

Spring 2020

## **Oral care during pregnancy: an educational intervention**

Holly Redwine

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Oral Care During Pregnancy: An Educational Intervention

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Masters of Science

in

Dental Hygiene

in the

College of Graduate Studies

Eastern Washington University

by

Holly Redwine RDH, BSDH

Spring 2020

Major Professor:

Sarah Jackson, RDH, MSDH

THESIS OF Holly Redwine APPROVED BY

*Sarah Jackson* DATE 04-30-2020  
Sarah Jackson RDH, MSDH GRADUATE STUDY COMMITTEE

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## Human Subjects Approvals



# EASTERN WASHINGTON UNIVERSITY

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start something **big**

TO: Holly Redwine, Department of Dental Hygiene  
FROM: Ruth A. Galm, Human Protections Administrator <sup>RG</sup>  
DATE: December 11, 2019  
SUBJECT: Preventive Dental Care for the Pregnant Patient: An Educational Intervention (HS-5846)

Human subjects protocol HS-5846 entitled "Preventive Dental Care for the Pregnant Patient: An Educational Intervention" has been approved as an exemption from federal regulations under 45 CFR Part 46.104(d)(1-8).

A signed and approved copy of your application is attached.

Student research qualifying for an exempt IRB review is valid through Spring Semester. If subsequent to initial approval, the research protocol requires minor changes, the Office of Grant and Research Development should be notified of those changes. Any major departure from the original proposal must be reviewed through a Change of Protocol application submitted to the IRB before the protocol may be altered. Please refer to HS-5846 on future correspondence as appropriate as we file everything under this number.

Cc: HS-5846 file  
Prof. Sarah Jackson, RPI  
Prof. Lisa Bilich, Dept. Chair  
Graduate Office

Primary IRB approval 📎 1 ▾ +

**Jennifer Baker** <[jbaker@westernu.edu](mailto:jbaker@westernu.edu)> 👍 ↶ ↷ → ...

Tue 1/28/2020 11:38 AM

Redwine, Holly; Rodney Hicks <[rhicks@westernu.edu](mailto:rhicks@westernu.edu)> + 1 other ▾

Good morning Holly,

Thank you for reaching out. Western University of Health Sciences IRB policy for IRB approved research utilizing our student population for subject recruitment requires a letter from the Dean of each College at Western University of Health Sciences in which you choose to recruit, granting you permission to do so. Given that you are not affiliated with Western University of Health Sciences, as student, staff or faculty, this permission letter (along with your approval from IRB of record) is all that is required.

Warm regards,  
Jenn

**Jennifer Baker (Kurtz)**  
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...



College of Health Sciences

February 3, 2020

I have been informed and approve that Holly Redwine is working on her research project, "Preventive Dental Care for the Pregnant Patient: An Education Intervention".

She will be providing a 90-minute lecture to the first-year PA students enrolled at Western University of Health Sciences and in the process will be giving a pre lecture survey, immediate post lecture survey, and a 3-week post lecture survey. The purpose of the surveys are to gather information for Holly Redwine's research project. I am aware that Holly Redwine has IRB approval from Eastern Washington University (EWU).

Sincerely,

A handwritten signature in black ink, appearing to read "Denise Schilling". The signature is fluid and cursive, with a large initial "D".

Denise Schilling, PhD, PT, FNAAP  
Interim Dean, College of Health Professions



January 22, 2020

Roy A. Guizado, MS, PA-C  
Chair, Associate Professor  
PA Education

To whom it may concern,

I am writing this letter at the request of Holly Redwine to confirm that we are working with her as she commences her research project, "Preventive Dental Care for the Pregnant Patient: An Educational Intervention"

I am aware that she will be providing a 90-minute lecture, lunch, and an Amazon gift card raffle to the Physician Assistant (PA) students enrolled at Western University of Health Sciences. Holly Redwine will have approval to do such procedures as long as she has IRB approval to do so from Eastern Washington University (EWU). I have reviewed the IRB approval from EWU (see below) and give permission for EWU to be the primary IRB during this research.

I also confirm that students here at Western University of Health Sciences will not intervene with subjects by performing procedures or providing advice on pre and posttest surveys. Holly Redwine will be the only personnel to execute study procedures.

Holly Redwine's research will be a valuable contribution and we will be happy to support this endeavor.

Sincerely,

Roy Guizado, MS, PA-C, DFAAPA  
Chair, Department

### Abstract

**Purpose:** Interprofessional collaboration can help prevent adverse pregnancy outcomes related to poor oral health. This study was conducted to see if an educational module provided by a dental hygienist (DH) could increase the knowledge and confidence of physician assistant (PA) students with preventive oral care for the pregnant patient.

**Methods:** A one group mixed-method approach was used in this research. Pregnancy and oral health knowledge were assessed using a 9-item pretest and posttest survey. Participants completed the pretest, were presented an educational module, and were asked to complete an immediate posttest. A second posttest was sent via e-mail to the participants three weeks after the educational module concluded. Pretest and first posttest answers were compared for statistical significance. The first posttest and second posttest were compared for participants' knowledge retention.

**Results:** A total of ( $N=54$ ) participants were included in the research study. The mean posttest score was statistically significantly higher than the mean pretest score ( $p < 0.001$ ). The results from the pretest and first posttest show a statistically significant increase in knowledge. There was also a slight increase from 4.16 ( $SD= 0.51$ ) to 4.22 ( $SD=0.47$ ) in mean scores from the first posttest to the second posttest indicating knowledge retention.

**Conclusion:** A pregnancy and oral health care educational module is an effective method to increase knowledge and confidence for PA students.



### **Acknowledgements**

I would like to thank my thesis committee for their knowledge, support, and guidance throughout this journey. First, thank you Sarah Jackson for your ultimate support and encouragement during my thesis process. Sarah, your passion and positive attitude always lifted me up during this journey, you are truly a mentor for how I hope to be with my students one day. To Ann O’Kelley Wetmore and Lucretia Berg, I am forever grateful for your expertise in your respected fields and will always cherish the advice and guidance from both of you. Thank you to Boyd Foster for your help with my statistics and always being kind during the process.

To Ryan, my amazing husband! You are the ultimate rock of our family, always supporting me during each of my dental hygiene programs. I could not have done any of this without your encouragement and for being the incredible father that you are to our kids. Thank you for your love and patience.

Last but not least, to my parents, I was able to finish this journey due to the countless weekends you were there to help me with Kennedy and Kameron so that I could study, write, and implement my research. I cannot thank you enough for the support I have always had from both of you during this time and always.

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## **Introduction/Literature Review**

### **Introduction to the Research Question**

Expecting a child can be the most exciting time in a woman's life. Pregnant women are encouraged to live a healthy lifestyle, eat a nutritious diet, limit caffeine intake, take prenatal vitamins, and exercise. Studies have identified there are adverse effects of drinking alcohol and smoking tobacco on the fetus during pregnancy. Oral health is also an important aspect to consider when thinking about a healthy pregnancy. A dental check-up along with smoking cessation education and supplementation of folate should be provided to women planning pregnancy (Moore & Blair, 2017). Hormonal and physiological shifts during pregnancy can cause changes to the oral cavity (Moore & Blair, 2017). According to the American College of Obstetrics and Gynecologists (ACOG), these changes include: benign oral gingival lesions, pregnancy gingivitis, tooth mobility, dental caries, periodontitis, and tooth erosion (Women's Health Care Physicians, 2017). Before, or during the first trimester is an optimal time for a woman's physician to screen for oral diseases, provide the patient with oral hygiene instructions, and encourage a visit to their general dentist. Moore and Blair (2017) state, screening for periodontal disease (PD) should be encouraged before conception to prevent oral complications during pregnancy. Screening for oral diseases when planning to conceive or during the first trimester, can help prevent the development of pregnancy related oral conditions during this important time for mother and baby.

### **Statement of Problem**

Hormonal changes during pregnancy can affect the oral cavity in a negative way. Women experiencing nausea and vomiting can be at risk for acid erosion of tooth enamel. Pregnancy hormones can cause swelling of the gingiva that may lead to pregnancy gingivitis or progression of existing periodontal conditions (Jain & Kaur, 2015). Early screening of an expectant mother's oral condition along with a subsequent visit to her general dentist may help lessen the need for therapeutic dental treatment. One potential barrier to preventive care for expectant mothers is the lack of referrals for women to visit their general dentist even before trying to conceive (Lee, Milgrom, Huebner & Conrad, 2010). Obstetricians, general practitioners, physician assistants (PA), nurses, and midwives may not feel comfortable performing intraoral exams on their patients. Dental hygienists (DH) may help educate medical professionals on performing an effective intraoral exam to screen for oral diseases in the early stages of pregnancy or when trying to conceive (Schramm, et al., 2016). Though many women receive care from an obstetrician, physician assistants may also provide physical exams, contraceptive prescriptions, and care during pregnancy.

According to The American Academy of Physician Assistants (AAPA), a PA is a medical professional that can practice in every state and in every medical setting including specialties (AAPA, 2019). Physician assistant education and practice emphasizes preventive care and treating the "whole patient." Physician assistants are able to diagnose illness, manage treatment plans, and prescribe medications. A PA has the ability to practice in every medical setting including hospitals, medical clinics, community health centers, retail clinics, workplace facilities, and correctional institutions

(AAPA, 2019). According to the Bureau of Labor Statistics, employment for PAs “is projected to grow 31% from 2018 to 2028, much faster than the average for all occupations” (Job Outlook section, para. 1). Physician assistants can provide many of the same services as physicians and serve as a patient’s primary health care provider (United States Department of Labor, 2019). According to the AAPA, PAs in obstetrics and gynecology are valuable members of the healthcare team. Physician assistants are licensed to evaluate and manage gynecological conditions and provide contraception education, prenatal care, childbirth, and postnatal care (AAPA, 2019). Due to the rapid growth of the PA profession and its focus on preventive care, PAs are an ideal candidate for implementing an educational module on oral health and pregnancy.

The purpose of this study is to explore the use of an educational module presented by a DH to PA students. The study was completed to answer the following questions:

- Will an educational module affect the knowledge and confidence level of PA students when speaking with pregnant patients and patients of child-bearing age about their oral health?
- Will an educational module affect PA students knowledge and comfortability performing an intraoral exam on pregnant patients?
- Will an educational module affect PA students awareness of adverse pregnancy outcomes related to poor oral health?

### **Overview of Research**

Preventive dental care during preconception or the first trimester can help to avoid many oral health complications for the expectant mother. The medical and dental community have the opportunity to achieve optimal care for expectant mothers by



providing collaborative care. When interviewing prenatal and dental providers ( $N=22$ ), Vamos et al. (2015) found these prenatal providers were not aware of any guidelines focusing on oral health during pregnancy. Dental professionals, including DH, can educate the medical providers in recognizing oral health conditions in their pregnant patients. Dental referrals given to expectant mothers during the first trimester may direct them to access the care they need to promote good oral health during pregnancy. Interprofessional programs with DH and obstetric health care providers may lead to more referrals for pregnant women for preventive dental services.

**Stages of Pregnancy.** Pregnancy begins two weeks after the first day of the last menstrual period. Pregnancy lasts approximately 40 weeks and is grouped into three trimesters. Each trimester lasts between 12-13 weeks (ACOG, 2020).

**First trimester.** The first trimester of pregnancy begins after fertilization until week 13. During this embryonic stage, most important development of the fetus is completed. Rapidly dividing cells during this time should not be exposed to any possible mutation chemicals such as medications. The concern for teratogenesis during this trimester needs to be a consideration for dental providers administering drugs (Lee & Shin, 2017). Ideally, drug administration should be avoided during this trimester, providing emergency dental procedures with the use of local anesthetic may outweigh the risk versus benefit for the patient (Ouanounou & Haas, 2016). Elective dental treatment should be postponed until after the first trimester (Lee & Shin, 2017).

**Second trimester.** The second trimester begins at 14 weeks and continues until 27 weeks. The literature suggests the risk of teratogenic effects is lowered during this trimester. Elective dental treatment may be performed during this time with precautions

including using an abdominal shield during radiographs and careful selection of local anesthetic agents. Dental providers must also take into consideration the risk of hypotension in the supine position for pregnant patients (Lee & Shin, 2017).

***Third trimester.*** The third trimester begins at week 28 and continues until delivery at approximately 40 weeks' gestation. Elective dental treatment during this time is considered safe with the consideration of the uterus being enlarged the patient is likely to experience "aortocaval compression in the supine position" (Lee & Shin, 2017, p. 87). Careful treatment planning and patient positioning should be taken into account while performing dental treatment in the third trimester. A pillow or blanket can be placed under the patient's back to support the lateral position to prevent aortocaval compression. Prudent treatment planning should be implemented for dental treatment performed including, but not limited to, dental prophylaxis or treatment for PD.

**Periodontal Disease.** Periodontal disease is one of the most common inflammatory diseases in adults affecting 3.9 billion people worldwide in 2010 (Bui et al., 2019). Periodontal disease (also known as periodontitis), is an inclusive term and describes any disease of the gingival tissue and surrounding teeth (Perry & Beemsterboer, 2007). The American Academy of Periodontology (2019) suggests PD can range from mild to aggressive and can be acute or chronic. The mildest form of PD is gingivitis. Gingivitis is often a result of poor oral hygiene. Harmful bacteria found in plaque biofilms cause an inflammatory response in the gingiva. Symptoms of gingivitis include; redness, swelling, and gums that may bleed easily. Gingivitis is reversible with professional treatment and good home care. Unlike gingivitis, PD is the result of connective tissue attachment loss; deepening of the space between the gingival margin,

and the gingival attachment to the bone referred to as a periodontal pocket; and an inflammatory response that includes bone loss, gingival recession and abscess formation if left untreated (Perry & Beemsterboer, 2007). The formation of PD is the result of plaque biofilm that leads to the destruction of the surrounding periodontal tissues. Treatment for mild to moderate forms of PD is performed by a dentist or DH by removing the harmful bacteria from the tooth structure and debridement of the periodontal pocket. Progression of the disease from moderate to severe is classified based upon bone loss and attachment loss and may require surgical procedures as complete biofilm removal becomes more difficult (Perry & Beemsterboer, 2007).

*Periodontal disease and pregnancy.* The ACOG reports 40% of pregnant women have some form of PD, moreover, PD in pregnant women is more common in African Americans, cigarette smokers, and women with low socioeconomic status (ACOG, 2013). The presence of periodontal bacteria may cause an immune response beyond the oral cavity indicating a relationship with systemic conditions (see Figure 1). Literature suggests an association between PD and systemic diseases including; cardiovascular disease, diabetes, Alzheimer's disease, gastrointestinal and colorectal cancer, and adverse pregnancy outcomes (Bui et al., 2019). Controlling the oral microbiome and treatment of periodontal infections can significantly reduce the risk of oral systemic conditions.

