting to reduce the risk of enamel erosion?
- a) Swish with baking soda and water
 - b) Vigorously brush her teeth
 - c) Immediately take a dose of a proton pump inhibitor
 - d) Immediately take three to four antacid tablets

APPENDIX D

STATISTICAL ANALYSIS



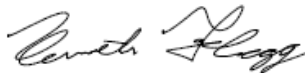
January 31, 2017

To Whom It May Concern:

Permission is hereby granted to Abrianna Johnson to include the report entitled *Oral Health in Pregnant Women and Parents* by Kenneth Flagg and Jordan Schupbach dated January 31 in its entirety as is as an exhibit for her scholarly project.

**Department of
Mathematical
Sciences**

- Mathematics
- Math Education
- Statistics


Kenneth Flagg

Lillian S. Lin, PhD
Director

2-214 Wilson Hall
P.O. Box 172400
Bozeman, MT, 59717-2400
www.math.montana.edu

Tel (406) 994-3601
Fax (406) 994-1789
math@math.montana.edu

Mountains & Minds

Statistical Consulting and Research Services

Montana State University

Statistical Consulting and Research Services

Oral Health in Pregnant Women and Parents

Lead Statistician:
Kenneth Flagg, M.S.

Director:
Lillian Lin, Ph.D.

Contributions from:
Jordan Schupbach, M.S.

This material is provided to communicate advice from SCRS statisticians based on our best understanding of your research needs. We encourage you to use this report in discussions with colleagues. Please do not publish any portion of this material without permission.

©Kenneth Flagg, M.S.

When you make use of our work for publications or presentations, please be sure to acknowledge the funding we receive from NIGMS using the following: Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number P20GM103474. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

prepared for Abrianna Johnson, BSN, RN

January 31, 2017

REFERENCES

- Achtari, M., Georgakopoulou, E., & Afentoulide, N. (2012). Dental Care Throughout Pregnancy- What a Dentist Must Know. *Oral health and dental management*, 11(4), 169-176.
- Alligood, M. R. (2013). *Nursing theorists and their work*. Elsevier Health Sciences.
- Altman D, Philips KE, Manning C. (2013). Engaged Leadership: Strategies for Guiding PCMH Transformation. In: Phillips KE, Weir V, eds. Safety Net Medical Home Initiative Implementation Guide Series. 2nd ed. Seattle, WA: Qualis Health and the MacColl Center for Health Care Innovation at the Group Health Research Institute.
- Alves, A. C., Nogueira, R. D., Stipp, R. N., Pampolini, F., Moraes, A. B., Goncalves, R. B., . . . Mattos-Graner, R. O. (2009). Prospective study of potential sources of Streptococcus mutans transmission in nursery school children. *J Med Microbiol*, 58(Pt 4), 476-481. doi: 10.1099/jmm.0.005777-0
- American Academy of Family Physicians. (2016). Primary Care. Retrieved from <http://www.aafp.org/about/policies/all/primary-care.html>
- American Academy of Pediatric Dentistry. (2014). *Guideline on infant oral health care*. American Academy of Pediatric Dentistry Reference Manual.
- American Academy of Pediatric Directors. (2011) *Best practice approaches for state and community oral health programs*.
- American Congress of Obstetricians and Gynecologists, (2006). *Guidelines for oral health care in pregnancy*.
- American Dental Association. (2016). Statement on Early Childhood Caries. (Internet). Retrieved from <http://www.ada.org/en/about-the-ada/ada-positions-policies-and-statements/statement-on-early-childhood-carries>
- American Dental Association. (2016b). New Study Shows Dental Treatment during Pregnancy is Safe. (Internet). Retrieved from <http://www.ada.org/en/press-room/news-releases/2015-archive/august/new-study-shows-dental-treatment-during-pregnancy-is-safe>
- American Dental Association. (2016c). Pregnancy and Teeth. (Internet). Retrieved from <http://www.mouthhealthy.org/en/pregnancy/>
- Bogges, K., & Edelstein, B. (2006). Oral Health in Women during Preconception and Pregnancy: Implications for Birth Outcomes and Infant Oral Health. *Maternal and Child Health Journal*, 10(5), 169-174. Doi: 10.1007/s10995-006-0095-x

