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Maternal Preventive Dental Services Utilization: The Role of Preconception Oral Health Counseling in and the Association With Birth Outcomes: Evidence From South Carolina Prams

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MATERNAL PREVENTIVE DENTAL SERVICES UTILIZATION: THE ROLE OF PRECONCEPTION ORAL HEALTH COUNSELING IN AND THE ASSOCIATION WITH BIRTH OUTCOMES: EVIDENCE FROM SOUTH CAROLINA PRAMS

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DEDICATION

I dedicate this work to the four chambers of my heart: Samantha Zorah Jae, Sarah Zemora Jai, Sawyer Zenith Jay and Sydney Zoe Jaye. You are my greatest accomplishment. Thank you for the gift of motherhood. Always remember that a person's greatest weakness is not knowing their own strengths. You are so beautiful, wonderful and powerful. May your lights shine brightest for all to see. Go forth and do even greater works.

Forever Yours,

Mom

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ABSTRACT

The purpose of this study is to examine maternal preventive dental services utilization by analyzing the role of preconception oral health counseling in utilization of dental cleaning services before or during pregnancy and the association of utilization with preterm birth (<37 weeks) and small for gestational age (SGA) (same sex newborns having birth weight for gestational age below the 10th percentile of the reference population as defined by the World Health Organization (WHO)). Studies suggest that unfavorable maternal oral conditions have significance in birth outcomes, specifically periodontal disease (periodontitis), an oral inflammatory condition which is shown to be a risk factor for preterm birth and low birth weight (Dortbudak et al., 2005; Guimarães et al., 2012; Tejada et al., 2012). Dental cleaning before and during pregnancy is effective in the prevention of oral disease including gingivitis and periodontitis (Johnson et al., 2006; Kurien et al., 2013; Steinberg et al., 2013).

Cross-sectional 2012-2015 data from the South Carolina Pregnancy Risk Assessment Monitoring System (SC PRAMS) survey, a population-based surveillance system on prenatal, perinatal and postpartum experiences of resident mothers who recently delivered a live-born infant, were analyzed using weighted analyses in SAS. Analyses included demographic univariate analyses, Rao-Scott Chi-squared tests of significance to study differences between groups, and multivariate logistic regression models to estimate adjusted odds ratios (AOR). This study controlled for socio-demographic characteristics and prenatal maternal morbidities that are known to be

associated with health services utilization and birth outcomes. Among the 2,870 surveyed mothers, 8% had received preconception oral health counseling and 59% had received dental cleaning before or during pregnancy. Preconception oral health counseling by a medical provider was associated with five-fold higher odds of having had dental cleaning relative to no counseling in both univariable and adjusted multivariable logistic regression analyses (OR 5.668; 95% CI [2.760, 11.639]; p <.0001) and (AOR 4.994; 95% CI [1.972, 12.649]; p < 0.0007) respectively.

The study showed that dental cleaning was associated with lower risks of both preterm birth and SGA outcomes. The beneficial effect of dental cleaning before or during pregnancy on preterm birth varied by smoking status and traumatic stress experiences. Among nonsmoking mothers, those who reported dental cleaning were 62% less likely to experience preterm birth than non-smoking mothers who did not have dental cleaning (AOR 0.377; CI [0.201, 0.706]; p=0.0023). Among smoking mothers, dental cleaning was not associated with a reduction in preterm birth risk; the risk was similar regardless of dental cleaning status. Among mothers who experienced any traumatic stress during pregnancy, dental cleaning was associated with reduced likelihood of preterm birth compared to mothers who did not have dental cleaning (AOR 0.241; CI [0.098, 0.594]; p=0.0020). With respect to SGA, mothers who smoked during pregnancy but completed a dental cleaning had 70% lower odds of SGA than smoking mothers who did not get dental cleaning (AOR 0.302; CI [0.097, 0.945]; p=0.04).

Overall, this study suggests that provision of oral health counseling by a medical provider before pregnancy is an effective low-cost intervention which impacts maternal preventive dental services utilization. Furthermore, dental cleaning is associated with

mitigation of preterm birth and SGA risks among sub-groups of mothers with other risk factors for these adverse outcomes. Regarding preterm birth, dental cleaning provides a protective effect among non-smoking mothers and mothers with traumatic stress. Regarding SGA, dental cleaning showed a protective effect among smoking mothers. This study provides positive evidence that obstetric care guideline changes to include oral health promotion among women of reproductive age may diminish the current underutilization patterns in preventive dental services and improve birth outcomes.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Pregnant women are receiving much attention due to evidence-based research connecting poor oral health status to unfavorable perinatal outcomes. For two decades, both the scientific and medical communities have demonstrated interest in the relationship between oral disease and adverse birth outcomes (Ren & Du, 2017). In the United States, oral disease is common during pregnancy yet dental services underutilization persist (Chung et al., 2014). There is little known concerning sociodemographic, behavioral and other individual characteristics which influence oral health status of pregnant women (Chung et al., 2014). Research suggests that inadequate knowledge about evidence-based perinatal dental care and the factors that influence care behaviors play a role in underutilization (Andersen et al., 2007; Cibulka et al., 2011; Institute of Medicine [IOM], 2011).

The pioneering 2000 Surgeon General's Report on oral health brought awareness to the necessity of good oral health and dental care practices during pregnancy (U.S. Department of Health and Human Services [USDHHS], 2000). Calling oral disease "a silent epidemic," the Surgeon General concluded that oral disease was a significant risk factor for systemic conditions such as cardiovascular disease, type 2 diabetes mellitus and osteoporosis (USDHHS, 2000). According to this report, periodontal disease may also have the potential to impact pregnancy outcomes that result in preterm birth and low birth

weight newborns (USDHHS, 2000). The Surgeon General called for continued research including longitudinal studies, studies on mechanisms of action, and intervention trials to fully determine whether periodontitis is a risk factor for adverse pregnancy outcomes (USDHHS, 2000).

This report pioneered a national oral health movement involving federal agencies, state health departments, community organizations, researchers and providers to bring awareness to the importance of oral health during pregnancy (Sanders et al., 2017). Since 2000, studies examining the association between periodontal disease or periodontal therapy and adverse birth outcomes have been published. Studies suggest that there is a relationship between maternal oral health and poor birth outcomes of preterm birth and low birth weight (Kumar & Samelson, 2006). Several studies implicate periodontitis, an oral inflammatory disease, as a risk factor for preterm birth and low birth weight (Dortbudak et al., 2005; Guimarães et al., 2012; Tejada et al., 2012).