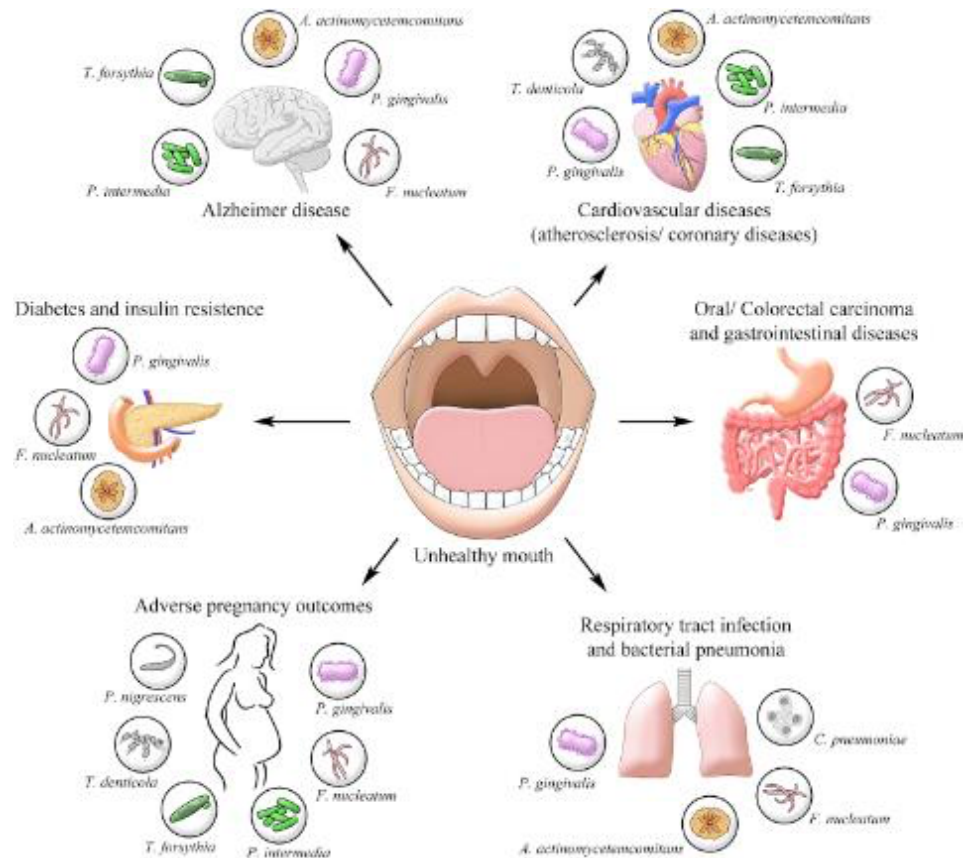


Figure 1. Oral systemic link with related pathogenic bacteria

Several studies examined the connection between oral health and pregnancy outcomes (Bui et al., 2019; Cobb et al., 2017; Meqa, Dragidella, Disha, & Dalipi, 2017; Moore & Blair, 2017; Vamos, et al., 2015). According to Cobb et al. (2017), current evidence suggests an association between the microbiome, PD, and systemic conditions. Adverse pregnancy outcomes on the fetus have also been linked to PD and oral infections as Cobb et al. (2017) stated, “chronic periodontitis is a highly prevalent dysbiosis-initiated, inflammatory condition that results in destruction of the supporting tissues of the teeth” (p. 552).

In a meta-analysis comparing periodontal health and implications associated with conception and adverse pregnancy outcomes, Moore & Blair (2017) found that on average, conception for women with PD took two months longer than women without the

disease. According to Jiang et al. (2013) treating PD during the pre-conception period is optimal for fetal and maternal health.

Adverse pregnancy outcomes including early pregnancy loss may be avoided by intervention before conception (Jiang et al., 2013). An ongoing randomized controlled trial of pre-conception treatment for PD is the first study of its kind. A sample of women ( $N=470$ ) planning to conceive within one year who have PD were recruited for the study. In this ongoing study, all participants will be randomly selected for the intervention group and receive scaling and root planning along with oral hygiene instructions or the controlled group who will not receive scaling and root planning intervention (Jiang, et al., 2013). This study aims to develop a preconception model for oral health care to improve both oral health for the mother and child. If the study is effective, the researchers state they will seek further funding and a larger sample size with hope in developing a standard of care for both medical and dental professionals (Jiang et al., 2013). Developing a standard of care for women of child-bearing age has potential to allow for better interprofessional communication, such as dental referrals.

Literature shows there is significant evidence that gram-negative virulent bacteria are associated with PD and adverse pregnancy outcomes (Meqa, Dragidella, Disha, & Dalipi, 2016). In a study conducted by Meqa et al. (2016) data was collected from nursing mothers ( $N=200$ ) who had given birth at the University Clinical Center of Kosovo's Obstetrics and Gynecology Clinic. The study found a correlation between periodontal conditions and preterm birth (PTB) or low birth weight (LBW). The study was conducted using periodontal evaluations and plaque index scores of the mothers by using natural light, a dental mirror, and periodontal probe. Obstetric data was obtained for

all mothers including due date, gestational age, and birth weight. Meqa et al. (2016) found an association between mothers with PD who gave birth to pre-term and (LBW) babies and illustrates “the subjects who gave birth to low-weighted babies had significantly higher dental plaque index ( $p=0.03$ ) as well as deeper periodontal pockets ( $p=0.028$ )” (p. 56). Women in the group with PD had babies with weight significantly lower ( $p= 0.0003$ ) than the mothers in the group PD (Meqa et al., 2016).

Limited evidence was available to suggest that treatment of PD during pregnancy reduces adverse pregnancy outcomes including PTB and LBW (Iheozor-Ejiofor, Middleton, Esposito & Glenn, 2017; Michalowicz et al., 2008; Schwendicke, Karimbux, Allareddy, & Gludd, 2015). According to Jiang et al. (2013) evidence of improved adverse pregnancy outcomes by treating PD during pregnancy have been inconsistent. Several studies have failed to prove periodontal therapy during pregnancy reduces the risk of adverse pregnancy outcomes (Jiang, et al., 2013; Offenbacher, et al., 2009). A controlled clinical trial of pregnant women with PD ( $N=1,760$ ) were randomly selected to receive scaling and root planing either during their early second trimester or after delivery. The objective of the study was to test the effects of receiving treatment of PD and the outcome of PTB, delivery before 37 weeks gestation. The results indicated no significant difference in the control group ( $n=902$ ) and the group that received treatment ( $n=903$ ). The PTB rate for the treatment group was 13.1% and the control group was 11.5% ( $p=.316$ ). These results indicated the treatment of PD does not influence PTB outcomes. The research does suggest the possibility that PD does increase the risk for adverse pregnancy outcomes, however, treatment of PD during pregnancy may not reduce the risk (Offenbacher et al., 2009).

***Pre-term birth and low birth weight.*** According to Latorre Uriza et al. (2018) PTB is the second leading cause of death in children under the age of five, with pneumonia being the leading cause. Current evidence of PTB is found from infections ascending from the vagina or cervix (Latorre Uriza, et al., 2018). According to the literature (Jiang, et al., 2013; Latorre Uriza et al., 2018; Meqa, Dragidella, Disha, & Dalipi, 2016; Offenbacher, et al., 2009) virulence factors associated with specific oral bacteria may spread from the periodontium into the bloodstream causing extraoral inflammation and infection. These specific oral bacteria may also be related to the adverse results seen in pregnancy and the “associations among periodontal disease, periodontopathogenic bacteria, systemic inflammatory mediators, and adverse pregnancy outcomes” (Latorre Uriza et al., 2018, p. 1). Maternal periodontal infections may represent a non-genital source of entry into the circulation system for microorganisms with the potential to influence the fetal-maternal health (Latorre Uriza et al., 2018). A pilot case-control study was conducted to analyze specific cytokines and inflammatory mediators in pregnant patients with PD who were at risk for PTB. The study consisted of ( $N=46$ ) patients, ( $n=23$  cases and  $n=23$  controls) who were past 20 weeks gestation (Latorre Uriza et al., 2018). Blood samples were taken from the patients to test for inflammatory markers and full periodontal evaluations were completed using a North Carolina probe and diagnosis based on the 1999 Armitage periodontal classification system (Latorre Uriza et al., 2018). The periodontal diagnosis for the 46 patients were as follows: 4.3% ( $n=2$ ) were healthy, 45.7% ( $n=21$ ) had gingivitis, and 50% ( $n=23$ ), had chronic PD. Two groups were formed with 23 patients at risk for PTB and 23 patients who were not at risk (Latorre Uriza et al., 2018). The study found that as the severity of

PD increased, so did the levels of cytokines and inflammatory markers. Additionally, the levels of cytokines were higher in patients at high risk for PTB (Latorre Uriza et al., 2018). The limitations of the study included being unable to determine if the patient's baseline inflammatory markers were an absolute risk for PTB as most of the at-risk patients did carry to full term. The research calls for further investigation into researching actual PTB and maternal inflammatory markers (Latorre Uriza et al., 2018). The outcome indicated an increase in treatment of PD may decrease the chance of PTB although according to the literature (Iheozor-Ejiofor, Middleton, Esposito, & Glennly, 2017; Michalowicz et al., 2008) there is little evidence that suggests treatment of PD during pregnancy reduces the chance of PTB.

***Gestational diabetes.*** Gestational diabetes mellitus (GDM) is a glucose intolerance developed during pregnancy that can cause serious complications for the mother and fetus (Abariga & Whitcomb, 2016). The literature suggests, GDM affects approximately 7% of all pregnancies and can lead to poor maternal and fetal health if left untreated (Abariga & Whitcomb, 2016; Kalra, Tangade, Punia, Gupta, Sharma & Jain, 2016; Yao, Xu, Zhu & Wang, 2019). Women who have been diagnosed with GDM during pregnancy are more susceptible to preeclampsia; high blood pressure and high levels of protein in the urine, stillbirth; fetal death after 20 weeks gestation, cesarean delivery; surgical delivery of baby, macrosomia; significantly larger than average baby at birth, PTB; delivery before 37 weeks gestation, and neonatal hypoglycemia; low plasma glucose levels at birth ( Kalra, et al., 2016). A systematic review and meta-analysis of observational studies by Abariga and Whitcomb (2016) identified 44 articles relating PD with GDM. Quality of the studies were assessed using the Newcastle Ottawa Scale



resulting in six case-control studies, three cross-sectional studies and one cohort study. Results from the meta-analysis demonstrated an association between PD and the development of GDM (Abariga & Whitcomb, 2016). A non-randomized comparative study conducted by Yao, Xu, Zhu, and Wang (2019) aimed to examine the association between GDM and the imbalance in the oral microbial during the second trimester of pregnancy. During the study women in their second trimester ( $N=331$ ) underwent testing for GDM. Of the 331, 19.6% ( $n=65$ ) of the women were diagnosed with GDM (Yao et al., 2019). The study examined one eligible tooth for each participant and completion of the gingival index (GI), plaque index (PI), tooth mobility degree (TMD), probing depth (PD), and bleeding on probing (BOP) were observed. Subgingival plaque was collected from the gingival sulcus using a sterile stainless-steel ring (Yao, et al., 2019). The oral health conditions were compared in pregnant women with and without GDM. According to the results “the GI, PI, TMD, PD and BOP of pregnant women with GDM were higher or more severe than those of nondiabetic pregnant women ( $p=0.05$ )” (Yao et al., 2019, p. 4). Moreover, the study found the differences in rates of oral bacteria in the two groups. Women with GDM had fewer oral streptococci ( $p=.000$ ) and lactobacilli ( $p=.000$ ) while the total of oral anaerobic bacteria ( $p=.000$ ) in pregnant women with GDM were higher than women without GDM. These findings suggest that elevated blood glucose in pregnant women with GDM may lead to changes in the oral microbiome balance (Yao, et al., 2019). These changes in the oral microbiome may lead to development of PD and the growth of periodontal pathogens. Pregnant women with GDM should be more aware of the risk of developing PD that can lead to pregnancy and fetal complications (Yao, et al.,

2019). Although this sample is not large enough for generalization and did not include randomization the results suggest further research.

***Preeclampsia.*** Preeclampsia is a pregnancy complication indicated by high blood pressure and possible damage to other organ systems including the liver and the kidneys (Khoram, Loripoor, Pirhadi & Beigi, 2019). Another complication of pregnancy is hemolysis, elevated liver enzymes and a low platelet count or HELLP syndrome. Severe preeclampsia/HELLP syndrome may cause maternal organ failure, inflammation, vascular disease, and PTB (Khoram et al., 2019).

Boggess, Berggren, Koskenoja, Urlaub, and Lorenz (2013) suggest an association between maternal self-report of PD where participants reported prior diagnosis of PD or periodontal treatment and preeclampsia which is the leading cause of pregnancy related deaths in developed countries. Boggess et al. (2013) conducted a written survey of patients of the University of North Carolina (UNC) Women's Clinic Ultrasound Unit ( $N=599$ ). Participants were asked to complete a questionnaire regarding their oral health symptoms and problems including bleeding gums, sore gums, missing teeth, and poor oral hygiene practices (Boggess et al., 2013). Medical records from the study were obtained and bivariate analysis was performed between the questionnaire and medical history. The study aimed to test the association between maternal/medical data and oral health problems such as; dental series utilization, oral hygiene practice, severe preeclampsia, hemolysis, elevated liver enzymes, and low platelet count (HELLP) syndrome (Boggess et al., 2013,). Of the 599 women ( $N=599$ ), the majority ( $n=470$ ) delivered at UNC Women's Hospital, while the remainder of the group ( $n=129$ ) delivered elsewhere. Out of the 470 participants, 7% ( $n=35$ ) reported smoking during their

pregnancy, 9% ( $n=42$ ) reported a history of chronic hypertension, 59% ( $n=278$ ) had carried prior pregnancies further than 20 weeks, and of those, 8% ( $n=22$ ) had a history of preeclampsia. The study found, 26% ( $n=121$ ) of the women had reported bleeding around their gums prior to pregnancy while a significant increase, 43% ( $n=203$ ), reported bleeding of their gums after becoming pregnant ( $p<.001$ ) and 10% ( $n=46$ ) of the participants developed a hypertensive condition during pregnancy (Boggess, et al., 2013). Results of this study show a significant association for women who reported a history of prior gum disease and severe preeclampsia/HELLP syndrome while oral hygiene practices and dental service utilization during pregnancy were not associated with preeclampsia/HELLP. Boggess et al. (2013) suggest the significant relationship between maternal PD during pregnancy and preeclampsia could be associated with inflammation including the presence of harmful periodontal pathogens.

**Gingival Diseases.** Changes in the gingiva and surrounding periodontal tissues related to pregnancy are well documented. The gingiva is the visible component of the periodontium and ranges in color from coral pink, pink or pale pink (Perry & Beemsterboer, 2007). The gingiva and oral mucosa are distinguished at the mucogingival junction. This junction indicates the change from the free unattached gingiva to the attached gingiva which is firmly attached to the bone (see Figure 2).