- Boggess, K., Uriaub, D., Moss, M., Polinkovsky, M., El-Khorazaty, J., & Lorenz, C. (2011). Knowledge and beliefs regarding oral health among pregnant women. *Journal of American Dental Association*, 142(11), 1275-1282.
- Bronfenbrenner, U. (1994). Ecological Models of Human Development. *International Encyclopedia of Education*, 3 (2), 37-43.
- Bronfenbrenner, U. & Ceci, S.J., (1994). Nature–nurturer conceptualized in developmental perspective: a bioecological model. *Psychological Review*, 101(4), 568–586.
- Bronfenbrenner, U. & Morris, P. A., (2007). The bioecological model of human development. In W. Damon and R. M. Lerner (eds), *Handbook of Child Psychology* 6th Edition, Vol. 1. (New Jersey, Hoboken, NJ: Wiley), pp. 793–828.
- Brown A. (2008). Access to oral health care during the perinatal period: A policy brief. National Maternal and Child Oral Health Resource Center (Internet). Retrieved from: <http://www.mchoralhealth.org/PDFs/PerinatalBrief.pdf>
- Brown, C., Wickline, M., Ecoff, L, and Glaser, D. (2009). Nursing practice, knowledge, attitudes and perceived barriers to evidence-based practice at an academic medical center. *Journal of Advanced Nursing*, 65(2), 371-381.
- California Dental Association, *Oral health during pregnancy and early childhood*. 2010
- Camacho, E., Perez, L., Perez, A., & Zepeda, A. (2009). Relationship between Severe Early Childhood Caries, Mother’s Oral Health and Mutans Streptococci in a Low-Income Group: Changes from 1996 to 2007. *Journal of Clinical Pediatric Dentistry*, 33(3), 241-246
- Carletto-Korber, F., Gonzalez-Ittig, R., Jimenez, M. & Cornejo, L. (2010). Initial acquisition and genetic identity of *Streptococcus mutans* of mother-child Pairs. *Pediatric Dentistry*, 32(3), 206-211.
- Chaffee, B. W., Gansky, S. A., Weintraub, J. A., Featherstone, J. D., & Ramos-Gomez, F. J. (2014). Maternal oral bacterial levels predict early childhood caries development. *J Dent Res*, 93(3), 238-244. doi: 10.1177/0022034513517713
- Cibulka, N., Forney, S., Goodwin, K., Lazaroff, P., & Sarabia, R. (2011). Improving oral health in low-income pregnant women with a nurse practitioner-directed oral care program. *Journal of the American Academy of Nurse Practitioners*, 23, 249-257.
- Cunningham, B. J., & Rosenbaum, P. L. (2015). A Bioecological framework to evaluate communicative participation outcomes for preschoolers receiving speech-

language therapy interventions in Ontario, Canada. *International Journal of Language & Communication Disorders*, 50(4), 405-415. doi:10.1111/1460-6984.12145

Current Nursing (2012). *Jean Watson's philosophy of nursing. Nursing theories: A companion to nursing theories and models*. Retrieved from currentnursing.com/nursingtheory/Watson.html

da Silva Bastos Vde, A., Freitas-Fernandes, L. B., Fidalgo, T. K., Martins, C., Mattos, C. T., de Souza, I. P., & Maia, L. C. (2015). Mother-to-child transmission of *Streptococcus mutans*: a systematic review and meta-analysis. *J Dent*, 43(2), 181-191. doi: 10.1016/j.jdent.2014.12.001

Douglass, J., Li, Y., & Tinanoff, N. (2008). Association of Mutans Streptococci Between Caregivers and Their Children. *Pediatric Dentistry*, 30(5), 375-387.

Duff, George, A., M., Johnson, M., & Dahlen, H. (2014). Piloting of an oral health education programme and knowledge test for midwives. *Contemporary Nurse*, 46(2), 180-186.