1.2 PROBLEM STATEMENT

According to the WHO, about 15 million newborns, more than one in ten, are born world-wide too soon each year. Preterm birth may result in both low birth weight and very low birth weight newborns (World Health Organization [WHO], 2011). Preterm birth, a factor in more than 75% of pediatric deaths, is singularly the most important cause of death during the first month and the second leading cause of death globally in children five and younger (Glass et al., 2015). Complications from preterm birth lead to 1 million childhood deaths annually (Glass et al., 2015; Lawn et al., 2013). Early birth survivors are at increased risk for newborn death as well as many short-term and long-term disabilities (Glass et al., 2015; Lawn et al., 2013). Both preterm birth and low birth

weight birth remain global and national health issues. In the United States, disorders related to preterm birth and low birth weight ranked second to birth defects (malformations, deformations, and chromosomal abnormalities) as the leading cause of infant death (Hoyert & Xu, 2012).

After a steady decline from 2007 to 2014, the preterm birth rate rose slightly in the United States from 9.57% in 2014 to 9.63% in 2015 (Martin et al., 2010). Additionally, the percentage of infants born with low birth weight increased nationwide from 2014 (8.00 %) to 2015 (8.07%) (Martin et al., 2010). Very low birth weight was constant at 1.40% from 2014 to 2015, but the proportion of moderately low birth weight infants weight grew from 6.60% to 6.67% (Martin et al., 2010). In South Carolina, the focus of this dissertation, about 9.2 % of newborns have low birth weight and 11.2% are born prematurely creating an unsurmountable burden on the health care system and community as a whole (Dobre et al., 2007).

Current evidence suggests that periodontal disease may have an association with adverse birth outcomes and treatment might reduce these negative effects (Corbella et al., 2016; Guimarães et al., 2012; Piscoya et al., 2012; Pitiphat et al., 2007). Published studies on the benefits of dental services during pregnancy include improvement in maternal oral health, reduction of mother-child bacterial transference, and the creation of opportunities for anticipatory guidance (Le et al., 2008; Weintraub et al., 2010). Routine dental treatment and oral disease control in pregnancy is safe and improves health for the mother and her child by reducing harmful bacteria (Featherstone, 2008; Hemalatha et al., 2013; Moimaz et al., 2014). Despite the benefits and safety of dental services during

pregnancy, utilization among expectant mothers continues to be low even among those with dental problems (Gaffield et al., 2001).

National dental utilization rates during pregnancy range from 23% to 43% (Lydon-Rochelle et al., 2004). A multistate study by Gaffield, Gilbert, Malvitz and others found that 12-25% of respondents reported a dental problem yet only 44-54% actually went for care. In 2012-2013, less than 47% of South Carolina pregnant women received dental services, 47% had oral health counseling, and 21% experienced a dental problem (Sanders et al., 2017). Of this 21%, 57% did not seek care (Sanders et al., 2017).

1.3 STUDY PURPOSE

The purpose of this study is to document reported oral health counseling and preventive dental services utilization (dental cleaning) in South Carolina mothers. This study will explore the association between receipt of oral health counseling by a medical provider before pregnancy and preventive dental utilization before or during pregnancy, adjusting for dental insurance. The study aim is to understand mutable factors associated with usage. This study will also examine maternal preventive dental services usage and reporting of a dental problem during pregnancy and their possible association with birth outcomes: preterm birth and SGA. The goal of this research is to promote the health of expectant mothers by raising individual, public and professional awareness of factors influencing oral health services usage. The ultimate objective of this dissertation is to encourage the adoption of evidence-based policy guidelines concerning oral health counseling, screening and treatment in the perinatal period.

1.4 STUDY SIGNIFICANCE

Study findings will inform mothers, maternity care providers, and policy makers about:

1. the importance of oral health counseling before pregnancy,
2. the role of oral health counseling in dental services utilization,
3. financial and sociodemographic factors associated with the likelihood of receipt of counseling and/or dental care,
4. factors associated with dental services usage during pregnancy which are amenable to intervention,
5. the significance of preventive oral services in the perinatal period,
6. the association of dental utilization and dental problems during pregnancy
7. the association of dental utilization during pregnancy with adverse birth outcomes,
8. the association of dental problems during pregnancy with birth outcomes,
9. recommendations for future adoption of preconception and prenatal oral health policy and practice guidelines,
10. the importance of comprehensive continuous care between clinical disciplines through medical referrals to dental providers.

CHAPTER 2

LITERATURE REVIEW

2.1 ORAL CHANGES DURING PREGNANCY

Pregnancy is associated with physiological changes which may contribute to increased vulnerability to disease. As a result of sustained exposure to these physiological changes during the gestation period, pregnancy is a time of significant oral vicissitudes (Kumar & Samelson, 2009; Steinberg et al., 2013). Indeed, the prenatal and perinatal period are sensitive stages involving complex somatic and biologic alterations. Gingival tissue and other oral structures are directly impacted by these overall biologic transformations, thereby challenging a woman's ability to maintain good oral health during pregnancy. The major changes occurring during pregnancy which affect oral and systemic health are caused by hormone upsurges.

There is an increased production of estrogen, progesterone, beta-human chorionic gonadotropin, and relaxin hormones during pregnancy (Kandan et al., 2011; Ressler-Maerlender et al., 2005; Steinberg et al., 2013). This upsurge of hormone production, mainly estrogen and progesterone, upsets the normal order of homeostasis in the pregnant woman. Consequently, the oral cavity is influenced by these hormones causing reversible and irreversible changes throughout the maturation process (Kandan et al., 2011). Hormones, progesterone and estrogen, play a key role in the process of heightened inflammatory responses during pregnancy. As the levels of sex hormones rise, there is a correlated response in the severity of this clinical reaction. Moreover, the increased

production of these sex hormones, estrogen and progesterone, affects periodontal and dental health during pregnancy through changes in immune response, epithelial barrier function and vascularity as well as anaerobic-to-aerobic subgingival plaque ratios (Markou et al., 2009; Steinberg et al., 2013). The mouth is distressed by endocrine hormonal actions and resulting adaptive changes which may present both ephemeral and permanent changes as well as modifications that are considered pathological (Kandan et al., 2011).