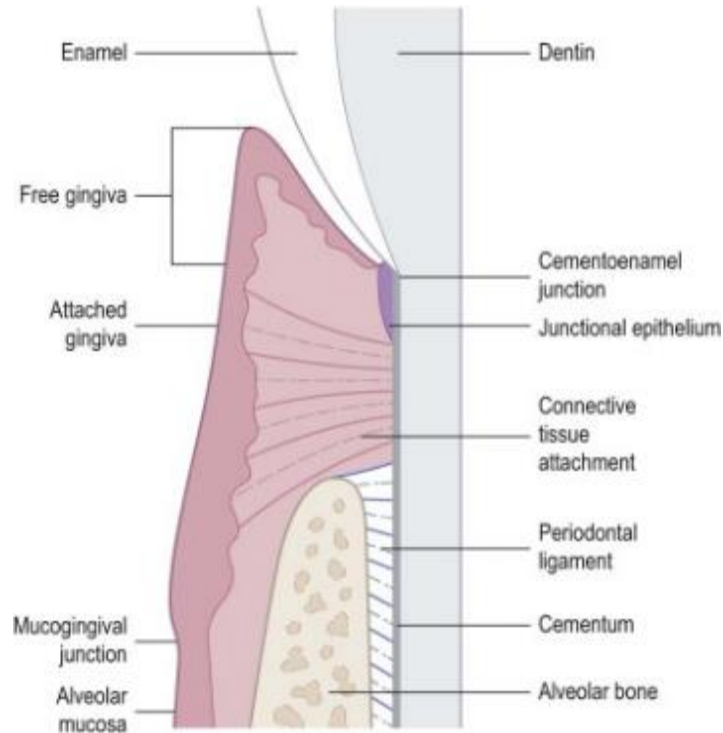


Figure 2. Diagram showing anatomy of the gingiva

**Pregnancy gingivitis.** According to Wu et al. (2016) gingival inflammation (gingivitis) is a well-known association with pregnancy. Pregnancy gingivitis is initiated by the harmful bacteria found in dental plaque and intensified by pregnancy related hormones. Literature shows the increase in female sex hormones during pregnancy may change the immune response for inflammatory cytokines and play a major role in periodontal conditions (Cobb et al., 2017; Jain & Kaur, 2015; Wu, et al., 2016).

Wu et al. (2016) also noted that good oral hygiene during pregnancy can help reduce the incidence of pregnancy gingivitis. A study of periodontally healthy women ( $N=30$ ) were evaluated during their first, second, and third trimesters of pregnancy and a control group of periodontally healthy non-pregnant women ( $n=20$ ) were evaluated twice during the trial. This study included probing pocket depth (PPD), gingival index (GI), bleeding index (BI), plaque index (PLI), and clinical attachment loss (CAL). Gingival

crevicular fluid (GCF) was collected to check for levels of interleukin-1B (IL-1B), tumor necrosis factor- (TNF-), and serum levels of progesterone and estradiol (Wu et al., 2016). The study found even with low PLI, the BI and GI scores of the pregnant women increased significantly ( $F=19.76, p<0.05$ ;  $F=19.98, p<0.001$ ). The results showed no significant difference in PLI in the pregnant group compared to the nonpregnant group ( $F=0.64, p=0.6373$ ) which indicated all subjects remained with good oral hygiene. Serum estradiol and progesterone levels increased gradually during pregnancy indicating a positive correlation between gingival inflammation (GI and BI) and estradiol levels during pregnancy ( $r=0.695, p<0.0001$ ;  $r=0.683, p<0.0001$ ). No changes were observed in the GCF IL-1B and TNF- levels during pregnancy. Results of this study show a positive correlation between gingival inflammation, estradiol, and progesterone serum levels during pregnancy (Wu et al., 2016).

**Oral lesions.** According to Jain and Kaur (2015) major hormonal and physiological changes occur during pregnancy. These physiological changes can also change the salivary pH in the oral cavity with a decrease in pH levels causing the saliva to become more acidic. These physiological changes of saliva during pregnancy may contribute to an increase in oral conditions including oral lesions throughout pregnancy (Jain & Kaur, 2015). A study of pregnant women ( $N=120$ ) whose ages ranged between 18 and 35 years were divided into three groups of 40 women, according to their pregnancy trimester. Oral lesions were evaluated and correlated with pH changes in each group (Jain & Kaur, 2015). A control group of non-pregnant women ( $n=40$ ) with the same ranges of age, were also enrolled in the study. All participants' periodontal health was recorded using the following indices: decayed missing or filled teeth (DMFT),

gingival index (GI), simplified oral hygiene index (OHI-S), and community periodontal index (CPI) (Jain & Kaur, 2015). Participants were examined clinically for oral hygiene, dental caries, gingival health, periodontal health, and the presence of oral and or gingival mucosal lesions (Jain & Kaur, 2015). Saliva samples were taken from each participant at least one hour after breakfast and the pH of each sample was determined within 30 minutes of collection (Jain & Kaur, 2015). Results of oral lesions progressed from control group through the third trimester while respectively pH levels progressively became more acidic from the control group through the third trimester group (Jain & Kaur, 2015). “Chi-square comparison of the differences in oral mucosal lesion prevalence among the different trimester groups found significant differences ( $p=0.034$ ) between the first and second trimester groups, and between the first and third” (Jain & Kaur, 2015, p 54). The study showed a statistically significant difference between all study groups ( $N=120$ ) with the exception of the control group ( $n=40$ ) and first trimester ( $n=40$ ). An increase in dental caries were seen toward the last months of pregnancy along with a higher incidence of *streptococcus mutans* and *lactobacillus* levels. A decrease in oral hygiene practice during pregnancy was also observed in later months of pregnancy which could correlate with the increase in caries causing bacteria loads (Jain & Kaur, 2015). The study found mucosal lesions in 44.2% of the pregnant women ( $n=53$ ) with a higher incidence of lesions in the pregnant women than non-pregnant women ( $n=40$ ) (Jain & Kaur, 2015). A higher prevalence of oral lesions 52.5% ( $n=42$ ) was seen in the second and third trimester participants as compared to the first trimester group 27.5% ( $n=11$ ). The number of women with one oral lesion was highest in the second trimester 47.5% ( $n=19$ ) compared to the first trimester 25.0% ( $n=10$ ) and third trimester 35.0% ( $n=14$ ). Fissured tongue was

the most common oral lesion found in the first and second trimester groups, along with gingival and mucosal enlargements and melanosis, a gingival change in pigmentation. Fissured tongue could be accompanied by nutrition deficiencies that are especially common in the first trimester (Jain & Kaur, 2015). Gingival and mucosal lesions could be related to physiological changes during pregnancy along with the decrease in oral hygiene as pregnancy progresses (Jain & Kaur, 2015). A decrease in oral hygiene, accompanied by physiological and nutrition changes may also put a pregnant woman at risk for developing carious lesions.

**Caries.** A systematic review and meta-analysis of dental caries and PTB risk was conducted by Wagle et al. (2017) included 9 studies involving ( $N=4826$ ) pregnancies. Five of the nine studies explored the potential risk of PTB in women who had caries in comparison to women who did not have carious lesions. Results from each of the five articles found carious lesions do not affect the risk of delivering before 37 weeks gestation. The systematic review showed dental caries in pregnant women did not increase their risk of PTB. Furthermore, the mean DMFT scores showed no difference between participants who experienced PTB and those who did not. The meta-analysis explains the importance for all health professionals to promote good oral hygiene practice during pregnancy through patient education even though a relationship between PTB and dental caries was not found. Wagle et al. (2017) suggests pregnant women are susceptible to dental related problems and should be educated regarding the risk of transmitting cariogenic flora to the infant during feeding practices. Increase in caries causing bacteria along with systemic factors such as gingival inflammation and acid production can be seen throughout the three trimesters of pregnancy. Before and during the first trimester of

pregnancy, fetal-maternal providers and dental providers should work together to achieve preventive care for the pregnant patient. There is no clear evidence suggesting caries are related to pregnancy related complications, however, health care professionals should promote good oral hygiene practices due to susceptibility of dental related problems in pregnant patients (Kamate et al., 2019; Popovici et al., 2018; Wagle et al., 2017)

According to Popovici et al., (2018) early detection of dental caries for a pregnant patient is an important opportunity to provide the least invasive treatment possible, and create beneficial effects for the patient's oral and systemic health while pregnant.

Popovici et al. (2018) explain the risks of dentin hypersensitivity which can occur shortly after conception. The pregnant woman may experience dentin hypersensitivity in the first trimester of pregnancy when hormone influences may increase nausea, resulting in vomiting and accompanied with consumption of acidic foods (Popovici et al., 2018). Dentin hypersensitivity may cause discomfort which may lead to less brushing, further plaque accumulation, and the possibility of caries formation. The opportunity for obstetricians and dental professionals to work together during the first trimester is crucial for caries prevention and early intervention (Popovici et al., 2018).

There is an increase in the formation of *Streptococcus mutans* during the second and third trimesters of pregnancy (Kamate et al., 2019). A randomly controlled study evaluated ( $N=50$ ) primigravida, first time pregnant women, using salivary analysis and socioeconomic status (Kamate et al., 2019). A salivary *Streptococcus mutans* count was conducted during each trimester of pregnancy and the postpartum period. Caries risk was determined using DMFT indices as well as a questionnaire regarding the socioeconomic status of the participants (Kamate et al., 2019). Scores were obtained using the World



Health Organization (WHO) criteria where carious lesions were recorded during examination. Saliva samples were collected for all participants four separate times during their pregnancy at weeks 6, 18, 30, and 6 weeks postpartum (Kamate et al., 2019). A control group of non-pregnant women ( $n=50$ ) was enrolled and evaluated during month five of the study. Results from the study showed “a significant increase in *streptococcus mutans* colonies during the second and third trimester as well as the postpartum period of pregnancy when compared to the control group ( $p<0.01$ )” (Kamate et al., 2019, p. 5). Additionally, there was an increase in risk of developing carious lesions during pregnancy compared to non-pregnant women. Socioeconomic status did not have any influence on the risk development of carious lesions for all participants (Kamate et al., 2019). These findings emphasize the need for an early establishment for dental care for all pregnant women and an increase in the awareness of oral hygiene practices for all stages of pregnancy (Kamate et al., 2019).

**Oral Health Intervention for the Pregnant Patient.** Conception and pregnancy are opportune times to educate women about their health and their baby’s health. Multiple medical appointments are recommended for monitoring health of the mother and the health of her fetus providing timely instruction on self and infant care. According to the ACOG (2017), the first prenatal visit is an important time to screen for oral health conditions and suggest a routine dental visit. In a postpartum survey published by ACOG (2017), data from the Centers for Disease Control and Prevention (CDC) Pregnancy Risk Assessment Monitoring System (PRAMS) in 10 states, ( $N=35, 267$ ) 56% of mothers did not have dental care and 60% did not receive dental prophylaxis during their most recent pregnancy. This data is supported by the findings of Vamos et al. (2014). In an

exploratory study both dental and medical professionals ( $N=22$ ) were interviewed regarding their knowledge and practice of oral health practices during pregnancy. Results demonstrate dental and medical professionals were aware of the adverse pregnancy outcomes of poor oral health, however, the dental providers had more knowledge and proficiency in discussing the oral-systemic link during pregnancy (Vamos et al., 2014). Moreover, Vamos et al. (2014) stated, prenatal providers were less likely to educate or even assess patients on oral health issues while dental providers completed oral health assessments and were likely to communicate with prenatal providers when treatment was deemed medically necessary. Participants stated, although they had some education on the importance of oral health during pregnancy, almost every participant reported a desire for more information. The participants agreed poor oral health during pregnancy is a problem, yet they had a limited understanding of specific procedures, potential complications, and prevention of oral diseases. (Vamos et al., 2015). Many findings in the literature ask for more guidelines regarding dental treatment during pregnancy including dental radiographs, local anesthetic, and treatment options.

Sharif, Saddki, and Yusoff (2015) conducted a cross-sectional study survey of nurses ( $N=152$ ) in Malaysia across thirty health care clinics. All nurses from the clinics were invited to participate in the study regarding prenatal health care services they provided (Sharif et al., 2015). The survey questionnaire included questions regarding PD and risk factors associated with pregnancy outcomes. The nurses were assessed on their attitude and education regarding the variables. A response rate of ( $n=133$ , 87.5%) was received. Almost all of the nurses who responded (99.3%) agreed oral health should be

included in health examinations and they should be trained on how to identify oral health diseases (Sharif et al., 2015).

Uniform guidelines for oral health care for prenatal patients are needed. A quantitative study using citation ties between eight medical and dental journals determined the collaboration between oral health care providers and prenatal providers (Skvoretz et al., 2016). Results from the study confirm a limited scholarly communication between the dental and medical groups may hinder research-based information for medical professionals to use in their practices (Skvoretz et al., 2016). Thus, both the medical and dental professions may benefit from uniform guidelines and recommendations for pregnant patients regarding their oral and dental health.

**Dental Procedures for the Pregnant Patient.** Routine dental procedures including dental prophylaxis are safe, effective, and important during pregnancy. Dental providers should understand the physiological changes of the female body while pregnant. These physiological changes affect multiple organs and must not be confused with pathological changes (Ouanounou & Haas, 2016). Normal physiological changes during pregnancy include; increased cardiac output, decreased gastric emptying and intestinal motility, decreased respiratory capacity, increased renal blood flow, glomerular filtration, and increased blood volume (Ouanounou & Haas, 2016). Understanding these physiological changes can help dental professionals administer drugs and treat pregnant patients safely. A pregnant patient should not have to suffer from dental related pain (Lee & Shin, 2017, Michalowicz et al., 2008; Ouanounou & Haas, 2016). The dental provider must take into consideration the risk versus benefit ratio when treating a pregnant patient. As stated by Ouanounou and Hass (2016), leaving dental related pain untreated, such as

an apical abscess, can cause harm to the pregnant patient due to the potential for chronic stress and systemic infection. Effects of local anesthetics for dental treatment during pregnancy must be carefully considered and dosages monitored for toxicity (Lee & Shin, 2017). Concern for teratogenic effects on the fetus during drug administration is an important consideration. Local anesthetics are frequently used in dentistry to aid in pain management. Safety of certain local anesthetic usage is supported in the literature for pregnant patients receiving needed dental treatment (Ouanounou & Haas, 2016). Local anesthetics administered with epinephrine are considered safe during pregnancy. The use of epinephrine in local anesthesia can minimize the systemic uptake and decrease the risk of toxicity for the patient and fetus (Ouanounou & Haas, 2016). The use of local anesthetics, although safe, can be avoided during pregnancy by reducing the incidence of oral disease by improving maternal, infant and child oral health through preventive measures (Thompson et al. 2012).

In 2007, dentists living in the state of Oregon ( $N=729$ ) were surveyed regarding treating patients while pregnant. This research utilized a Likert scale questionnaire with 54 multi-level items related to the knowledge of the practitioners for treating pregnancy patients based on the CDC and New York State Guidelines that encourage dentists to perform dental services including emergencies and periodontal treatment during pregnancy (Lee, Milgrom, Huebner & Conrad, 2010). Study results showed a “high level of incorrect knowledge about routine and emergency procedures” (Lee et al., 2010, p. 6). The questionnaire was organized into providing treatment during each trimester and in the case of an emergency. The results indicated 69.2% ( $n=535$ ) would not perform scaling and root planing procedures during an emergency such as a periodontal abscess.

Respectively, 22% ( $n=165$ ) of the participants responded they would not provide periodontal therapy during the second trimester (Lee et al., 2010). “The mean of indices of incorrect knowledge for routine services during pregnancy was 44.2 ( $SD=6.1$ , range=30-54) where higher scores indicated incorrect knowledge” (Lee et al., 2010, p. 6). These results suggest an educational program to overcome the limitations with the current system regarding dental treatment for women of child-bearing age or who may be currently pregnant. Furthermore, different types of interventions may be needed to fit the patient population. A successful pilot program in Klamath County, Oregon worked with pregnant women and their young children to increase dental care utilization. In the program, a DH and case manager were hired to work with the women and dental offices to gain access to care. Physicians were also included in the program to refer their pregnant patients for dental care. The results from this program increased dental care utilization from 8.8% to 56% (Lee et al., 2010).