Flagg, K., Lin, L., & Schupbach, J. (2017). Oral Health in Pregnant Women and Parents. 1-22

Gauvain, M., & Cole, M. (2000). *Readings on the development of children*. 2004 (2nd ed., Vol. 3): p 3-8

George, A., Shamim, S., Johnson, M., Dahlen, H., Ajwani, S., Bhole, S., & Yeo, A. E. (2012). How Do Dental and Prenatal Care Practitioners Perceive Dental Care During Pregnancy? Current Evidence and Implications. *Birth: Issues in Perinatal Care*, 39(3), 238-247.

Giglio, J., Lanni, S., Laskin, D., & Giglio, N. (2013). Oral Health Care for the Pregnant Patient. *Dental Assistant*, 82(6), 38-47.

Goldie, M. (2003). Oral health care for pregnant and postpartum women. *International Journal of Dental Hygiene*, 1(3), 174-176.

Grant JS, Roberts MW, Brown WD, & Quinoñez RB. (2007). Integrating dental screening and fluoride varnish application into a pediatric residency outpatient program: clinical and financial implications. *J Clin Pediatr Dent*. Spring; 31(3):175-8.

Hallas, D., et al., (2015) *OHEP: an oral health education program for mothers of newborns*. *J Pediatric Health Car*. 29(2).

- Health, N.Y.S.D. (2006). *Oral health care during pregnancy and early childhood practice guidelines* New York state department of health.
- Huck, O., Tenenbaum, H., & Davideau, J. (2011). Relationship between Periodontal Diseases and Preterm Birth: Recent Epidemiological and Biological Data. *Journal of Pregnancy*, 2011, 1-8
- Hummel, J. (2016). Oral Health an Essential Component of Primary Care Implementation Guide. 1-115.
- Hwang, S., Smith, V., McCormick, M., & Barfield, W. (2011). The Association between Maternal Oral Health Experiences and Risk of Preterm Birth in 10 States, Pregnancy Risk Assessment Monitoring System, 2004–2006. *Maternal and Child Health Journal*, 16, 1688-1695.
- Hwang, S.S., et al. (2011). *Racial/ethnic disparities in maternal oral health experiences in 10 states, pregnancy risk assessment monitoring system, 2004-2006*. *Maternal and Child Health Journal*. 15(6): p. 722-729.
- Jiang et al. (2013). A randomized controlled trial of preconception treatment for periodontal disease to improve periodontal status during pregnancy and birth outcomes. *BMC Pregnancy and Childbirth*. 13(228), 1-7.
- Johnson, J. K., Barach, P., Cravero, J. P., Blike, G. T., Godfrey, M. M., Batalden, P. B., & Nelson, E. C. (2007). Improving patient safety. In E. C. Nelson, P. B. Batalden, & M. M. Godfrey (Eds.), *Quality by design: A clinical microsystems approach* (pp. 165-177). San Francisco, CA: Jossey-Bass
- Katre, A., & Damle, SG. (2013). Comparison of mutans streptococcal strains of father, mother, and child in indian families using chromosomal DNA fingerprinting. *The Journal of Contemporary Dental Practice*, 14(5), 911-916.
- Kloetzel, M. K., Huebner, C. E., & Milgrom, P. (2011). Referrals for dental care during pregnancy. *Journal of Midwifery & Women's Health*, 56(2), 110–117.
- Krisdapong, S., Somkotra, T., & Kueakulpipat, W. (2014). *Disparities in Early Childhood Caries and Its Impact on Oral Health–Related Quality of Life of Preschool Children*. *Asia Pac J Public Health*. 26(3): p. 285-294
- Kumar J, Samelson R. (2009). Oral health care during pregnancy recommendations for oral health professionals. *N Y State Dent J*. 75(6):29-33.