Steinberg and others describe the effect of estrogen and progesterone on immune system functioning with the weakening of neutrophil chemotaxis, phagocytosis, T-cell, and antibody responses (Basavaraju et al., 2012; Steinberg et al., 2013). Consequently, pregnant women undergo a decreased immune reaction to protect the developing fetus from immune responses of the mother thus diminishing her entire body's protective and reparative abilities. Locally, estrogen also plays a role in enfeebled restoration systems in the gingiva by specifically targeting epithelial barrier function by means of estrogen receptors, cellular multiplication of blood vessels, reduced keratinization, and heightened epithelial glycogen (Kornman & Loesche, 1982; Steinberg et al., 2013; Vittek et al., 1982). Also contributing to changes in supporting oral tissue, progesterone disturbs normal gingival status in pregnant women through increases in permeability, edema, bleeding and gingival crevicular fluid production and movement into the sulcus. Additionally, progesterone decreases the ability of the body to perform gingival healing in three ways: reduction in fibroblast proliferation, inhibition of collagen production, and prohibition of naturally occurring gingival repair processes.

A further effect of estrogen and progesterone changes during pregnancy is folate metabolism which may result in a greater predisposition for undesired oral health conditions. The requirement for maintaining healthy tissue is compromised through this breakdown of folate causing tissue growth changes which decrease the solidity of the epithelial tissue (Thomson & Pack, 1982). Orally, folate deficiency is a concern because it is responsible for the body's decreased ability to fight inflammatory mediators and conduct tissue repair (Thomson & Pack, 1982). For this reason, folate deficiency may result in oral changes such as open eruptions of the tongue and other areas of the oral cavity. All of the conditions caused by hormonal upsurges put pregnant women at greater predisposition to developing undesired oral health conditions.

Examples of these oral complications which are most common in pregnancy are erosion, dental caries, pregnancy gingivitis, bleeding gums, gingival soreness and pregnancy tumors (pyogenic granuloma). These conditions are exacerbated in individuals with poor preexisting oral health status. The aforementioned oral manifestations, together with an increased predisposition to inflammatory conditions such as gingivitis and periodontitis, create substantial oral health challenges for expectant mothers.

2.2 PERIODONTAL DISEASE: BIOLOGY

Often painless, gum disease plagues many pregnant women due to the physiological changes. Gum disease is a local infection of the surrounding tissues that support teeth and has an impact on systemic inflammatory mediators. A reversible form of gum disease, gingivitis, is the most common oral disease in pregnancy (Kandan et al., 2011). In the irreversible state gum disease is also referred to as periodontal disease. Periodontal disease, also called periodontitis, is a chronic infection produced by

anaerobic gram-negative bacteria commonly present in plaque biofilm. Periodontitis also known as pyorrhea means inflammation around the tooth. This chronic, low-grade, oral disease damages the soft tissue and bone of the periodontium which support teeth (Pitiphat et al., 2007). In a susceptible host, periodontal diseases are identifiable assorted infections that trigger periodontal damage. Severity of the disease varies. The etiology of periodontal disease follows the basic principles of epidemiology as it relates to infectious disease where disease expression is an amalgamation of host, microbial elements and the external conditions (Kawar & Alrayyes, 2011).

Gum disease progression is set off by an alteration in oral flora contributing to the succession of harmful bacteria and local irritants namely plaque and calculus. Periodontitis is an anaerobic disease progression caused by microorganisms specifically gram-negative bacteria such as Porphyromona gingivalis, Tannerella forsythensis, Eikenella corrodens and Aggregatibacter actinomycetemcomitans (Agueda et al., 2008; Contreras et al., 2006). Plaque, the sticky film which regularly forms on teeth, is made of bacteria, cholesterol, cell waste, calcium, adipose materials and fibrin from the blood. Calculus, tartar formed from plaque, initiates when plaque is not removed by proper oral hygiene regimens. This calcified plaque on the enamel of teeth progresses subgingivally (below the gum line) causing tissue changes and bone loss in periodontitis.

Biological factors such as gender, genetics, diabetes, obesity, osteoporosis, insufficient dietary calcium or vitamin D all play a significant role in the introduction, development and severity of periodontal disease (Genco & Borgnakke, 2013). Behavioral factors such as stress, tobacco use, alcohol use and prescription drug usage may also influence the onset or progression of this disease (American Dental Association [ADA],

2017; University of Maryland Medical Center, 2017; Genco & Borgnakke, 2013). For example, medications used to treat non-oral conditions like calcium channel blockers, antidepressants, heart medications, oral contraceptives, anti-epilepsy prescriptions, steroidal drugs, oral bisphosphonates and cancer treatments increase the odds of the onset of oral inflammatory conditions during pregnancy (ADA, 2017; University of Maryland Medical Center, 2017). Prescription medications whose side effects are dry mouth, gingival overgrowth (oral contraceptives, antidepressants and heart medications), or osteonecrosis (oral bisphosphonates for osteoporosis) change the oral environment making patients more susceptible to periodontal disease (University of Maryland Medical Center, 2017).

2.3 THEORIES OF ASSOCIATION OF PERIODONTITIS AND BIRTH OUTCOMES

Many reviews from systematic and interventional studies infer an association between periodontitis and adverse pregnancy outcomes based on existing theories on the biological relationship between periodontal disease and poor birth outcomes. These theories attempt to explain the proposed biological mechanisms examining the link between maternal periodontitis and low birth weight, preterm birth, preeclampsia and other pregnancy related conditions. The etiology of these adverse birth outcomes is unsettled, but some authors suggest that possible causal factors could be inflammation or bacteria (Steinberg et al., 2013). Although the precise mechanisms by which periodontitis can be linked to undesirable birth outcomes is inconclusive, prevailing data supports several theories proposed about the relationship. For the scope of interest in this dissertation, following the outline of Kawar and Alrayyes, three major groups were

created. These groups were classified as the following: bacterial infection hypothesis, inflammatory mediators theory, and genetic/environmental host susceptibility belief (Kawar & Alrayyes, 2011).

2.3.1 BACTERIAL INFECTION HYPOTHESIS

Subclinical oral infections have gained support as a significant risk factor of preterm birth or premature rupture of membranes; they are key obstetric precursors to spontaneous preterm births (Kawar & Alrayyes, 2011). The bacterial infection hypotheses, those theories explaining bacteria as the root cause of adverse birth outcomes, follow the belief that bacteria are transferred from the mother's oral flora to her unborn child causing fetal harm. Biologically, a mother's oral bacteria may be transmitted through the blood and amniotic fluid in the womb to her unborn child. Moreover, bacteria is a common link between chorioamnionitis, maternal sepsis, intrauterine infection and preterm birth (Bohrer et al., 2012a).