An analysis of data from 2004-2008 postpartum surveys conducted by the Maryland Department of Health and Mental Hygiene (n.d.) with the CDC questioned women after delivery ( $N=6,171$ ) whether they were counseled about dental care during their pregnancy. Multiple factors were analyzed in the study including race, age, access to insurance, and educational level. During this study, Thompson et al. (2013), found teeth cleanings are strongly influenced by enabling factors including health insurance and prenatal care during pregnancy. The increase of oral health promotion needs to be made on the state and national levels to improve women’s health by removing barriers. Access to dental care during pregnancy would benefit not only the woman but also the infant’s health after delivery (Thompson et al., 2013).

*Non-surgical periodontal therapy during pregnancy.* Nonsurgical periodontal therapies (NSPT) for PD requires a DH or dentist to remove plaque and calculus by using mechanical equipment and hand instrumentation as well as oral hygiene instructions and counseling on how to prevent dental plaque and calculus accumulation (Iheozor-Ejiofor et al., 2017). A randomized controlled study of pregnant women with PD ( $N=823$ ) were selected to receive scaling and root planing and/or essential dental treatment (EDT). These women were between 13 to 21 weeks gestation or up to three months post-partum. Researchers found 26% of the women sampled for this study were advised by a health care professional to seek dental care (Michalowicz et al., 2008). All participants in this study were diagnosed with PD. Out of the 823 participants, a group of women ( $n=413$ ) was randomly selected to receive scaling and root planing before 21 weeks gestation while the remaining ( $n=410$ ) were monitored in a control group and received scaling and root planing after delivery (Michalowicz et al., 2008). All participants received baseline comprehensive periodontal examinations and monthly visits. The treatment group received oral hygiene instructions and tooth polishing while the control group received brief examinations only (Michalowicz et al., 2008). Complete data collection was obtained from this study including adverse pregnancy outcomes from both groups. Findings suggested the distribution of serious adverse pregnancy outcomes including stillbirth, PTB, and congenital anomalies did not differentiate significantly between the control and treatment group ( $p>.05$ ). The study also demonstrated no significant difference in adverse outcomes in women who received complete EDT, partial EDT or who did not require EDT (Michalowicz et al., 2008). A 2016 systematic review investigated randomized controlled trials ( $N=15$ ) focused on the effects of NSPT in the

prevention or reduction of perinatal and maternal morbidity and mortality (Iheozor-Ejiofor et al., 2017). The 15 studies included a total of 7,611 ( $N=7161$ ) participants, 11 studies compared NSPT with no treatment during pregnancy and the meta-analysis shows no difference in PTB (RR 0.87, 95% CI 0.70 to 1.10; 5671 participants; 11 studies; low-quality evidence). Moreover, four of the studies compared NSPT with alternative periodontal treatment and “data pooling was not possible due to clinical heterogeneity” very low-quality evidence was seen for both PTB and LBW perinatal mortality with different periodontal treatments (Iheozor-Ejiofor et al., 2017). A meta- and trial sequential analysis investigated randomized clinical trials ( $N=13$ ) evaluating pregnant women ( $n=6283$ ). Results of the meta-analysis showed no significance of NSPT on pregnant patients and adverse pregnancy outcomes such as LBW, PTB, and perinatal mortality. Meta-analysis did not find a significant effect of NSPT and PTB in trials with moderate occurrence of PTB (<20%) moreover, in populations with high occurrence of PTB (>20%) NSPT seemed to significantly decrease the risk for PTB although firm evidence of NSPT and PTB outcome was not reached. The meta-analysis calls for future randomized clinical trials with limited bias in populations of high risk for PTB. The author suggests the treatment of NSPT during pregnancy should be for the impact of PD itself including possible harmful effects to the mouth and body (Schwendicke, 2015).

**Barriers to dental care for the pregnant patient.** Several barriers to dental care during pregnancy have been identified in the literature (Bahramian, Mohebbi, Khami, & Quinonez, 2018; Le, Riedy, Weinstein, & Milgrom, 2009). A 2018 qualitative study using a triangulation approach collected data from pregnant women ( $n=22$ ), midwives ( $n=8$ ), and dentists( $n=12$ ) regarding the lack of dental service use during pregnancy in

Tehran, Iran. The data showed the use of dental services by pregnant women is relatively low even in developed countries (Bahramian, et al., 2018). The study found the most common reported barriers for dental care were cost, insurance, lack of perceived need, time constraints, and concerns of fetal safety (Bahramian et al., 2018). As noted by Bahramian et al. (2018) “85% of midwives and 60% of dentists expressed they had not taken continuing education courses regarding prenatal oral health” (p. 3). The most common barriers among the pregnant patients included lack of knowledge, cost, misbelief, and fear of dental treatment during pregnancy. The dentists were fearful of being blamed if a miscarriage were to happen to the patient after dental treatment (Bahramian et al., 2018).

A 2006 qualitative study conducted in Klamath County, Oregon aimed to understand why low-income pregnant women did or did not utilize dental care provided to them in a pilot program to promote dental care (Le et al., 2009). Women enrolled in Medicaid were identified. Of those eligible, ( $N=339$ ; 80.5%) received care, and 235 ( $n=235$ , 69.3%) received home visits, 60 of the women who received care were contacted via telephone interview and 51 participants were given “semi-structured telephone interviews” (Le et al., 2009). Two types of barriers were identified; stress and issues related to dental care. Stress was identified as internal to the individual including physical and emotional issues, as well as financial constraints or relationship problems (Le et al., 2009). Dental related issues included negative dental experiences from the individual’s past, and long wait times at the dental office, transportation, and childcare constraints (Le et al., 2009). Of note, all of the mothers who were interviewed made positive comments about the value of oral health (Le et al., 2009).



There is a low referral rate from prenatal care providers to dental providers for pregnant patients (Bahramian, et al., 2018; Lee, et al., 2010; Michalowicz, et al., 2008). Qualitative research completed by Bahramian et al. (2018) reported due to a busy work schedule and time constraints, midwives often fail to refer patients for dental care. Furthermore, oral examinations are not a priority (Bahramian et al., 2018). In a 2008 study examining the safety of dental treatment in pregnant women ( $N=823$ ), only 26% of the women were advised to seek dental care by their prenatal care providers (Michalowicz, et al., 2008).

**Utilizing Dental Hygienists.** Prevention of oral disease during pregnancy is the best way to provide optimal health care for both mother and fetus. Moore and Blair (2017) stated,

Ensuring that preventative measures are in place [during pregnancy] can reduce the possibility of pregnancy gingivitis...special care should be taken to thoroughly remove bacterial plaque between teeth, using floss and interdental brushes. This should be formally reviewed by the dentist or DH to ensure optimal cleaning techniques are used with the correct cleaning aids. (p. 290, para. 6)

An anonymous electronic survey was administered to all Michigan Dental Hygiene Association (MDHA) members ( $N=1,047$ ). Members of the MDHA were surveyed with items regarding their knowledge and attitudes relating to treating women during pregnancy. The response rate was 14.4% ( $n=150$ ) and indicated a high level of knowledge about the topic regarding the best time to treat a pregnant patient. Results showed a disagreement rate of 85.6% ( $n=129$ ) when asked if pregnant patients should only be treated during the second trimester. Respondents agreed there was an association between poor dental care

and adverse pregnancy outcomes 95.9% ( $n=144$ ) and obstetric complications associated with poor oral health 91.6% ( $n=138$ ). Schramm et al. (2016) found 90% ( $n=135$ ) of the respondents reported they are willing to provide dental hygiene care for pregnant women and 85% ( $n=128$ ) stated their employers accepted referrals to treat pregnant women.

A community-based intervention program was implemented in Klamath County, Oregon to provide a dental home for women who were pregnant and also receiving Medicaid (Milgrom et al., 2008). Milgrom et al. (2008) identified pregnant women on Medicaid ( $N=503$ ), of the total pregnant women identified, ( $n=421$ ) were contactable, and ( $n=235$ ) women received care ( $235/421$ , 55.8%). The goal of this program was to place focus on treating the mother with dental services to prevent disease in the child (Milgrom, et al., 2008). All initial care was provided to the women at the Oregon Institute of Technology Dental Hygiene Clinic. The program provided preventive as well as diagnostic services to the women and the DH communicated with the woman's treating physician during treatment. Once initial dental hygiene care was completed, the patient's chart was assigned a dental office where restorative, periodontal, and oral surgical services were rendered. The mothers were then followed after pregnancy and provided xylitol chewing gum at Women, Infants, and Children (WIC) programs for six months (Milgrom et al., 2008). Xylitol chewing gum can lead to less dental plaque and a lower incidence of caries (Cocco et al., 2017). This study is ongoing and continuing to monitor the children's oral health of the mothers who delivered during this intervention. Data suggests the mothers exceeded the usual rate for utilization of dental services by five-to-six-fold and exceeded the 48% rate of all pregnant women utilizing dental services in the state of Oregon regardless of their income level (Milgrom et al., 2008). Positive outcomes

of this study included the training of dentists, DH, and physicians in preventive oral care for mother and child, as well as an outreach and case management for serving pregnant women with access to Medicaid (Milgrom et al., 2008). Literature findings suggest, DH are in a position to practice guidelines and use current findings to provide preventive care for pregnant patients (Schramm et al., 2016). The role of the DH is crucial in interprofessional collaboration with the medical community to provide preventive and therapeutic dental treatment to patients who are expecting or of child-bearing age.

**Oral health education in the medical curriculum.** There is a need for increasing oral health screenings in the medical setting, and providing patients with dental referrals (Haber et al., 2015; Lord, 2015). According to Haber et al. (2015) improving oral health is a leading population health goal according to the Surgeon General's Report, *Oral Health in America* released in 2000. The report called for medical professionals to align with dental professionals and "view the mouth as a window to the body" (Haber et al., 2015, p. 437). Haber et al. (2015) stated the biggest initiative to surface after the report was the alignment of pediatric physicians working to prevent oral health disparities in children by providing screenings, placing fluoride varnish, and finding children dental homes with referrals. Since the 2000 report, approximately 70% of medical schools include four hours or less in their curriculum on oral health education, 10% have no oral health content. Moreover, PA programs typically follow a medical school curriculum and do not have oral health education requirements (Haber et al., 2015). A case study conducted by New York University (NYU) College of Nursing along with the NYU College of Dentistry introduced a change in the traditional HEENT (head, ears, eyes, nose, and throat) examination performed by medical professionals to a

HEENOT examination including “O” for oral cavity. The HEENOT program was used by more than 150 medical professional faculty including nurse practitioners (NP), medical doctors (MD), nurse-midwives (NM) and PA between 2011 and 2014. The oral cavity examination adds a focus on oral health screenings from medical professionals to examine teeth, gums, mucosa, tongue, and palate. Data collected from the oral-systemic health simulations and case study experiences revealed ( $N=330$ ) NP, MD, NM, and DDS students demonstrated competency for oral systemic health treatment planning and assessment (Haber et al., 2015). Furthermore, evidence suggests interprofessional collaboration was seen with more than 1000 referrals to NYU dental clinics.

Since 2008 there has been improvement in oral health education in PA programs (Lord, 2015). Jacques et al. (2010) found out of ( $N=83$ ) PA programs only 32.8% ( $n=27$ ) provided oral health education to their students. Shortly after the research conducted by Jacques et al. (2010), the major PA organizations came together to create a strategy to educate PA students about the oral-systemic connection and contribute to the improvement of oral health in the United States (Lord, 2015). Following this initiative, PA educators partnered with stakeholders across dentistry, nursing, pharmacy, medicine, and the workforce community to help impact the public health issue. During a 2014 national survey of PA program directors, 78.4% ( $n=125$ ) indicated they had significantly updated their curriculum to include oral health topics (Lord, 2015). According to Haber, et al. (2015) integrating interprofessional education (IPE) competencies in medical and dental programs will help contribute to the Healthy People 2020 goals for improving oral health. Interprofessional education between dental and medical professionals is still a need in the medical curriculum. A cross-sectional study consisting of two 8-item surveys

were sent to dental and Obstetrics/Gynecology (OBGYN) programs in the United States regarding prenatal oral health (POH) education provided in their programs. Response rate from the dental school programs was ( $n=31$ ) and OBGYN programs was ( $n=97$ ). Results indicated almost every dental school (93.6%) reported providing at least one hour of POH while most schools (61.3%) providing three or more hours. Conversely, a majority of the OBGYN programs (61.9%) reported providing no POH education. The OBGYN programs who did provide POH education 32% provided one to two hours, 6.2% provided three to four hours, and none provided more than four hours of POH education in their curriculum (Curtis, Silk, & Savageau, 2013). Efforts from both dental and OBGYN programs to work interprofessionally can help raise awareness and the importance of incorporating POH in the OBGYN curriculum. Curtis, Silk and Savageau (2013) suggest dental schools and residency programs working synergistically to increase oral health education for medical and dental learners including promoting national consensus on pregnancy oral health guidelines.

### **Summary**

Pregnancy is a crucial time for increased risk for oral health complications for both the mother and child (Vamos et al., 2015). Hormonal changes in a woman's body during pregnancy can exasperate oral health complications such as caries, tooth erosion, PD, and oral lesions. Currently, there is little evidence that shows treating oral infections such as PD during pregnancy lessens the outcomes of PTB and LBW (Iheozar-Ejiofor et al., 2017). Although routine dental procedures are safe, effective, and important during pregnancy, the optimal time for providing therapeutic and preventive dental services is during the pre-conception stage (Jiang et al., 2013). Although there has been little

evidence of preventing PTB and LBW with periodontal treatment during pregnancy, expectant mothers are more likely to suffer from inflammatory responses due to hormonal changes and therefore preventive care is essential for creating a healthy mouth that will benefit both mother and baby (Moore & Blair, 2017). Existing research shows a lack of knowledge between medical professionals and dental providers on current guidelines for treating a patient during pregnancy. Current medical curriculum, specifically PA programs, are lacking specific guidelines for oral health education (Lord, 2015). Physician assistants are expected to be a growing role in providing healthcare services and are able to specialize in all aspects of healthcare, including women's health (United States Department of Labor, 2019). Therefore, a comprehensive educational program on oral changes during pregnancy, potential adverse pregnancy outcomes, oral health education, and providing a dental referral has potential to educate PA students on the importance of pregnancy and oral health for women of child-bearing age.

## **Methodology**

### **Research Method or Design**

A mixed method approach was used with a one-group pretest/posttest design in this study to determine if an educational module increased the knowledge and confidence level of PA students regarding oral health complications and pregnancy. The mixed method perspective used quantitative measures as the primary method in the pretest to determine participant knowledge and confidence in oral complications of women of child-bearing age or currently pregnant. Demographic items were included in the pretest and inquired if the participants had previous medical training, current medical licensure, and/or experience in the OBGYN field. Qualitative items measured the effect of the educational module on the students' perceived value to impact their future careers. The advantage of this study is the feasibility and ease of presenting this educational module to students who are in an educational setting for the medical field.

### **Procedures**

**Human subjects protection/informed consent.** Institutional review board (IRB) approval was obtained at Eastern Washington University (EWU) before implementing the educational program. A letter of approval was also obtained from the Dean of the College of Health Sciences at Western University of Health Sciences (WUHS) for EWU to serve as the primary IRB, and, for participation of the PA student population in the study (see Human Subjects Approval). Minimal risk was anticipated for participation in the research study. Respondents were asked to create an identification (ID) item using the

first two letters of their birth month and the last four digits of their phone number via the survey links provided by SurveyMonkey®. All survey answers were anonymous. To ensure anonymity, SurveyMonkey® settings were set to anonymous responses. Informed consent (see Appendix A) was sent to the students via email before completing the pre and posttest surveys. All data was collected and stored on a password-protected computer only accessible by the principal investigator (PI).