- Lachat, M. F., Solnik, A. L., Nana, A. D., & Citron, T. L. (2011). Periodontal disease in pregnancy: Review of the evidence and prevention strategies. *The Journal of Perinatal & Neonatal Nursing*, 25(4), 312–319.
- Lachman, V.D. (2013). *Applying the Ethics of Care to Your Nursing Practice*. MedSrug Nursing Journal, 2012 21(2): p. 112-116
- Leong, P. M., Gussy, M. G., Barrow, S. Y., de Silva-Sanigorski, A., & Waters, E. (2013). A systematic review of risk factors during first year of life for early childhood caries. *Int J Paediatr Dent*, 23(4), 235-250. doi: 10.1111/j.1365-263X.2012.01260.x
- Li, Y., Caufield, P., Dasanayake, H., & Vermund, S. (2005). Mode of Delivery and Other Maternal Factors Influence the Acquisition of Streptococcus mutans in Infants. *Journal of Dental Research*, 84(9), 806-811.
- Lieff, S., Boggess, K.A., Murtha, A.P., Jared, H., Madianos, P.N., . . . Moss K. (2004). The oral conditions and pregnancy study: periodontal status of a cohort of pregnant women. *J Periodontol*. 75:116–26.
- Lynch, D. J., Villhauer, A. L., Warren, J. J., Marshall, T. A., Dawson, D. V., Blanchette, D. R., . . . Drake, D. R. (2015). Genotypic characterization of initial acquisition of Streptococcus mutans in American Indian children. *J Oral Microbiol*, 7, 27182. doi: 10.3402/jom.v7.27182
- Mahat, G., Lyons, R., & Bowne, F. (2014). Early childhood caries and the role of the pediatric nurse practitioner. *Journal for Nurse Practitioners*, 10(3), 189-193.
- McKenzie JF, Neiger BL, & Thackeray R. (2009). Planning, Implementing, & Evaluating. Health Promotion Programs. (5th Ed.). San Francisco: Pearson Education, In
- Michalowicz, B.S., Hodges, J.S., & Diangelis, A.J. (2006) Treatment of periodontal disease and the risk of preterm birth. *NEnglJMed*.; 355:1885-1894.
- Mitchel, S. e. a. (2009). Maternal Transmission of Mutans Streptococci in Severe-Early Childhood Caries. *Pediatric Dentistry*, 31(3), 193-201.
- Morgan, M. A., Crall, J., Goldenberg, R. L., & Schulkin, J. (2009). Oral health during pregnancy. *The Journal of Maternal-Fetal & Neonatal Medicine*, 22(9), 733-739. doi: 10.1080/14767050902926954
- Nathe, C. (2016). Oral health in primary care. *Rdh*, 36(5), 50-80.

- National Interprofessional Initiative on Oral Health, (2016). Clinicians for Oral Health. Retrieved from <http://www.niioh.org>
- Nelson, E., Batalden, P., & Godfrey, M. (2007). Specific aim. In E. Nelson, P. Batalden, M. Godfrey (Eds.), *Quality by design* (pp.308-312). San Francisco, CA: Jossey-Bass
- Offenbacher, S., & Beck, J. (2009). Effects of Periodontal Therapy on Rate of Preterm Delivery: A Randomized Controlled Trial. *Obstetrics & Gynecology*, 114(3), 551-559.
- Office of Disease Prevention and Health Promotion. (2014). Oral Health. Retrieved from <https://www.healthypeople.gov/2020/topics-objectives/topic/oral-health>
- Ortiz, Fernanda Ruffo, Tomazoni, Fernanda, Oliveira, Marta Dutra Machado, Piovesan, Chaiana, Mendes, Fausto, & Ardenghi, Thiago M. (2014). Toothache, Associated Factors, and Its Impact on Oral Health-Related Quality of Life (OHRQoL) in Preschool Children. *Brazilian Dental Journal*, 25(6), 546-553.
- Ping, N. K., & Ling, N. C. (2012). The Effects of Practice Size on Quality of Care in Primary Care Settings: A Systematic Review. *JBIM Database of Systematic Reviews and Implementation Reports*, 10(27), 1549-1633. Doi:10.11124/01938924-201210270-00001
- Plonka, K.A., et al. (2013). *A longitudinal case-control study of caries development from birth to 36 months*. *Caries Res.* 47(2): p. 117-127
- Qualis Health, (2016b). Qualis Health Published Comprehensive Guide for Implementing Oral Health Integration. Retrieved from <http://www.qualisheath.org/about-us/newsroom/press-releases>
- Qualis Health. (2015). Oral Health: An Essential Component of Primary Care. 1-67.
- Rainchuso, L. (2013, December). Improving Oral Health Outcomes from Pregnancy through Infancy. *He Journal of Dental Hygiene*, 87(6), 330-335.
- Ramos-Gomez, F. J. & Shepard, D.S. Cost-effectiveness model for prevention of early childhood caries. *Journal of the California Dental Association.*, 1999, Vol.27(7), p.539-544
- Siegler, R., Deloache, J., & Eisenberg, N. (2006). *How children develop*. (2nd Ed.). New York: Catherine Woods.