In 2010, Han and others reported the first human evidence of a subgingival oral pathogen, Fusobacterium nucleatum, originated from maternal subgingival plaque that traveled to the placenta and fetus. They reported that this bacteria was potentially responsible for the acute inflammation that led to term stillbirth in the participant. (Han et al., 2010). Additional studies noted that Fusobacterium nucleatum is an oral pathogen associated with early delivery and chorioamnionitis (Bohrer et al., 2012a). Hans et al. believed that bacteria which originates in a women's mouth (subgingival plaque) should be considered a significant source of intrauterine infection possibly causing adverse birth outcomes (2010). Furthermore, bacteria may cause chorioamnionitis which may affect the extraplacental membrane causing premature membrane rupture and ultimately

preterm delivery (Kawar & Alrayyes, 2011). Early birth can also be activated by proinflammatory cytokines existing at the maternal-fetal junction which are caused by microbial infection (Kawar & Alrayyes, 2011).

2.3.2 INFLAMMATION MEDIATORS THEORY

In addition to bacterial infection hypotheses, there are theories which place emphasis on host response to infectious diseases during the process of pathogenesis, known as inflammatory mediator theories. These inflammatory mediators signal labor to begin and may contribute to the risk of early delivery, low birth weight, infection or gestational diabetes in the newborn. These theories accept inflammation as the key cause of oral-systemic relationship between periodontal health and pregnancy outcome. Inflammation is noted as an important factor in the pathogenesis of early birth as well as periodontitis (Farrell (nee Moore) et al., 2006). Inflammation is also a common constituent in many other chronic conditions (Hunter, 2012).

Within the inflammation theory, research suggests that periodontitis is associated with increased plasma C- Reactive Protein (CRP) levels in early pregnancy (Pitiphat et al., 2006). CRP is a protein found in blood plasma, with increased levels associated with the inflammatory response. It is an acute-phase reactant protein made by the liver that increases following interleukin-6 secretion and tumor necrosis factor-alpha (Pitiphat et al., 2006). Results of the study by Pitiphat et.al suggest that there is a possibility that CRP may facilitate the association between adverse pregnancy outcomes and periodontal disease (2006).

2.3.3 GENETIC/ENVIRONMENTAL HOST SUSCEPTIBILITY BELIEF

Lastly, there are published studies which support the genetic/environmental host susceptibility belief. In a 2007 study, Tarannum and Faizuddin noted a genetic explanation for the association of periodontitis and preterm birth. Periodontitis and preterm birth share common risk factors; further, there are common genes present in both medical conditions that have particular polymorphisms that code for cytokines (Tarannum & Faizuddin, 2007). Another study conducted in the United Kingdom concluded that a higher proportion of mothers who gave birth early carried the polymorphic TNF-alpha-308 gene (Moore et al., 2004). In contrast, some studies conducted to determine the linkage between polymorphic gene expression, periodontitis and preterm birth reported contradictory results and unsuccessfully demonstrated an association between periodontal disease severity and preterm births or low birth weight infants (Moore et al., 2004; Offenbacher, Boggess et al., 2006; Offenbacher, Lin et al., 2006).

2.4 PERIODONTAL DISEASE AND ADVERSE PREGNANCY OUTCOMES

Pregnancy is a fragile state where there are many functional changes making both the mother and developing fetus susceptible to certain oral inflammatory conditions such as gingivitis and periodontitis. Developing evidence indicates periodontitis may be associated with adverse birth outcomes of preterm birth (< 37 weeks gestation) and low birth weight (<2,500 grams or 5.5 pounds) (Kumar & Samelson, 2009; Vamos, Walsh et al., 2015). An estimated 40% of reproductive-aged women overall and 30% of pregnant women have periodontal disease (Kumar & Samelson, 2006; Thompson et al., 2013). Prevalence of gingivitis during pregnancy ranges from 30% to 100%, and approximately

5% to 20% of pregnant women manifest clinical signs of periodontitis, according to various studies (Offenbacher, Boggess et al., 2006; Offenbacher, Lin et al., 2006). Many biological and epidemiological evidence-based studies suggest that periodontitis is associated with maternal and infant outcomes, including pre-eclampsia, low birth weight, preterm birth, spontaneous abortion and stillbirth (Vamos, Walsh et al., 2015). Still, evidence-based research to date on the correlation between maternal periodontal disease and risk of preterm birth and low birth weight is mixed, but generally reported a positive association, occurring commonly in low-income populations (Steinberg et al., 2013). Other authors reported that periodontal disease or the presence of oral inflammatory mediators did not have an effect on preterm birth or low birth weight; periodontal disease was not a risk factor for preterm birth or low birth weight (Calabrese et al., 2010; Michalowicz et al., 2009; Schenkein et al., 2012; Souza et al., 2016). Continued exploration of maternal oral-systemic associations is needed to settle this dispute.

To review current knowledge on the association, this literature review included studies (systematic reviews, meta-analyses and randomized clinical trials) which related periodontal disease to the adverse pregnancy outcomes of preterm birth or low birth weight. Within these selected studies, there were studies which found no effect of periodontal disease on low birth weight or preterm birth. The remaining published studies found significant associations between periodontitis and preterm birth and/or low birth weight. Each study was classified on the basis of whether or not they found periodontal disease to be an independent risk factor and/or have significant association with adverse pregnancy outcomes: preterm birth and/or low birth weight. The studies are classified and

outlined in the following sections. Knowledge gaps in previous research and study significance are addressed in section 2.17.

2.4.1 STUDIES SUPPORTING STRONG ASSOCIATIONS OF PERIODONTITIS AND ADVERSE PREGNANCY OUTCOMES: LOW BIRTH WEIGHT, PRETERM BIRTH

Many studies suggest there is a link between oral health and the overall health of the mother as well as their unborn child (Guimarães et al., 2012; Klebanoff & Searle, 2006; Tejada et al., 2012). Several studies have documented the positive correlation between oral inflammatory conditions, such as periodontitis, premature rupture of membranes, preterm birth and low birth weight (Dortbudak et al., 2005; Guimarães et al., 2012; Martins Moliterno et al., 2005; Piscoya et al., 2012; Radnai et al., 2004). These case-control, systemic review and multivariate analyses found that maternal periodontitis is strongly associated with preterm birth as well as low birth weight (Basha et al., 2015; Chaparro et al., 2013; Corbella et al., 2016; Marakoglu et al., 2008; Martins Moliterno et al., 2005; Piscoya et al., 2012; Radnai et al., 2004). Overall, periodontitis was found to be an independent risk factor for adverse pregnancy outcomes (Agueda et al., 2008; Dortbudak et al., 2005; Kawar & Alrayyes, 2011; Pitiphat et al., 2007; Tarannum & Faizuddin, 2007). In the following nine studies, periodontitis was found to have strong associations with preterm birth and/or low birth weight:

A. Radnai et al., 2004

The aim of this case-control study was to determine if early localized periodontitis is a risk factor for adverse pregnancy outcome: preterm birth. Eighty-five postpartum mothers (41 case and 44 control) without systemic disease were included. Data from

obstetric medical records, dental examination and questionnaire were used to identify periodontitis. Periodontitis was defined using bleeding surface areas and probing depths. This study found that early localized periodontitis of the patient during pregnancy can be regarded as a significant risk factor for preterm birth (Odds Ratio (OR) 5.46; 95% Confidence Interval (CI) 1.7207-17.3244).