**Sample Source, Plan, Sample Size, Description of setting.**

*Sample Source.* A convenience sample was used for this study. The target population is students enrolled in an accredited PA program. The sample consisted of students enrolled in the Master of Science Physician Assistant (MSPA) program at WUHS located in California. The MSPA curriculum is taught in a two- year program including six semesters (see Figure 3).

<b>Year 1</b>		
<b>Phase I, First Year, Fall Semester</b>		
<b>Course</b>	<b>Title</b>	<b>Credit Hours</b>
IPE 5000	Patient Centered Cases I	1.00
PA 5005	Medical Terminology	1.00
PA 5010	Structure & Function I	3.00
PA 5020	Clinical Skills I	1.50
PA 5030	Physical Assessment I	2.50
PA 5040	Health Promotion/Disease Prevention I	2.50
PA 5050	Introduction to Adult Medicine	3.50
PA 5060	Pharmacology and Therapeutics I	2.50
PA 5100	Pediatrics I	1.50
PA 5170	Pathophysiology I	1.50
<b>Semester Total:</b>		<b>20.50</b>
<b>Phase I, First Year, Spring Semester</b>		
<b>Course</b>	<b>Title</b>	<b>Credit Hours</b>
IPE 5100	Patient Centered Cases	1.00
PA 5011	Structure & Function II	3.00
PA 5021	Clinical Skills II	2.50



PA 5031	Physical Assessment II	2.50
PA 5041	Health Promotion/Disease Prevention II	1.50
PA 5051	Introduction to Adult Medicine II	3.50
PA 5061	Pharmacology and Therapeutics II	2.50
PA 5070A	Psychosocial Dynamics	0.00
PA 5101	Pediatrics II	1.50
PA 5110A	OB/GYN	0.00
PA 5171	Pathophysiology II	1.50
HSCI 5206	Research Methods II	2.50
<b>Semester Total:</b>		<b>22.00</b>
<b>Phase I, First Year, Summer Semester</b>		
<b>Course</b>	<b>Title</b>	<b>Credit Hours</b>
PA 5070B	Psychosocial Dynamics	2.50
PA 5110B	OB/GYN	2.50
PA 5120	Geriatrics	2.50
PA 5130	Emergency Medicine	2.50
PA 5140	Professional Roles & Responsibilities	1.50
PA 5160	Health Care Delivery System	1.50
PA 5180	Introduction to Clinical Education	1.00
<b>Semester Total:</b>		<b>14.00</b>
<b>First Year Total:</b>		<b>56.50</b>

Figure 3. Western University of Health Sciences PA first year program curriculum

**Plan.** Inclusion criteria for participation in this study included enrollment in the MSPA program. The PA students are in their first year, second semester of the curriculum. Inclusion criterion for participation in this study included enrollment in PA5041 Health Promotion/ Disease Prevention II. The OBGYN rotation for PA students begins during the summer semester following implementation of this educational module.

**Sample Size.** The MSPA program currently enrolls 98 students at the beginning of each school year. All 98 students were invited to participate.

**Description of the Setting.** The educational module was presented in a lecture hall at WUHS to first year students enrolled in the PA program. This lecture was voluntary, and lunch was provided by the PI for those who attended.

**Variables.** The independent variable for this research was an educational module provided via lecture using PowerPoint®. The educational module content was developed using current research findings and presented to the PA students. The dependent variable for this research was knowledge for guidelines and importance of preventive dental care for a pregnant patient or women of child-bearing age concluded by the pre/posttest survey scores.

**Instruments.** The pretest, educational module, and posttest were designed by the PI using adaptation from the Smiles for Life (SFL) teaching curriculum (2018). Smiles for Life is a national oral health curriculum created by the Society of Teachers of Family Medicine Group on Oral Health in 2005. The SFL program has developed three editions since 2005, the curriculum focuses on all primary care providers including PA. The goal of the SFL curriculum is to provide educational resources for the role of primary care providers training in Family Medicine to promote oral health. The SFL curriculum is endorsed by 20 national organizations including the American Dental Association and the American Academy of Family Physicians (Smiles for Life: A national oral health curriculum, 2018). The entire SFL curriculum consists of nine PowerPoint® educational modules. The PI used Module Five; Oral Health for Women: Pregnancy and Across the Lifespan. An account was created by the PI through the curriculum website where access to downloading and customizing slides from the course was granted. The SFL curriculum is the “nation’s most comprehensive and widely used oral health curriculum for primary

care clinicians” (Smiles for Life: A national oral health curriculum, 2018, para. 6).

According to The SFL website, the program was developed to help educators implement their curriculum in an educational setting. The program includes a PowerPoint® Slide Sorter Tool (See Figure 4) that allows educators to customize their presentations and slides by downloading slides from more than one module and combines them to create a customized PowerPoint® presentation (Smiles for Life: A national oral health curriculum, 2018). The individual slides from the curriculum cannot be modified. A YouTube® video was played during the module to serve as a visual aid for implementing an intra oral exam.



Figure 4. PowerPoint® Slide Sorter Tool

The pretest (see Appendix B) and posttest (see Appendix C) consisted of 15 survey items: nine Likert style items, and six demographic items. The first posttest and second posttest survey consisted of 11 Likert style items and five open ended questions. The pretest, posttest, and second posttest were developed by the PI using the SFL teaching curriculum to create unbiased items.

**Equipment.** Delivery of the educational module was presented using PowerPoint® in a lecture classroom. The presentation was displayed using a projector and lecture room computer. The PowerPoint® educational module was developed using the SFL teaching curriculum. The SFL teaching curriculum was modified by the PI to include updated content validated by the current research findings on the topic. Survey items were delivered to participants via a link to Survey Monkey®.

**Steps to implementation.** The educational module was reviewed by the thesis committee. Approval for research was obtained by the IRB at EWU. Western University of Health Sciences as stated per IRB does not need any approval on their end to implement an educational module with student participation but requires an approval letter from the college dean. Approval letter from the College of Health Professions Interim Dean was provided to the PI (see Human Subjects Approval). The PI worked with the PA chair at WUHS Sciences to set up implementation of the module and distribution of survey e-mails (see Appendix H). The purpose of the study, informed consent, and SurveyMonkey® link for the pretest were provided prior to the lecture via student e-mail addresses (see Appendix A). The students were enrolled in the study once they reviewed the informed consent and chose to click the survey link to the pretest. The pretest was e-mailed to the students one week before the educational module. The students were then given ten minutes during the beginning of the lecture to answer the pretest if need be. The educational module was presented in a lecture hall to first year students enrolled in the PA program. The educational module covered adverse pregnancy outcomes for both mother and fetus related to poor oral health conditions. This lecture was voluntary, and lunch was provided by the PI to those who attended. A drawing for

one \$50 Amazon gift card was provided as incentive for the students following completion of all three surveys. Students entered the drawing by clicking on a link given with the second posttest and provided an email address in a separate Google document. This kept the participant's email separate from their responses to maintain anonymity. The winner was chosen after the second posttest survey link closed using a randomizer.

***Pretest.*** The PI sent an e-mail to the PA Department Chair providing the informed consent and a link for the pretest one week prior to the lecture date. The participants were then reminded of the pretest link immediately before the lecture and were given ten minutes to answer the pretest items if they had not done so. The 60-minute educational module was presented to the participants by the PI. The PI was able to answer any questions from the participants after the educational module was complete.

***First Posttest.*** The posttest link was provided to the students immediately upon completion of the educational module presentation and question period. The students were given ten minutes to respond to the posttest. The first posttest link was available until the end of the same day as the educational module implementation. The PI was able to analyze the immediate change in confidence and knowledge the educational module had on the students. The posttest survey had the same quantitative items as the pretest, followed by two Likert scale qualitative, a yes or no item, and three open ended qualitative questions (see Appendix C).

***Second Posttest.*** An identical second posttest was sent to the participants via student e-mail account three weeks after the completion of the educational module to determine retention of the educational module material. The second posttest link was

available for 72 hours after the e-mail was sent. An e-mail reminder was sent before the link closed.

### **Summary**

The study focused on providing an educational module to PA students currently enrolled in an accredited MSPA program. The students were given a pretest prior to the educational module with Likert style items. These items focused on their knowledge and confidence levels for the importance of preventive oral care for a pregnant patient and/or woman of child-bearing age. The educational module presentation provided a YouTube® video with a step by step guide to performing an intra oral exam to identify oral health conditions. The first posttest was given immediately after the educational module presentation to determine the effect of the educational module on the knowledge and confidence level of the participants regarding pregnancy and oral health. A second posttest was sent to the participants with identical items as the first posttest to determine retention of the educational module material. All survey data was collected using Survey Monkey® and entered into SPSS® for analysis.

## Results

### Description of Sample

A convenience sample of 98 first year PA students enrolled in PA5041 Health Promotion/ Disease Prevention II were invited to participate in this study. Of the 98 students, 67 students completed the pretest and consented to the research study. Of the 67 students who completed the pretests, ( $N=54$ ) students attended the educational module and completed the first posttest. A total of ( $n= 48$ ) students provided matching identification numbers from the pretest and the first posttest. It can be assumed that 6 of the students who took the first posttest did not complete the pretest or did not provide the same identification number and therefore, their data was excluded from the analysis. A total of ( $n=48$ ) were included in the data analysis. Of the 48 participants ( $n=48$ ) completed the demographic questionnaire and ( $n=37$ ) students completed the second posttest. Out of the 37 students who completed the second posttest, ( $n=31$ ) of the participants had matching identification numbers to the first posttest. Analysis from the first posttest and second posttest only included the participants with matching identification numbers ( $n=31$ ). A summary of participant flow is provided in Figure 5. A majority of participants who completed the demographic questionnaire ( $n=48$ ) were female ( $n= 33$ ), white/Caucasian ( $n=25$ ), with no prior medical license ( $n=28$ ). These statistics are consistent with the national average of recently certified PAs (NCCPA, 2020). A majority of the participants ( $n=35$ ) did report having some type of clinical experience prior to the PA program. A summary of demographic data is provided in Table 1.

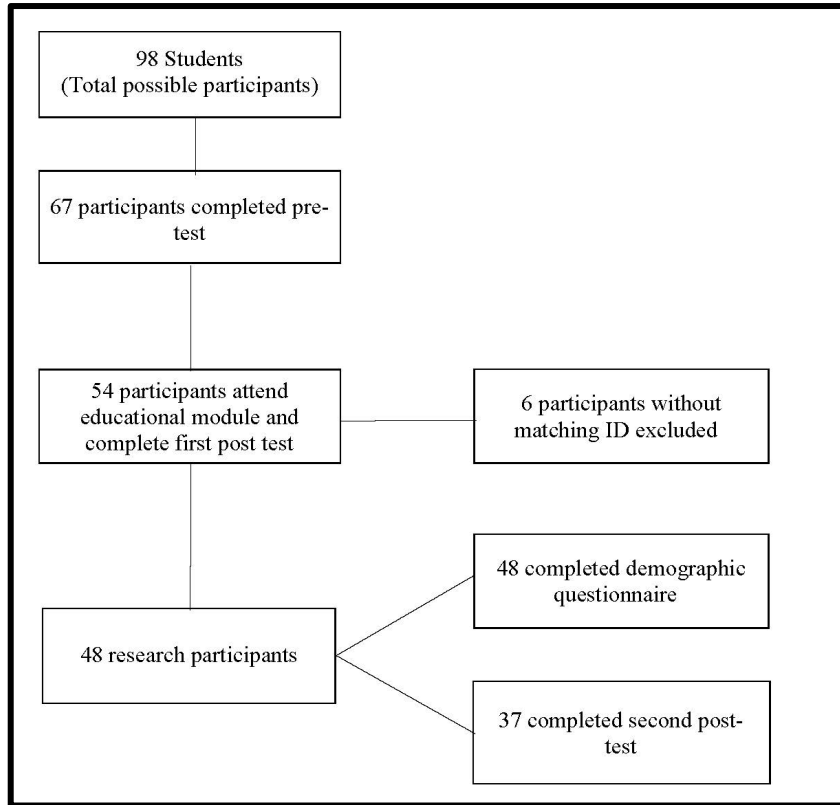


Figure 5. Summary of Participants Flow



Table 1

*Demographic Characteristics of Research Participants*

Demographic Characteristic	<i>n</i>	%
Current medical license or certificate		
Medical Assistant	4	8.3%
Emergency Medical Technician	11	22.9%
None	28	58.3%
Other	5	10.4%
Practiced in a clinical setting		
Yes	35	72.9%
No	13	27.1%
Experience in clinical setting		
Less than 6 months	10	20.8%
7 months – 1 year	6	12.5%
1-3 years	23	47.9%
3 or more years	9	18.8%
Experience with OBGYN/Midwife/NP		
Yes	1	2.1%
No	47	97.9%
Gender		
Male	15	31.3%
Female	33	68.8%
Ethnicity		
Asian or Asian American	12	25.0%
Black or African American	1	2.1%
White or Caucasian	25	52.1%
Hispanic or Latino	6	12.5%
Other	4	8.3%

**Statistical Analysis**

**Pretest and First Posttest.** This study aimed to determine if an educational module presented by a DH to PA students could significantly increase the knowledge and confidence level of PA students when speaking with pregnant patients or patients of childbearing age. The research questions were centered around the importance of oral health and pregnancy and performing intraoral exams. The pretest survey consisted of demographic questions and 9 Likert style items. The first and second posttest were identical using the same 9 Likert style items as the pretest as well as three open-ended

prompts and one dichotomous question serving as the qualitative component of the study. The participants were also asked to rate the content of the educational module using a 5-point scale with 1 being poor and 5 being excellent. To determine if the educational module significantly increased the knowledge and confidence levels of PA students, the differences between the mean of the pretest and first posttest scores were evaluated (see Table 2). The mean pretest score was 2.78 ( $SD = 0.65$ ) and the mean first posttest score was 4.15 ( $SD=0.45$ ). The mean first posttest score was statistically significant higher scores than the pretest score ( $p < 0.001$ ). The variance was also higher on the pretest score (0.43) than the first posttest score (0.21). The results of the pretest and first posttest show a statistically significant increase in knowledge.

Table 2  
*Total Average Scores for Pretest and Posttest 1*

	Total Avg Pre Score ( $n=48$ )	Total Avg Post 1 Score ( $n=48$ )
Mean	2.78	4.15
Std. Deviation	0.65	0.45
Variance	0.43	0.21

Paired  $t$ -tests for each item were performed to determine if any items had significantly different scores after the educational module (see Table 3). A statistically significant increase in the mean difference was found in 7 of the 9 Likert style items ( $p < .05$ ).

Table 3

*Individual Question Pretest and First Posttest results*

Item	Pretest mean score (n=48)	First posttest mean score (n=48)	p-value
Q1-Important to talk to pregnant women about oral health	4.69	4.98	0.00*
Q2- Confident discuss oral health with a pregnant patient	2.92	4.27	0.00*
Q3- Feel knowledgeable in adverse pregnancy outcomes and poor oral health	2.19	4.31	0.00*
Q4- Can list 3 common oral conditions in pregnancy	2.15	4.31	0.00*
Q5- Can state optimal time for woman to receive dental treatment	2.06	4.40	0.00*
Q6- Important to promote oral issues for women across their lifespan	4.67	4.73	0.569
Q7- Can describe how periodontal disease can affect pregnancy outcomes	2.13	4.35	0.00*
Q8- Can complete intraoral exam	2.10	4.10	0.00*
Q9- Can counsel pregnant patient on safety of dental care	2.19	1.90	0.00*

*Note.* Statistical significance found at \* $p < .05$

One of the items, *it is important to promote and address oral health issues for women across their lifespan*, had a high mean score on both the pretest and first posttest. Therefore, no statistically significant difference was found, as the participants scored above average on both the pretest and first posttest ( $p = 0.56$ ). The remaining questions show a statistically significant difference ( $p < .001$ ) in the mean scores between the pretest and first posttest.