- Slade GD, Rozier RG, Zeldin LP & Margolis PA. (2007). Training pediatric health care providers in prevention of dental decay: results from a randomized controlled trial. *BMC Health Services Research*. 7 (176).
- Smiles for Life, (2016). Smiles for Life: A National Oral Health Curriculum. Retrieved from <http://www.smilesforlifeoralhealth.org>
- Srinivas, S., & Parry, S. (2012). Periodontal Disease and Pregnancy Outcomes: Time to Move On? *Journal of Women's Health*, 21(2), 121-125.
- Task Force on Periodontal Treatment of Pregnant Women, American Academy of Periodontology. (2004). American Academy of Periodontology statement regarding periodontal management of the pregnant patient. *J Periodontol*. 75(3):495.
- Teanpaisan, R., Chaethong, W., Piwat, S., & Thitasomakul, S. (2012). Vertical Transmission of Mutans Streptococci and Lactobacillus in Thai Families. *Pediatric Dentistry*, 34(2), 24-29
- The American Academy of Pediatric Dentistry, Council on Clinical Affairs. (2011). Guideline on perinatal oral health care. American Academy of Pediatric Dentistry. (Internet). Retrieved from: http://www.aapd.org/media/Policies_Guidelines/G_PerinatalOralHealthCare.pdf
- Twetman, S. (2008). Prevention of early childhood caries (ECC)--review of literature published 1998-2007. *European Archives of Paediatric Dentistry*, 9(1), 12-15.
- U.S. Department of Health and Human Services. (2003). A National Call to Action to Promote Oral Health. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and the National Institutes of Health, National Institute of Dental and Craniofacial Research. NIH Publication No. 035303.
- Vamos, C., Walsh, M., Thompson, E., Daley, E., Detman, L., & DeBate, R. (2015). Oral-Systemic Health during Pregnancy: Exploring Prenatal and Oral Health Providers' Information, Motivation and Behavioral Skills. *Maternal & Child Health Journal*, 19(6), 1263-1275. Doi:10.1007/s10995-014-1632-7
- Wagner, A. I. (2010). *Core concepts of Jean Watson's theory of human caring/caring science*. Watson Caring Science Institute.
- Wan, A.K.L., Seow, W.K., Purdie, D.M., Bird, P.S., Walsh, L.J., & Tudehope, D.I. (2003). A longitudinal study of *Streptococcus Mutans* colonization in infants after tooth eruption. *Journal of Dental Research*. 82(7).

- Watson, J. (2001). *Jean Watson: Theory of human caring*. In M.E. Parker (Ed.), *Nursing theories and nursing practice* (pp. 343-354). Philadelphia, PA: Davis
- Wilder, R., Robinson, C., Jared, H., Lieff, S., & Boggess, K. (2006). Obstetricians' knowledge and practice behaviors concerning periodontal health and preterm delivery and low birth weight. *The Journal of Dental Hygiene*, 81(4).
- Zanata, R., Fernandes, K., & Navarro, P. (2008). *Prenatal dental care: evaluation of professional knowledge of obstetricians and dentists of Londrina/Paraná, Brazil, 2004*. *Journal of Applied Oral Science*. 16(3): p194-200