B. Dortbudak et al., 2005

The goal of this study was to assess the relationship between periodontitis and premature gestation by examining amniotic fluid cytokines in early-stage pregnancy. The sample consisted of 36 women who were at risk for pregnancy complications. Periodontal examinations and amniotic fluid collections were performed during week 15 through 20 of pregnancy, including vaginal smears and intra-oral plaque samples. Study results showed that periodontitis was diagnosed in 83% of preterm cases and in 20% of normal births (OR 20.0; 95% CI [2.0–201.7], $p<0.01$). The authors found that cytokine levels (interleukin (IL)-6 and (IL)-8, prostaglandin-E2 (PGE2)) were higher in preterm births ($p<0.001$). Dortbudak and others also found that pregnant women with elevated amniotic fluid levels of PGE2, IL-6 and IL-8 and having periodontitis are at high risk for premature birth. Moreover, periodontitis can trigger a host inflammatory response which leads to preterm birth.

C. Martins Moliterno et al., 2005

The purpose of this study was to verify a possible association between periodontitis and low birth weight newborns. Data from the Hospital registration records and personal interviews were collected from 151 mothers who gave birth to naturally delivered newborns. Additionally, a periodontal examination was performed which

measured probing pocket depth (PPD) and clinical attachment loss (CAL) from six clinical sites, excluding third molars. Periodontitis was defined using PPD and CAL. After comparing the case and control group, Moliterno et al. concluded that periodontitis was considered a risk indicator for low birth weight in the sample (OR 3.48; 95% CI [1.17-10.36]) along with other risk factors recognized by obstetricians.

D. Offenbacher, Boggess et al., 2006; Offenbacher, Lin et al., 2006

The goal of this prospective study was to determine whether maternal periodontal disease predicted preterm birth (<37 weeks) or very preterm birth (< 32 weeks). A sample of 1,020 pregnant women, enrolled at less than 26 weeks, received antepartum and postpartum periodontal examinations. Offenbacher and others modeled maternal exposure to periodontal disease at enrollment and/or periodontal disease progression during pregnancy, adjusting for risk factors. These risk factors included previous preterm birth, race, smoking, social domain variables and other infections. The incidence of preterm birth was 11.2% for the periodontally healthy (referent group), versus 28.6% in moderate-severe periodontal disease (Adjusted Risk Ratio (ARR) 1.6; CI [1.1–2.3]). Spontaneous preterm births increased with antepartum moderate-severe periodontal disease (15.2% versus 24.9%, ARR 2.0; CI [1.2–3.2]). Likewise, the unadjusted rate of very preterm birth was significantly higher in mothers with periodontal disease progression (6.4% versus 1.8%, ARR 2.4; CI [1.1–5.2]). Authors concluded that maternal periodontitis increases relative risk for preterm birth or spontaneous preterm birth. Moreover, periodontal disease progression (during pregnancy) was an independent risk factor for very preterm birth.

E. Pitiphat et al., 2007

The purpose of this prospective cohort study, from 1999-2002, was to evaluate whether the connection between maternal periodontal disease and increased risk of preterm birth can be generalized to middle-class populations, assuming an existing relationship between maternal periodontitis and low socioeconomic classes. The sample consisted of 1635 medically insured pregnant women. Pitiphat et al. evaluated periodontitis in relation to preterm birth and SGA. Obstetric data were obtained through medical files and self-reporting of periodontal disease (verified by radiographs). Study confounders were age, race, tobacco status, income, dental check-ups frequency, pre-pregnancy BMI, weight gain, gravidity, history of preterm birth as well as genitourinary infection. Periodontitis was found to be associated with preterm birth and SGA individually; the odds ratios were as follows: preterm 1.74 (95% CI [0.65–4.66]); SGA 2.11 (95% CI [0.76–5.86]); combined 2.26 (95% CI [1.05–4.85]). The results of this study suggest that periodontitis, among middle-class women, is an independent risk factor for poor pregnancy outcomes.

F. Marakoglu et al., 2008

The objective of this research was to evaluate periodontal disease as a risk factor for preterm low birth weight newborns. Forty-eight mothers (20 mothers had preterm low birth weight newborns and 28 controls) were evaluated in the Clinics of Periodontology, Faculty of Dentistry, Cumhuriyet University. The examination included full mouth pocket depths, a Loe and Sillness Gingival Index score measurement, pocket depths (PD) and a panorex used to diagnosis periodontitis. Data were also extracted from patients' prenatal record and history through an administered questionnaire. The study results

indicated that periodontitis was an independent risk factor for preterm low birth weight newborns (OR 3.6; 95% CI [1.06-12.18]).

G. Tejada et al., 2012

The goal of this prospective case–control study was to assess the association between maternal periodontitis and early preterm delivery, adjusting for confounders. The sample consisted of 429 women who had periodontitis, using USA and European consensus definitions of periodontitis and early preterm delivery (<35 weeks gestation; *n*=84) at the maternity unit of the University Hospitals of Geneva, Geneva, Switzerland from 2007-2010 (among 4,000 annual hospital births). The control group consisted of women delivering at term (≥37 weeks; *n*=345). A postpartum periodontal examination diagnosed periodontitis based on the consensus guidelines. Tejada and others found that when using the USA definitions, there were increased numbers of mothers identified as having severe periodontitis, adjusting for main confounders (34.5% versus 17.72%; p=0.003; OR 2.38; 95% CI [1.36–4.14]). The authors concluded that early preterm delivery was associated with periodontitis when the USA consensus definitions were used; however, the European definitions were not sufficient to draw any conclusion due to the lack of "discrimination power."