**Clinical Experience.** An independent samples *t*-test to compare those with clinical experience to those without was conducted to see if there were significant differences in scores. The mean score for participants without clinical experience was 3.04 ( $SD = 0.88$ ) on the pretest and 4.42 ( $SD = 0.47$ ) on the first posttest. The mean score for participants with clinical experience was 2.69 ( $SD = 0.53$ ) on the pretest, and 4.23 ( $SD = 0.50$ ) on the first posttest. The data showed mean scores between the two groups did not have equality of variance as shown in Table 4. Levene's test for equality of variance showed significantly different variances in the two groups, therefore the "equal variances not assume" *t* values were utilized to determine significant differences. A statistical significance was not found on the pretest ( $p = 0.198$ ) or first posttest ( $p = 0.232$ ) between participants who reported past clinical experience and those that reported none. A second independent *t*-test was conducted to determine if there was a statistical significance between years of clinical experience. Participants who answered yes to past clinical experience were divided into two groups; less than one year, and more than one year. Between these two groups, a statistical significance was found with participants with more than one year of clinical experience on the mean pretest scores ( $p < 0.05$ ). There was no statistically significant difference in the mean first posttest scores ( $p = 0.440$ ) between the two groups, as shown in Table 5.

Table 4

*Clinical Experience vs. Non-Clinical Experience Results*

Practiced in Clinical Setting		<i>n</i>	<i>M</i>	<i>SD</i>	<i>p</i>
Average agree score across 9 items	no	13	3.0427	0.88138	0.198
	yes	35	2.6921	0.53768	
Total average first posttest	no	13	4.4274	0.47325	0.232
	yes	35	4.2349	0.50687	

Table 5

*Clinical Experience: Less Than One Year vs. More Than One Year*

Years of experience less than 1, 1+		<i>n</i>	<i>M</i>	<i>SD</i>	<i>p</i>
Average agree score across 9 items	1+ year	32	2.61	0.47	0.037*
	Less than 1 year	16	3.12	0.84	
Total average first posttest	1+ years	32	4.24	0.49	0.440
	Less than 1 year	16	4.36	0.51	

*Note.* Statistical significance found at \**p* < .05

**Qualitative Data.** Thematic coding was used for qualitative analysis to identify prominent themes from the open-ended questions added to the first posttest. A total of 53 participants (*n*=53) answered both open-ended questions and one participant skipped both questions. All comments were read thoroughly before analysis began. Primary themes were identified using keywords such as; knowledge, importance, comfortable, patient education, dental safety, and oral exam. These keywords were then color coded within the responses using the tag tool provided by SurveyMonkey®. Comments with more than

one keyword were color-coded according to each keyword. The sample comments represented in Tables 7 and 9 were copied from SurveyMonkey® responses provided by the participants.

Three major themes were found in item 11; *How do you feel the SFL program will impact your future practice?* These common themes included: the module was a great resource for patient education ( $n=18$ ), the importance of dental care during pregnancy ( $n=13$ ), and a gain in knowledge regarding dental health ( $n=12$ ). One participant stated, “I never thought about the importance of dental care during pregnancy and SFL program helped me understand the importance of patient education and dental health in pregnant women.” Another participant mentioned oral health is a close tie to overall health and “educating patients about the importance of their oral health will be a part of my future practice.” A summary of the common themes found in item 11 are listed in Table 6.

Table 6

*Summary of Open-ended Question How will the Smiles for Life Program Impact Your Future Practice*

Thematic response	Number ( $n=53$ )	Percentage
Educate patients on importance of oral health	18	33.9%
Importance of oral health	13	24.5%
Knowledge about oral health	12	22.6%
Confidence to complete oral exam	4	7.5%
Comfortable addressing oral health	1	1.9%
Aware of asking about dental health	1	1.9%

Table 7

*Thematic Analysis: Sample Comments Focused from Survey Item 11 “How do you feel the Smiles for Life Program will impact your future practice?”*

Coded theme	Comment
Awareness	“I will definitely be more conscious to ask people about their dental health and when the last time they visited the dentist was”
Comfortable	“It will help me to be more comfortable with addressing oral health during pregnancy”
Importance	“It helps to drive home the point of importance in proper dental care”  “I think that oral health is tied closely to the overall health of a person, so educating patients about the importance of their oral health will be a part of my future practice”  “It made me realize how important it is to educate women for oral health”
Knowledge	“It gave me more base knowledge to counsel pregnant patients”  “Make me more knowledgeable”  “It will help my knowledge with patients”  “It made me more educated about the misconceptions of pregnancy and dental care”
Oral Exam	“I will be able to do an oral exam and refer patients as necessary”
Patient education	“I can use it as a resource to refer back to when educating patients”  “I would like to work in OB, so I think I will use it a lot with my patients”

*Note.* Comments were selected from various participants after thematic coding

The second open ended item asked participants to list key points that resonated with them after the educational module was over. A common theme found was the importance of dental care before, during, and after pregnancy ( $n=14$ ). The second common theme found indicated that dental care for pregnant patients was safe ( $n=11$ ). One participant stated, “I think it’s so important to ask patients about their dental health, and it is something that often goes unnoticed.” A complete summary of common themes found from this question is shown in Table 8. A summary of common themes found in item 12 are shown in Table 9.

Table 8

*Summary of Open-ended Question: Key Point That Resonated with You*

Thematic Response	Number ( $n=53$ )	Percentage
Importance of dental care while pregnant	14	26.4%
Safety of dental care while pregnant	11	20.7%
Possible adverse effects on fetus	7	13.2%
Prevention is key	7	13.2%
Caries transmission from mother to baby	5	9.4%
Dental x-ray safety	6	11.3%
Provide oral exams for pregnant patients	3	5.6%



Table 9

*Thematic Analysis: Sample Comments Focused from Survey Item 12 “What is a key point from the Smiles for Life module that resonated with you?”*

Coded Theme	Comment
Adverse effects on fetus	“That dental health affects a patient during pregnancy which negatively affects the baby”
	“Having an oral infection can cause preterm birth”
	“That babies being born preterm and underweight can be associated with poor oral health hygiene- I had no idea!”
	“Bacteria from the mother’s oral infection passing through the placenta”
Caries Transmission	“Poor dental germs can be transmitted to babies through kiss”
	“Cavity bacteria can be spread”
	“Women can pass their bacteria to their children”
	“Dental care is important at all stages of life!... Also, learning that dental caries can be spread from mother to baby via saliva was truly an interesting fact!”
Safety of Dental Care	“That dental care during pregnancy is not contraindicated or harmful to the fetus”
	“Dental care during pregnancy is safe”
	“That pretty much nothing is contraindicated in pregnancy for oral care. I thought it was a bad idea to go to the dentist”
Importance of Dental Care	“That it’s important to start dental care before pregnancy”
	“That all pregnant patients should have dental health”

Table 9 Continued

Prevention is Key	<p>“It is better to prevent dental problems before mom’s get pregnant!”</p> <p>“How a lot of diseases can be avoided, but, the education is lacking!”</p> <p>“The prevention is key and most important BEFORE future mom’s get pregnant”</p>
Provide Oral Exams	<p>“Always take a look in patients mouth at every visit possible”</p>
Dental X-Ray Safety	<p>“I was very interested in the fact that x-rays are safe for pregnant women”</p> <p>“Most pregnancy patients have certain myths, such as that X-rays will be detrimental to the pregnancy, but this is untrue”</p>

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*Note.* Comments were selected from various participants after thematic coding

A dichotomous question was asked to the participants regarding their knowledge of how to access the SFL Program after the educational module was complete. Results from this question indicated 53 participants selected yes ( $n=53$ ), and 1 participant selected no ( $n=1$ ), (see Figure 6). Finally, the participants were asked to rate the content of the educational module on a scale of 1 through 5 with 1 being poor and 5 being excellent. The average rating was 4.8 with ( $n=10$ ) participants providing a grade of 4 and ( $n=44$ ) participants providing a grade of 5, (see Figure 7).

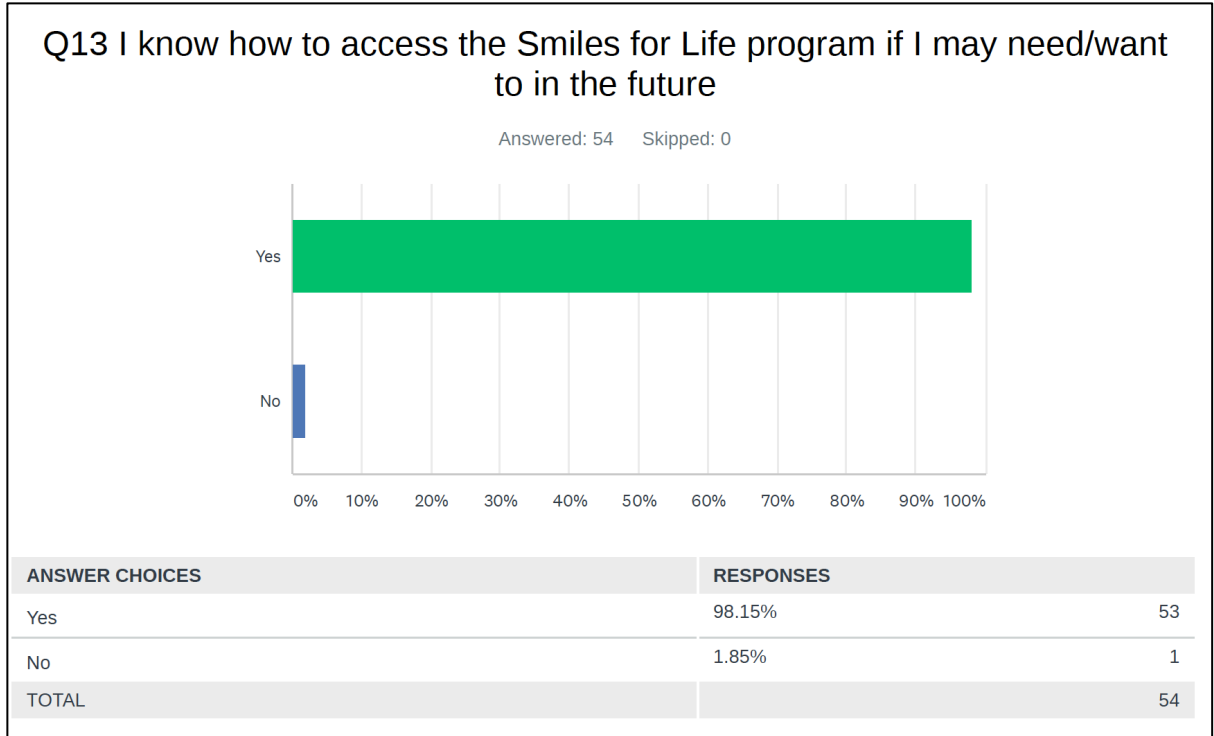


Figure 6. Participant Response for Knowledge to Access Smiles for Life

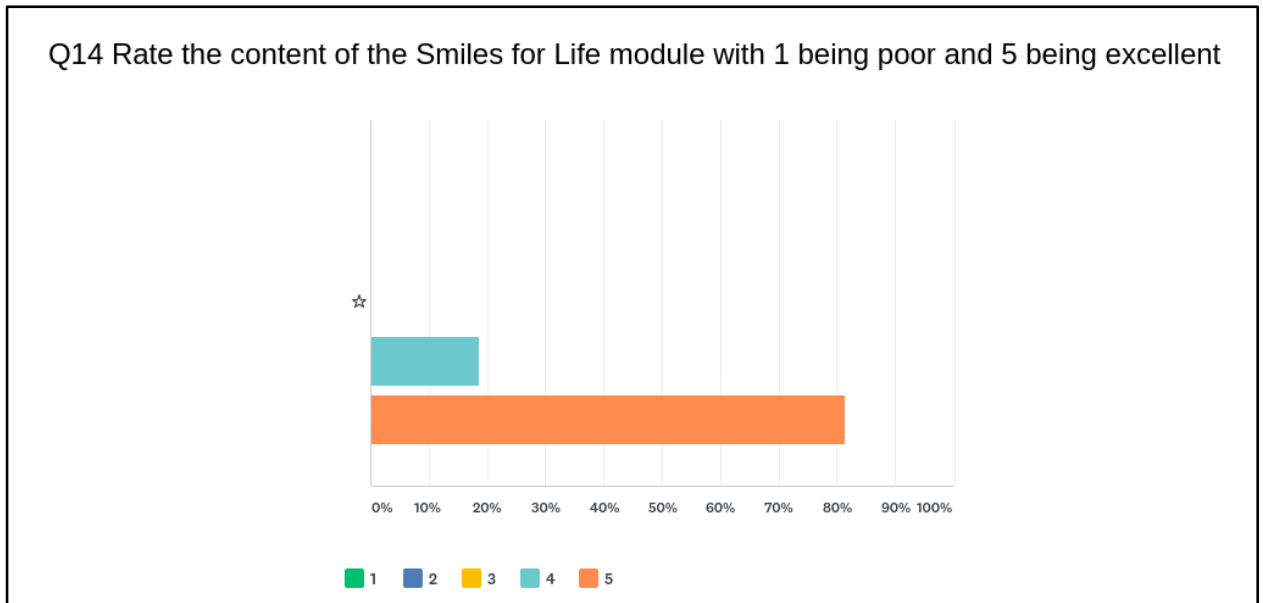


Figure 7. Participant Response Rate Content of Education Module

**Second Posttest.** A second posttest was sent to the participants via e-mail 3 weeks after the educational module via e-mail link and remained open for 72 hours. After

the 72 hours, a total of 37 participants ( $n=37$ ) completed the second posttest and matching ID numbers were found for 31 ( $n=31$ ) of the 37 participants. Analysis from the participants ( $n=31$ ) was completed from the first posttest and second posttest. The mean second posttest score was 4.22 ( $SD = 0.47$ ), in comparison to the first posttest mean score of 4.16 ( $SD= 0.51$ ). An overall slight increase in mean scores was found between the first posttest and the second posttest. No significant difference was found between the first posttest and second posttest mean scores ( $p = 0.50$ ) indicating the participants had retention in knowledge from the educational module. Discussion of all findings can be found in the next chapter.

## **Discussion**

### **Summary of Major Findings**

The results of this study showed statistically significant data that supports an educational module provided to PA students from a DH can increase knowledge, and awareness of pregnancy and oral health. A statistically significant increase in the mean difference was identified in 7 of the 9 pretest and first posttest questions. The participants understood the importance of promoting oral health issues for women across their lifespan as both pretest and first posttest score results showed a high mean score without a statistical difference. No statistical significance was found between participants with clinical experience and those without; however, a statistical significance was found on pretest scores for individuals who had more than 1 year of clinical experience. A second posttest was conducted to measure retention from the educational module. The overall mean scores increased from the first posttest to the second posttest. Two open ended questions were asked to the participants regarding how this educational module will impact their future practice and what key points resonated with them. The most significant answers from the open-ended questions included: the importance of educating patients regarding oral health, an increase in their knowledge about oral health, importance of dental care while pregnant, and the safety of dental care for pregnant patients. Finally, after completion of the educational module the participants were asked to rate the content of the material, the average score reported was 4.8 out of 5.

## Discussion

The optimal time to screen for oral conditions for an expectant mother is during the early weeks of the pregnancy. Ideally, a woman of child-bearing age should be visiting their dental provider regularly to prevent adverse pregnancy outcomes related to poor oral conditions. Physician assistants are able to prescribe medications, diagnose illness, manage treatment plans, and have the ability to practice in every medical setting. Physician assistant education is founded on preventive care and treating the patient as a whole (AAPA, 2019). The results of this study suggest it is likely that an educational module can significantly increase the knowledge and confidence level of PA students when speaking with women of child-bearing age about the importance of oral health and pregnancy. This study found statistically significant differences between the overall mean pretest and first posttest scores. Individual questions showed statistical significance in the participants' scores for a majority of the questions. One question, "It is important to promote and address oral health issues for women across their lifespan" became a question of little importance as it did not have a statistical significance from the pretest to first posttest scores, as a majority of the participants strongly agreed or agreed to this question on both surveys. It can be assumed that the positive response for this question from both the pretest and first posttest is related to the existing knowledge promoting preventive healthcare in all aspects from their previous semester of PA education or, this question was worded in a way that automatically made the participants respond with "yes of course!"

**Research Questions.** To further understand the results found from this study, data was collected from the survey items, analyzed, and is discussed in this section.

Organization of this section is centered around the research questions, concepts of the practitioner experience, and participant knowledge retention.

*Knowledge and confidence on speaking with pregnant patients.* The results of this study indicate an increase in knowledge when speaking with pregnant patients and patients of child-bearing age about their oral health. A statistical significance was found in two Likert items, “I am confident in discussing oral health with pregnant patients”, and, “I feel knowledgeable in adverse pregnancy outcomes related to poor oral health.” Similar results were found in a study that examined the effectiveness of an IPE oral health program for pediatric nurse practitioner students. The study, conducted by Khanbodaghi et al. (2019) that used an educational module, pretest, and posttest design found significant improvement in overall knowledge, confidence, and attitude of oral health topics (Khanbodaghi, Natto, Forero, & Loo, 2019). Furthermore, these authors stated previous articles show traditional didactic education did not improve physician performance, yet, delivering effective education using IPE has been successful in knowledge and confidence retention. The use of IPE can provide PA and other healthcare providers the essential knowledge, and confidence to properly screen patients for oral health issues and provide proper dental referrals. This study suggests the use of a DH in providing oral health education to PA students is a valuable tool in increasing the knowledge and confidence levels of the oral-systemic link and treating patients of child-bearing age.

One unanticipated theme found in the open-ended questions was the response to caries transmission from mother to child. Several participants noted a key point from the educational module was the information that caries can be transferred. One participant

stated, “Dental care is important at all stages of life! Dental care begins at home but is reinforced by the providers that people encounter. Also, learning that dental caries can be spread from mother to baby via saliva was truly an interesting fact!” Research conducted by Kamate et al. (2019) found an increase in the formation of *Streptococcus mutans* during the second and third trimesters of pregnancy. Providing the PA students with knowledge regarding caries transmission from mother to child prepares them to educate their patients on the importance of not only the mother’s dental health but also how to care for the oral health of their future child. Collaboration among dental professionals and healthcare professionals should be conducted by the oral health community by providing resources and implementing IPE courses together. Development of uniform oral health guidelines for prenatal patients would help both oral health and medical professionals when treating pregnant patients or patients of child-bearing age. An increase in medical and dental collaboration may serve to inform the development of prenatal guidelines, and thus improve the general overall health for women of child-bearing age. Future oral health guidelines for women of child-bearing age could provide resources to aid in development of public health programs which in return may provide increased access for patients to receive preventive oral healthcare.

*Counsel patients.* Another question with a statistical increase from the pretest to the first posttest asked the participants if they could “counsel pregnant patients regarding the safety of dental care.” This data is supported by findings in previous studies that have shown IPE can have a significant increase in non-dental healthcare workers feeling comfortable with providing oral health education to patients (Khanbodaghi et al., 2019). This data is also supported by the comments provided in the qualitative questions. One



participant stated, “It will help me to be more comfortable with addressing oral health during pregnancy.” Another participant noted, “Will help me counsel patients on dental hygiene, including negative consequences of not following good habits.” Several studies have reported a connection between poor oral health and adverse pregnancy outcomes. (Bui et al., 2019; Cobb et al., 2017; Meqa et al., 2017; Moore & Blair, 2017; Vamos et al., 2015). The quantitative and qualitative data collected from the PA students indicates an educational module can increase the knowledge and confidence in communicating with patients regarding the complications of poor oral health and pregnancy. The use of IPE between dental professionals to healthcare students can help promote the collaboration of care (Estes et al., 2018). Having a DH provide the necessary knowledge and tools for PA students to screen patients for oral health conditions, as well as the confidence to provide simple oral health instructions suggests adding an IPE experience to PA programs is beneficial. Similarly, for practitioners, applying an interprofessional approach for continuing education experiences regarding oral care for the pregnant patient may improve oral health disparities for women of child-bearing age.

*Importance of oral health.* A common theme found in the open-ended questions was being able to educate patients on the importance of oral health. One participant stated, “It is very useful especially if working in an urgent care and you are the first person to see a pregnant woman.” Another participant illustrated, “Smiles for Life will impact my future practice by helping me educate pregnant patients and know the problems I need to worry about.” Research supports promotion of good oral health for women of child-bearing age. Jiang et al. (2013) state adverse pregnancy outcomes including early pregnancy loss may be avoided by providing intervention before

conception. Additionally, Moore and Blair (2017) found, on average women with PD took two months longer to conceive than women without the disease. Providing IPE is an important method of helping healthcare professionals feel comfortable and confident in screening for oral diseases and providing dental referrals to pregnant patients and patients of all ages.

***Knowledge and comfort performing an intraoral exam.*** Responses from the study show a statistical significance in performing an intraoral exam on patients. One thematic response suggested this educational module would impact the future practice of the PA students' ability to perform an intraoral exam. One participant wrote, "I will be able to do an oral exam and refer patients as necessary." The results of this study support the research of Haber et al. (2015) that introduced the change in the traditional HEENT (head, ears, eyes, nose and throat) examination to include the "O" for oral cavity. The introduction of the HEENOT program was implemented by more than 150 medical training facilities between 2011-2014. Implementing the HEENOT examination in the didactic and clinical setting will increase the comfortability of PA students including this exam for women of child-bearing age (Haber et al., 2015). A YouTube® video was provided during the module to serve as a visual aide for completing an intra oral exam (see Appendix F). A statistical significance was found on the Likert item "I can complete an intraoral exam" indicating the students increased their knowledge regarding how to complete an intraoral exam on a patient. This data is also supported by positive statements regarding the video, one participant stated they learned the bony growths found inside the mandible were normal. The results of this study showed a DH providing IPE for the intraoral exam may better prepare PA students to identify normal vs abnormal

findings in the oral cavity of their patients. One may infer that interprofessional activities between practitioners learning and discussing collaboratively the importance of identifying and addressing abnormal oral findings may lead to better referrals between medical and dental health care providers. Thus assuring women are being treated holistically to achieve maximum health during pregnancy.

Additional qualitative analysis from this study showed positive responses from the participants regarding completing intra oral exams on patients. Item 12 asked participants to write down a key point from the SFL module. Participants included comments such as, “the oral exam demonstration” and “How important it is to check every single patient’s teeth!” This data supports the suggestions from Curtis et al. (2013) for dental and residency programs to work synergistically to increase oral health education and promote national oral health guidelines for pregnancy. Positive responses were noted from the PA students regarding implementing the use of oral health and intraoral exams when treating patients of child-bearing age. As noted, knowledge of how to properly perform an intraoral exam may increase dental referrals from the medical community and improve overall general health for women of child-bearing age.

Participants were allowed to leave feedback at the end of the first posttest. Sample comments included “the presenter was informed and engaging” and “I enjoyed how passionate the presenter was about the subject and provided personal examples and stories that were applicable to our futures!” These findings indicate the educational module being presented by a dental professional made an impact on the participants understanding of the material. Dental educators should seek opportunities to use for IPE, as access to oral health care is limited in socioeconomic minorities or those who lack oral

health literacy (Estes et al., 2019). The integration of interprofessional collaboration between dental professionals and medical practitioners may bridge the gap from for patients lacking the knowledge of oral health importance or those who do not currently have a dental home.

A clinical component may provide further knowledge for the PA students in completing an intraoral exam and recognizing normal and abnormal findings. This module provides a great opportunity for the educator to take this educational intervention into a dental or medical clinic and incorporate peer to peer intraoral examinations. Furthermore, this module could also serve as a way for dental students and PA students to collaborate together on intraoral examinations in a clinical setting. Oral health providers have the opportunity to collaborate with the medical community by providing resources for pregnant patients or patients of child-bearing age to prevent adverse pregnancy outcomes related to poor oral health and improve the overall health of the population.

*Awareness of adverse pregnancy outcomes related to poor oral health.* The results of this study show a statistical significance in poor oral health and pregnancy awareness. A statistical significance was seen in individual questions relating to this research question.

*Knowledgeable in adverse pregnancy outcomes related to poor oral health.* Many hormonal and physiological shifts happen during pregnancy and can negatively impact the oral cavity (Moore & Blair, 2017). Pregnant patients may seek care in non-dental facilities such as urgent care or emergency rooms if they develop oral health conditions such as pregnancy gingivitis, pregnancy granuloma, or dental related pain. Many pregnant patients may not have dental insurance or have a false understanding of visiting

the dentist while pregnant. It is important for healthcare providers to be aware of adverse pregnancy outcomes related to poor oral health and how to properly screen their patients for oral conditions including PD. The use of an educational module can help equip healthcare providers with the right tools to screen patients for poor oral health conditions and help them receive dental care. Integration of oral health education for primary care physicians can help reach one of the Healthy People 2020 objectives for improving oral health care.

*Potential adverse pregnancy outcomes related to PD.* According to the ACOG, 40% of pregnant women have some form of PD whether it be mild or aggressive. Active periodontal infections are associated with PTB, LBW, and pregnancy complications such as GDM and preeclampsia (Meqaet al., 2016). Responses from the qualitative data showed a positive response regarding the knowledge gained from the module. One participant stated, the educational module “will help me identify both early and late stage dental disease, improving the health outcomes of my patients.” Another participant stated, “I will be able to screen patients and be a part of preventative care.” The SFL module was an effective tool for educating PA students on the negative effect’s PD may have not only on the mother but also the potential adverse pregnancy outcomes on the fetus. The educational module along with the intraoral exam video may help PA students identify patients suffering from PD before pregnancy and provide a dental referral. Treatment of PD before conception may decrease the chance of the mother developing adverse pregnancy outcomes related to periodontal infections such as PTB and LBW.

Providing IPE to PA students showed positive knowledge retention and positive qualitative responses. The concept of IPE education is supported by the findings of

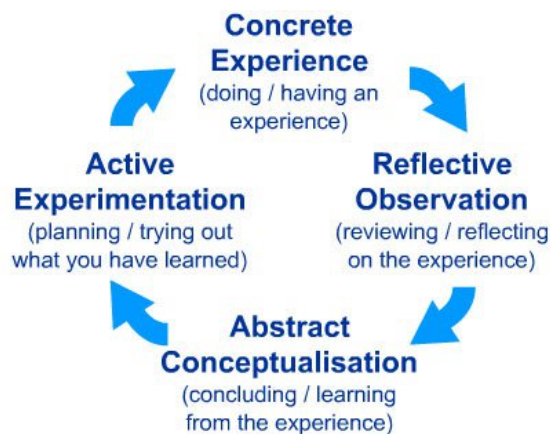
Hunter et al. (2015) who found a significant improvement in educational outcomes with IPE-related learning. Incorporating oral health education to PA students through IPE can provide awareness for adverse pregnancy outcomes related to poor oral health. This concept is supported by the research conducted by Jacques et al. (2010) and Lord (2015) who found a need for oral health education in PA programs. Strategies have been implemented to incorporate oral health education in PA programs and as of 2014 ( $n=124$ ), PA program directors had updated their curriculum to include oral health education. The statistical significance in the PA student's awareness of pregnancy complications related to poor oral health shows how IPE may provide adequate knowledge they need for oral health issues. Oral health education should be included in all medical and allied medical programs to improve their knowledge and confidence, which in return may increase the rate of dental referrals. Providing interprofessional continuing education will encourage medical and dental practitioners to work together in providing the best overall treatment for patients of child-bearing age.

The SFL program was a simple yet effective tool for providing an oral health curriculum to help educators implement IPE. Each of the nine PowerPoint® modules is complete with presenter notes, educational objectives, and test questions. The module was easily accessible online, and the familiar information was presented in a clear and concise manner. Educational images in the module helped aid in providing clear visuals to the PA students through a clinical simulation center. These visual references may help students identify oral diseases and abnormalities they may encounter when working with patients of child-bearing age (Haber, 2015). According to McLeod (2017) development of new concepts is subject to new information and new experiences. This module

supports the experiential learning theory developed by David Kolb which represents a four-stage learning style; concrete experience, reflective observation, abstract conceptualisation, and active experimentation. The SFL program is easily accessible online for PA students or PA faculty to utilize further. Future use of these modules and a clinical component can provide the PA students with effective learning that is supported by the four stages of Kolb's learning cycle (see Figure 8). Respectively, the SFL program serves as a content resource for all health care providers to employ not only within academia but for continuing education (CE) opportunities or lunch and learn sessions for OBGYN practices.

***Knowledge retention.*** Participants were asked to complete an identical second posttest three weeks after the educational module. No statistical significance was found between the first posttest and second posttest mean scores, in fact, a slight increase in scores was found. It can be concluded that the participants retained the knowledge gained from the educational module and show a positive response from the educational module. These results are supported by a 2016 study that assessed the short term and long-term knowledge of health care professionals regarding autonomic dysreflexia (Krassioukov et al., 2016). This study provided a pretest, immediate posttest and three months follow up posttest after an educational module intervention. The immediate posttest scores showed a significant increase in overall mean scores. Although the 2016 study showed a decrease in mean scores on the second posttest, it should be noted that the second posttest scores were significantly higher than the original posttest scores (Krassioukov et al., 2016). Krassioukov et al. (2016) stated despite the encouraging findings found after the educational module, educational modules without hands on activities have little impact

on the changes of health care provider's behavior. The use of a mixed approach of didactic and clinical formats is more likely to increase the effectiveness long term. It may be expected for knowledge retention to increase if the PA students were provided this content immediately before completing their OBGYN rotations. Implementation of this educational module or a review of the module and Youtube® video could increase the learning retention prior to clinical rotations (McLeod, 2017). This course content sequencing is supported by Kolb's learning cycle.



*Figure 8. Kolb's Learning Cycle*

### **Limitations**

The results of this study were limited by the sample size, missing identification numbers, and the use of a single PA program. Due to participation in the study intervention being voluntary, approximately half ( $N=48$ ) of the first year PA students attended the educational module presentation and correctly filled out both the pretest and first posttest ID question. Another limitation was the low response rate of the second posttest with a total of ( $n=31$ ) participants correctly matching ID number to the previous two surveys. Although a YouTube® video was provided during the module as a visual aid for how to perform an intra oral exam, not having a hands-on clinical component is



another limitation to this study. Lastly, this study could have benefited from providing the educational module and surveys to more than one PA program or the use of another PA program as a control.