H. Guimarães et al., 2012

The purpose of this study was to evaluate the association of maternal periodontitis and very low birth weight and low birth weight. In this study, 1,206 postpartum women (normal n=1,046; low birth weight *n*=145; very low birth weight *n*=15) were examined to identify periodontitis based on defined clinical criteria (two definitions) using probing depth and clinical attachment loss. Regression analysis showed that maternal

periodontitis was significantly associated with decreased mean birth weight (perio definition 1: p=0.027; perio definition 2: p=0.003. Using perio definition one, maternal periodontitis was associated with low birth weight and very low birth weight (OR 2.0; 95% CI [1.39–2.90]); periodontitis was associated with low birth weight (OR 1.65; 95% CI [1.15–2.36]) using perio definition two. Guimaraes and colleagues concluded that mean birth weight was lower in women diagnosed with maternal periodontitis resulting in very low and low birth weight associations.

I. Piscoya et al., 2012

The objective of this case-control study was to determine the relationship between maternal periodontitis and preterm birth. The sample consisted of 718 puerperae (post-partum women) who experienced a spontaneous delivery (premature n=360; full-term n= 358). Data from sociodemographic, obstetric (prenatal and perinatal) as well as periodontal data were obtained. For this study, periodontitis was defined using probing depths and attachment loss for 34 teeth. Piscoya et al. found that periodontitis was independently associated with preterm birth (OR 6.05; CI [3.01–12.16]), after adjusting for known confounders of age, income, premature birth history, premature membrane rupture, ruptured membranes, smoking, urinary tract infection, leukorrhea, pre-eclampsia, number of prenatal consultations and precarious housing. Piscoya and others concluded that periodontitis was strongly associated with preterm birth.

J. Basha et al., 2015

The purpose of this study was to explore the association of maternal periodontitis with preterm birth and low birth weight. Basha and others conducted this prospective study with 340 pregnant women (18-28 years old) in Karnataka, India. Surveys and

periodontal examination took place during the second trimester. Periodontal examinations followed the community periodontal index and clinical attachment loss guidelines. Of 307 subjects (33 lost to follow-up), 126 (41.04%) were diagnosed with periodontal disease. For subjects diagnosed with periodontal disease, 15.87% had a preterm birth and 34.25% had low birth weight. In the control group (no periodontitis), the rates of preterm birth and low birth weight were 9.39% and 18.78%, respectively. Basha and colleagues concluded that there was a strong association between periodontitis and adverse birth outcomes, adjust for confounders with OR 4.54; 95% CI [1.98–5.46] for preterm birth, and OR 5.32; 95% CI [2.01–6.79] for low birth weight.

K. Corbella et al., 2016

The purpose of this systemic review study was to examine periodontal status as an independent risk factor for adverse pregnancy outcomes of preterm birth and low birth weight along with other systemic conditions. Data were collected by evaluating case-control studies from MedLine, Embase and Cochrane databases, where the focus of the study was pregnancy outcomes and periodontal status. A total of 22 studies (among 422 screened) accounting for a total of 17,053 subjects were included. Corrections were made for methodology biases and heterogeneity assumptions. The authors reported an existing but low association between periodontitis and adverse pregnancy outcomes.

2.4.2 STUDIES FINDING NO ASSOCIATION OF PERIDONTITIS AND ADVERSE PREGNANCY OUTCOMES: PRETERM BIRTH AND LOW BIRTH WEIGHT

A. Michalowicz et al., 2009

This study examined whether periodontal disease progression during pregnancy was associated with adverse birth outcomes. They used clinical data and birth outcomes from the Obstetrics and Periodontal Therapy Study. The randomized sample grouped pregnant women into two groups: periodontal treatment before 21 weeks of gestation (n=413; treatment group) or after delivery (n=410; control group). All study participants had periodontitis at baseline. Clinical attachment loss and bleeding upon probing were used to define periodontitis progression, comparing birth outcomes between non-progressing and progressing groups. These authors found that there were no significant differences between gestational age distribution and mean birth weight (3,295 versus 3,184 grams, p=0.11) of women with and without disease progression. Michalowicz and colleagues concluded that periodontal disease progression had no association with an increased risk for preterm birth or low birth weight.

B. Calabrese et al., 2010

The goal of this observational study was to estimate the association between periodontitis and preterm low birth weight. A sample of 120 pregnant women was selected from the University Hospital clinical setting in Italy. Clinical full mouth examinations were conducted by one periodontist who examined the entire sample, recording the following dental readings: Plaque Index (PI) and Bleeding Index (BI), Probing Pocket Depth (PPD), Recessions (REC), Bleeding on Probing (BOP) and

Clinical attachment level (CAL). Periodontitis was defined according to the European Consensus (2005) definition which included two thresholds (interproximal attachment loss >3mm in at least two non-adjacent teeth and presence of interproximal attachment loss >5 mm in >30% of teeth). Using these definitions, 33 women (27%) of sampled women were classified as having periodontitis. In terms of birth outcomes, 11% delivered low birth weight newborns and 9% delivered preterm low birth weight newborns. Calabrese and colleagues concluded that there was no association between periodontitis and adverse pregnancy outcomes, using either of the definitions.

C. Schenkein et al., 2012

The objective of this survey study was to examine the association between Aggressive Periodontitis (AgP) and mean birth weight of infants. Birth weight and other variables were collected from mothers diagnosed with AgP by an initial periodontal evaluation as well as prospective and retrospective birth outcome data. The control group consisted of the mothers' siblings (with no evidence of periodontal disease) and other recent mothers (unrelated and healthy orally). The sample was taken for survey data collected by the Virginia Commonwealth University Clinical Research Center for Periodontal Disease (n=452). Schenkein and others found that when comparing the control group and AgP patients, there were no significant differences in mean birth weights. Their results indicate that there is no evidence that AgP (different from chronic periodontitis) in the mother predisposes occurrence of low birth weight births.

D. Souza et al., 2016

The aim of this case-control study was to evaluate whether there is an association between maternal periodontitis and low birth weight. The sample included 951 mothers

(low birth weight *n*=269; normal birth weight *n*=682) from the Brazilian Unified Health System. Data were collected from questionnaires/interviews, hospital book records (birth weight) as well as a full mouth periodontal examination. Periodontal disease was diagnosed based on probing depths, clinical attachment loss and bleeding; periodontitis was 16.4% (case group) and 17.4% (control group). The authors adjusted for confounders: age, pre-gestational BMI, frequency prenatal visits, number of pregnancies, education, smoking and hypertension (Adjusted Odds Ratio (AOR) 1.00; 95% CI [0.61–1.68]). Souza et al. found that periodontitis was not associated with low birth weight (OR crude 0.92; 95% CI [0.63–1.35]) and they concluded that there was no association between maternal periodontal disease and low birth weight.

2.5 PERIODONTAL THERAPY IMPACT ON BIRTH OUTCOMES

Recent research is concerned with exploring the relationship between periodontal therapy and pregnancy outcomes. To explore the association, researchers examined the association of maternal periodontal therapy and improved birth outcomes. Intervention studies and systematic reviews have been conducted to determine the beneficial impact of non-surgical periodontal therapy before and during pregnancy on birth outcomes (Fogacci et al., 2011; Hujoel et al., 2006; Michalowicz et al., 2006; Offenbacher et al., 2009; Tarannum & Faizuddin, 2007). The shared goal of these randomized clinical trials (RCT) is to determine whether periodontal therapy during pregnancy decreases the risk for undesired birth defects (Iheozor-Ejiofor et al., 2017). The objective of these studies was to determine whether periodontal care utilization was associated with decreased odds of unwanted birth outcomes, adjusting for certain risk factors. Table 2.3 outlines maternal periodontal therapy studies.

There have been conflicting studies published on the effectiveness of periodontal therapy as well as the effect of cessation of periodontal care during pregnancy. In a meta-analysis (15 RCTs; *n*=7,161 participants) by Iheozor-Ejiofor and others, they concluded the impact of periodontal treatment on prevention of adverse obstetric outcomes of preterm birth and low birth weight was not clear due to the low-quality evidence of existing RCT studies (2017). They determined that the studies that met inclusion criteria for their study were at high risk of bias caused by dissimilarity in sample population baseline characteristics, participant attrition, or low number of events (wide confidence intervals) (Iheozor-Ejiofor et al., 2017). See Table 2.1 for studies which support an association and Table 2.2 for studies which do not support an association of periodontal therapy and incidence of preterm birth or low birth weight.

Hujoel et al., in a population-based case-control, examined whether interruption of care for chronic periodontitis during pregnancy increased the risk of low birth weight infants (Hujoel et al., 2006). The population consisted of all women who had known eligibility for dental insurance both prior to and during pregnancy between 1993 and 2000 in Washington state. The sample consisted of all women with live births in Washington state with Washington Dental Insurance. Compared to the population, sample participants had greater dental insurance uptake, were older, more educated, smoked substantially less and were more likely to be White (Hujoel et al., 2006). The case group consisted of 793 low birth weight infants (< 2,500 grams) from a group of 3,965 infants. Ultimately, they found that periodontal care patterns alone were unrelated to low birth weight. Women receiving periodontal care had genetic (race) and

environmental characteristics (smoking, diabetes) that predisposed them to periodontal disease and birthweight (Hujoel et al., 2006).

Cessation of periodontal care during pregnancy was also not associated with an increased risk for a low birth weight, adjusting for smoking, diabetes, maternal age and race, compared to women with no periodontal care (OR, 0.96; 95% CI [0.60–1.52]) (Hujoel et al., 2006). Hujoel et al. found that patterns of care for chronic periodontitis were unrelated to increased risk of low birth weight. Possible limitations of this study were that women of lower socio-economic classes and the uninsured, who are at higher risk for low birth weight, were not included. Also, periodontal cessation reporting during pregnancy from health insurance data may not accurately depict the periodontal health of the expectant mother before or during pregnancy. Thereby, additional studies as well as periodontal intervention trials are needed to determine the association of periodontal therapy in never smokers (Hujoel et al., 2006).

Michalowicz et al., studied the effect of nonsurgical periodontal treatment on maternal periodontal disease status and the association with preterm birth and low birth weight risks (primary outcome: gestational age; secondary outcome: birth weight and SGA) (2006). A total of 823 pregnant women were randomly assigned (between 13 and 17 weeks of gestation) to two groups. The groups were scaling and root planning (SRP) before 21 weeks (treatment group n=413) or after delivery (control group n= 410 patients) (Michalowicz et al., 2006). The intervention for the treatment group included monthly tooth polishing and oral hygiene instructions. Michalowicz and colleagues documented preterm birth in 49 of 407 women (12.0%) in the treatment group and 52 of 405 women (12.8%) in the control group (2006). They noted that periodontal treatment

improved periodontal health but not preterm delivery risks. There were no significant differences between the treatment and control groups related to birth weight or SGA (fetal growth restriction). Later randomized clinical trials done also found that treatment of periodontal disease is safe during pregnancy, but did not prevent preterm birth or low birth weight (Macones et al., 2010; Newnham et al., 2009; Offenbacher et al., 2009).

Some authors reported a significant relationship between periodontal treatment and birth outcomes (Tarannum & Faizuddin, 2007). Tarannum and Faizuddin, in a randomized controlled clinical trial, determined that there was a significant effect of periodontal treatment on birth outcomes (2007). In this study, a total of 200 pregnant women were randomly assigned to treatment and control groups. Women completed a full-mouth periodontal examination with periodontal index recordings and non-surgical periodontal therapy for the treatment (during pregnancy) and control (after delivery) groups. Gestational age and infant birth weight outcomes were assessed. The dependent variables were preterm birth (>37 weeks gestation) and low birth weight (> 2,500 grams birthweight). Maintaining minimal characteristic differences in the treatment and control group at baseline, they concluded that non-surgical periodontal therapy can reduce the risk for preterm birth in pregnant women diagnosed with periodontitis (Tarannum & Faizuddin, 2007). Specifically, non-surgical periodontal therapy may decrease the levels of proinflammatory cytokines, C-reactive protein (CRP) levels and PGE_2 levels which are responsible for the inflammatory responses related to the onset of labor (Dortbudak et al., 2005; Farrell (nee Moore) et al., 2006; Pitiphat et al., 2006; Tarannum & Faizuddin, 2007).

Another randomized, controlled, blinded clinical trial by Jeffcoat et al. tested the association between successful periodontal treatment and the incidence of spontaneous preterm birth (2011). A total of 322 pregnant women (6–20 weeks of gestation) having periodontal disease were randomly assigned to receive SRP and oral health instruction (treatment group n=160) or only oral health (control group n=162). The primary outcome measure was spontaneous preterm birth (<35 weeks of gestation). Periodontal examinations before and 20 weeks after SRP was used to determine success of treatment "successful" (non-exposure) or "unsuccessful" (exposure) (Jeffcoat et al., 2011). Jeffcoat and colleagues found a highly significant difference between the incidence of preterm birth in the control group and the "successful" periodontal treatment determined at second examination (OR 6.02; 95% CI [2.57–14.03]). Jeffcoat and others concluded the success of periodontal treatment efforts may influence the relationship between preterm birth and periodontal therapy.