### **Recommendations/Suggestions for Future Research**

The current study investigated if an educational module can affect the knowledge and confidence of PA students in regard to oral health and pregnant patients. A suggestion for further research would be to include a clinical component or standardized patient simulation activity as part of the educational module intervention to increase confidence in counseling pregnant patients and to perform intra oral exams. Implementing the educational module in multiple PA programs across different areas could increase sample size and generalizability.

A control group would provide a way of determining if an IPE intervention is effective as opposed to traditional methods of teaching content on oral care of the pregnant patient within the PA curriculum. A third posttest over a longer period of time could provide valuable information for retention regarding the research questions especially if the PA students were participating in their clinical experiences with pregnant patients after the intervention.

Additionally, this study would benefit from a focus group that the PI could continue to gather data from after the PA students enter the healthcare workforce. A longitudinal study following practicing PAs in OBGYN offices could provide IPE for possible changes and implications to be made for this educational material for future PA students.

### **Conclusions**

The results of this study demonstrate the use of an educational module can significantly increase the knowledge and confidence of PA students regarding pregnancy and oral health. Additionally, participants retained the knowledge gained from the educational module. Qualitative data suggests knowledge and confidence gained from this educational module will be beneficial to the PA students during their future careers in healthcare. Use of an educational module based upon the SFL evidence-based content readily available via the internet has the potential for use in IPE experiences. Implementing IPE among medical and dental students may improve interprofessional collaboration between medical and oral health care professionals leading to dental screenings, consultations, and referrals to women of child-bearing age seen in medical settings. Interprofessional educational experiences and interprofessional collaboration utilizing content such as the SFL modules may decrease oral health disparities for women of child-bearing age with socioeconomic limitations, which could help reach the Healthy People 2020 goal for improving oral health.

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## Appendix A

### Participant Consent Letter

Dear PA students,

My name is Holly Redwine and I am currently pursuing my Master of Science in Dental Hygiene degree at Eastern Washington University. I would like to invite you to participate in a study titled Preventive Dental Care for the Pregnant Patient: An Educational Intervention. I currently practice dental hygiene and live in Fontana, California. Being a mother and dental hygienist, my passion for women's health and the importance of preventive dental care during and after pregnancy has brought me to focus my thesis on this subject.

The purpose of this study is to provide an educational module to assist in the interprofessional collaboration between the dental field and health care providers. Potential benefits of this study include working together to increase the knowledge of dental disease and help provide access to care for those in need. As stated by The American College of Obstetricians and Gynecologists (2013), physiologic changes during pregnancy may result in changes to the oral cavity, including but not limited to; pregnancy gingivitis, benign oral lesions, tooth mobility, tooth erosion, dental caries, and periodontitis. With my study I hope to provide you with the insights of current research regarding oral disease and women's health and obtain valuable information that will provide you with confidence while caring for patients who are women of child-bearing age or currently pregnant.

As part of this research, you will be asked to complete three surveys; one prior to the educational module, one immediately after the module and the third will be sent three weeks after the lecture to your student e-mail account. Participation during the survey process will provide valuable information in the research process. The brief surveys will be available to take online and are estimated to take no longer than 10 minutes. To access the first survey, please click the link located at the end of this e-mail. Your consent to participate in this study is implied when you access the survey and answer the questions.

The data from the pretest and post-test will not be linked to you in any way. You are under no obligation to participate in the study and your consent or non-consent to participate will not impact your academic grade in any way. Please know that your participation in this study is completely voluntary and that your responses are anonymous. Also, you may skip any questions that you are not comfortable answering and you may opt out of the survey at any time. This study is less than minimal risk.

As an incentive for your full participation, each student who completes all three surveys will be entered into a raffle for a \$50 Amazon gift card. You can choose to enter the drawing by clicking on a link given with the second post-test and providing an email address in a separate Google document. This will keep your email separate from their responses to maintain anonymity. Those who provide their email address as participants will remain confidential.

If you have concerns about your rights during participation in this research or any complaints you wish to make, you may contact Charlene Alspach, Executive Director, Grant and Research Development, (509) 359-2517 or [calspach@ewu.edu](mailto:calspach@ewu.edu). Any questions can be sent to myself [Hredwine@ewu.edu](mailto:Hredwine@ewu.edu), or my thesis advisor Professor Sarah Jackson, RDH, MSDH [sjackson2@ewu.edu](mailto:sjackson2@ewu.edu).

Sincerely,

Holly Redwine RDH, BSDH, MSDH©

[Hredwine@eagles.ewu.edu](mailto:Hredwine@eagles.ewu.edu)

909-240-5288

**To begin participation in this study please click the link below**

**[https://www.surveymonkey.com/r/redwine\\_1](https://www.surveymonkey.com/r/redwine_1)**

**Appendix B**

Pretest Survey

Please answer the following

Please enter the first two letters of your birth MONTH, followed by the last FOUR digits of your phone number.

Example: August (760) 333-1234  
 AU1234

Do you hold a current medical license or certificate? (check all that apply)

- A. Registered Nurse
- B. Licensed Vocational Nurse
- C. Nurse Practitioner
- D. Medical Assistant
- E. Emergency Medical Technician
- F. Licensed Clinical Social Worker
- G. Other. \_\_\_\_\_
- H. None

Have you practiced in a clinical setting?

- Yes
- No

How much experience do you have in clinical setting?

- None
- Less than 6 months
- 7 months – 1 year
- 1- 3 years
- 3 or more years

Do you have experience working with pregnant patients? (yes or no)

- Yes
- No

Have you had experience working with an Obstetrician, Midwife, or Obstetrics Nurse Practitioner who would refer pregnant patients for dental care?

- Yes
- No

What is your gender?

- Male
- Female
- Transgender
- Other

Ethnicity

- Asian or Asian American
- Black or African American
- Native Hawaiian or Pacific Islander
- American Indian or Alaska Native
- Caucasian
- Hispanic or Latino
- Choose not to respond
- Other

1. It is important to talk to women who are pregnant or those of child-bearing age about

oral health

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

2. I am confident in discussing oral health with a pregnant patient

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

3. I feel knowledgeable in adverse pregnancy outcomes related to poor oral health

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

4. I can list 3 common oral conditions in pregnancy

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

5. I can state the optimal time period for a pregnant woman to receive elective dental care
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
6. It is important to promote and address oral health issues for women across their lifespan
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
7. I can describe how periodontal disease can affect pregnancy outcomes
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
8. I can perform a complete intra-oral exam on a patient
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
9. I can counsel pregnant patients regarding the safety of dental care
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree



## Appendix C

### First Posttest Survey

Please answer the following

Please enter the first two letters of your birth MONTH, followed by the last FOUR digits of your phone number.

Example: August (760) 333-1234  
AU1234

1. It is important to talk to women who are pregnant or those of child-bearing age about oral health
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
2. I am confident in discussing oral health with a pregnant patient
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
3. I feel knowledgeable in adverse pregnancy outcomes related to poor oral health
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
4. I can list 3 common oral conditions in pregnancy
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
5. I can state the optimal time period for a pregnant woman to receive elective dental care
  - Strongly agree

- Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
6. It is important to promote and address oral health issues for women across their lifespan
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
7. I can describe how periodontal disease can affect pregnancy outcomes
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
8. I can perform a complete intra-oral exam on a patient
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
9. I can counsel pregnant patients regarding the safety of dental care
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree

**Please answer the following**

1. How do you feel the Smiles for Life program will impact your future practice?
2. What is a key point from the Smiles for Life module that resonated with you?
3. I know how to access the Smiles for Life program if I may need/want to in the future
  - Yes
  - No
4. Rate the content of the Smiles for Life module with 1 being poor and 5 being excellent
  - 1
  - 2
  - 3
  - 4
  - 5
5. Please provide any feedback/comments for the presenter (what did you enjoy most, what would you have liked to be different, etc.)

## Appendix D

### Second Posttest Cover letter and Consent

Dear PA students,

Thank you for participating in the Smiles for Life educational module. If you would like to continue your participation, please click on the post-test survey link below. This link will be active for 72 hours, your prompt response is appreciated.

Participation during the survey process will provide valuable information in the research process. The brief survey will be available to take online and is estimated to take no longer than 10 minutes.

Please note, as an incentive for your participation, each student who completes all three surveys will be entered into a raffle for a \$50 Amazon gift card by clicking on a link at the end of the post-test and providing an email address. This will keep your email separate from your responses to maintain anonymity. Those who provide an email address as participants will remain confidential. The winner will be chosen after the survey link is closed using a randomizer.

Your participation in this study is completely voluntary and your responses will remain anonymous. The surveys do not require you to disclose any information that will identify you. Your consent to participate in this study is implied when you access the survey and answer the questions.

If you have concerns about your rights during participation in this research or any complaints you wish to make, you may contact Charlene Alspach, Executive Director, Grant and Research Development, (509) 359-2517 or [calspach@ewu.edu](mailto:calspach@ewu.edu). Any questions can be sent to myself [Hredwine@ewu.edu](mailto:Hredwine@ewu.edu), or my thesis advisor Professor Sarah Jackson, RDH, MSDH [sjackson2@ewu.edu](mailto:sjackson2@ewu.edu).

Sincerely,

Holly Redwine RDH, BSDH, MSDH(c)

[Hredwine@eagles.ewu.edu](mailto:Hredwine@eagles.ewu.edu)

909-240-5288

Please click on the following link to complete the survey  
[http://www.surveymonkey.com/r/redwine\\_3](http://www.surveymonkey.com/r/redwine_3)

## Appendix E

### Second Posttest Survey

Please answer the following

Please enter the first two letters of your birth MONTH, followed by the last FOUR digits of your phone number.

Example: August (760) 333-1234  
AU1234

1. It is important to talk to women who are pregnant or those of child-bearing age about oral health
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
2. I am confident in discussing oral health with a pregnant patient
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
3. I feel knowledgeable in adverse pregnancy outcomes related to poor oral health
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
4. I can list 3 common oral conditions in pregnancy
  - Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
  
5. I can state the optimal time period for a pregnant woman to receive elective dental care
  - Strongly agree

- Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
6. It is important to promote and address oral health issues for women across their lifespan
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
7. I can describe how periodontal disease can affect pregnancy outcomes
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
8. I can perform a complete intra-oral exam on a patient
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
9. I can counsel pregnant patients regarding the safety of dental care
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree

**Please answer the following**

1. How do you feel the Smiles for Life program will impact your future practice?
2. What is a key point from the Smiles for Life module that resonated with you?
3. I know how to access the Smiles for Life program if I may need/want to in the future
  - Yes
  - No
4. Rate the content of the Smiles for Life module with 1 being poor and 5 being excellent
  - 1
  - 2
  - 3
  - 4
  - 5
5. Please provide any feedback/comments for the presenter (what did you enjoy most, what would you have liked to be different, etc.)

Appendix F

<https://youtu.be/ReFRAUMuAYM>



The video player shows a title card with a blue and purple geometric background. The text on the card reads: "The Importance of Oral Health in Comprehensive Health Care" and "THE CONCISE ORAL EXAM". The NIDCR logo is visible on the right side of the card. The video player interface includes a progress bar at 0:01 / 12:00, a volume icon, and various control icons (CC, settings, full screen, etc.).

NIDCR - The Concise Oral Exam

37,343 views · May 3, 2018

356 13 SHARE SAVE ...

**Curriculum Vitae**

**Holly Redwine RDH BSDH, MSDH (c)**

**4008 Obsidian Rd. Rosena Ranch Ca 92407  
Phone: 909-240-5288 Email: holly.redwine@yahoo.com**

**Licensure**

California Registered Dental Hygienist 2012-Current  
Dental Hygiene Board of California

**Certifications**

Laser Certified 2013-Current  
810 & 980 diode laser

CPR Certified 2010-Current

**Education**

Master of Science in Dental Hygiene 2017-Current  
Eastern Washington University  
Spokane, Washington

Bachelor of Science in Dental Hygiene 2015-2016  
Eastern Washington University  
Spokane, Washington

Associate of Science in Dental Hygiene 2010-2012  
Pasadena City College  
Pasadena, California

Pre-requisites for Dental Hygiene Program 2007-2010  
Chaffey Community College  
Rancho Cucamonga, California

Pre-requisites for Dental Hygiene Program 2006-2007  
University of California Riverside  
Riverside, California

**Work Experience**

Triangle Dental Group and Orthodontics Nathaniel Leng DDS and Associates Fontana, California	2013-Current
Gateway Dental Group and Orthodontics Joan To DDS and Associates Riverside, California	2013-2016
Coast Dental West Covina, California	2012-2013
Mimi's Café Rancho Cucamonga, Ca	2005-2012

**Course Work**

Whitening: Beyond the Basics	2014
Sirona Laser Training	2013

**Research Experience**

Cardiovascular Disease and the relation with Periodontal Disease Bachelors Completion Program research assignment	2016
The Effects of Healthcare Systems on the Practice of Dental Hygiene Senior Research Project	2012
Aspirated Bacterial Pneumonia: The Leading Cause of Death in Nursing Homes Junior Table Clinic	2011

**Teaching Experience**

Oral Care for the Pregnant Patient: An Educational Intervention Western University of Health Sciences Physician Assistant Program Pomona, California	2020
Medical Emergency Drugs and Equipment Pasadena City College Dental Hygiene Juniors Pasadena, California	2019
HIV/AIDS Pasadena City College Dental Hygiene Juniors	2019



Pasadena, California

SOAP NOTES 2019

Pasadena City College Dental Hygiene Juniors  
Pasadena, California

Silver Diamine Fluoride: What the Dental Hygienist Needs to Know 2018

Pasadena City College Dental Hygiene Seniors  
Pasadena, California

Life After Hygiene School: Alternatives to Clinical Practice 2018

Pasadena City College Dental Hygiene Seniors  
Pasadena, California

Periodontal Disease and Cardiovascular Disease 2016

Presentation to Dental Staff  
Fontana, California

Adopt a Home 2012

Oral hygiene instructions and lesson plans for special needs patients  
Pasadena, California

Oral Hygiene Instructions first grade level-6-week course 2012

Romana Elementary School  
Alhambra, California

### **Community Service**

CDA Cares 2019

Large organized weekend of free dental care, provided dental hygiene services  
San Bernardino, California

Pacific Dental Services We Serve Day 2019

Free dentistry donated to Inland Valley Regional Center

Pacific Dental Services We Serve Day 2018

Free dentistry donated to Inland Valley Regional Center

Pacific Dental Services We Serve Day 2017

Free dentistry donated to Inland Valley Regional Center

Special Olympics World Games

2016

Dental Hygiene Volunteer

Los Angeles, California

Braveheart 2014  
 Provided dental care to a community in need  
 Inglewood, California

Pacific Dental Services We Serve Day 2014  
 Provided donated dentistry to patients at Gateway Dental  
 Riverside, California

CDA Cares 2013  
 Large organized weekend of free dental care, provided dental hygiene services  
 Del Mar, California

Give Kids a Smile 2012  
 Hosted by Dr. Patel  
 Claremont, California

**Affiliations/Membership**

California Dental Hygienists' Association 2019-Current  
 Tri-County

American Dental Hygienists' Association Student 2015

American Dental Hygienists' Association 2010-2013

**Honors and Awards**

Dean's list  
 Pasadena City College  
 Pasadena, California 2010-2012

**Leadership Activities**

Class President 2010-2012  
 Pasadena City College