Possible explanation for the unsettled findings on the effectiveness of periodontal therapy may be attributed to the timing of periodontal therapy; late delivery of care may encourage present unsettled findings of the effectiveness of periodontal therapy. (Boggess & Edelstein, 2006). Michalowicz et al. noted that periodontal care during pregnancy may be too late affect birth outcomes due to the long-standing nature of chronic periodontal disease (2006). In this study, timing of care was consistent with two previous randomized trials (before 21 weeks) (Michalowicz et al., 2006). The majority of current research is limited to examining the association of birth outcomes where patients started or stopped periodontal therapy during pregnancy. One conjecture in support of improved outcomes is treatment of periodontal disease in the preconception period

(before pregnancy) or in very early pregnancy. Periodontal treatment offered too late in pregnancy or not delivered as a preventive measure may not be early enough to avoid the negative consequences of known oral inflammatory influences. Thus, treatment which takes place before pregnancy (for nulliparous women) or during the period between pregnancies (in multiparous women) could yield more promising results versus treatment in the second trimester as seen in the majority of studies (Agueda et al., 2008). Researchers believe that early treatment in the preconception period is required to have a significant impact on birth outcomes (Bobetsis et al., 2006; Boggess & Edelstein, 2006; Farrell (nee Moore) et al., 2006). Continued clinical trials and evidence-based research are needed to further explore the impact of periodontal therapy given the systemic link to cardiovascular disease, stroke, diabetes and adverse pregnancy outcomes (Iheozor-Ejiofor et al., 2017).

2.6 PRAMS STUDIES ON ORAL HEALTH AND DENTAL SERVICES DURING PREGNANCY

The majority of dental health perinatal PRAMS published studies are related to the following topics: dental cleaning, problem-focused dental care visits, maternal characteristics, race/ethnicity care disparities, oral health promotion interventions, barriers to dental services access, self-reported dental problems and oral health status, maternal oral health experiences, risk of preterm birth, oral hygiene instructions, dental caries, community interventions and overviews of the design and methodology of PRAMS. For this dissertation, 50 PubMed oral health studies using PRAMS data were reviewed. Nine predominant PRAMS studies which were related to oral hygiene counseling ("oral health counseling"), dental problems, problem-focused dental visits,

dental cleaning, maternal characteristics of maternal oral health experiences, and the relationship between the aforementioned and preterm birth were selected. See Table 2.4. Details about each study follow.

A. Naavaal et al., 2019

The purpose of this study was to identify the factors associated with preventive dental visits (dental cleaning) in Virginia mothers before and during pregnancy and examine the relationship of dental insurance with dental visits, using data from 2012–2014. The analytic sample consisted of 1,344 weighted respondents represented 293,608 mothers. Sociodemographic characteristics, health risk factors, chronic conditions, oral health knowledge and oral health promotion variables. Overall, 56% of mothers had a dental cleaning before pregnancy and 47% during pregnancy. The majority of mothers were non-Hispanic White (60%), aged 20-34 years of age (78%) with dental insurance (67%). Dental insurance (OR 3.5; 95% CI [2.17–5.67]) and oral health knowledge (OR 2.8; 95% CI [1.42–5.48]) were associated with dental cleaning before pregnancy. Dental cleaning during pregnancy was associated with having dental insurance (OR 5.8; 95% CI [2.80–11.97]), history of dental cleaning before pregnancy (OR 20.72; 95% CI [11.14–38.54]), and oral hygiene instructions during a dental visit (OR 12.37; 95% CI [7.31–20.93]). Authors concluded that the use of a preventive dental visit (dental cleaning) before and during pregnancy in Virginia was low. Therefore, efforts to improve preventive services usage before pregnancy, access to dental insurance, and health care provider education interventions can impact dental cleaning during pregnancy.

B. Muralidharan & Merrill, 2019

The aim of this Utah PRAMS study of mothers (*n*=2,793), using data from 2014-2015, was to identify the level of dental care received during pregnancy and factors associated with care. They found that prenatal oral hygiene instructions where a dentist or health care worker talked with them about how to care for their teeth and gums, dental knowledge of the importance of oral care during pregnancy, and dental insurance uptake during pregnancy were positively associated with dental care. This study examined oral hygiene self-care instructions given during a dental visit by a dental or other health care worker in pregnancy as "oral health counseling." They found that 51.4% of mothers reported oral hygiene instructions. Dental knowledge (importance of caring for their teeth and gums) during pregnancy (97.4% versus 87.6%, $p < 0.0001$) was associated with dental cleaning during pregnancy and more common among those that had oral hygiene instructions (95.2% versus 82.8%, $p < 0.0001$). Mothers who knew the importance of care (91.2%) were 1.4 (95% CI [1.1–2.0]) times more likely to have a dental cleaning (during). Among those that knew it was important to care for their teeth and gums during pregnancy, 58.8% completed a dental cleaning during pregnancy. In this study, 18.8% reported a dental problem during pregnancy. Among mothers who reported a problem-focused dental visit, 70% also reported that a dental/health care worker talked with them about how to care for their teeth and gums. Of those who reported a need for a problem-focused visit, 74.5% visited the dentist during pregnancy. Dental insurance was also found to be associated with care receipt. Those with dental insurance during pregnancy (76%) were 1.9 (95% CI [1.5–2.4]) times more likely to have a dental cleaning and 1.6 (95% CI [1.2–2.2]) times more likely to experience a problem-focused visit in pregnancy.

They concluded that their findings support the importance of oral health education for patients and providers on the safety and necessity of dental care during pregnancy.

C. Chenwi & Savitz, 2018

The aim of this study was to examine the distribution of preventive dental care for mothers in Rhode Island (*n*=4,687) between 2012- 2015. The variables preventive dental care usage and race/ethnicity were used to examine population differences in preventive dental care services utilization. Preventive dental care was studied as whether or not a mother went to a dental clinic for a problem, needed to see a dentist for a problem, received a dental talk about how to care for their teeth and gums or had a pre-established understanding of the importance of oral prevention. Hispanic mothers had a higher likelihood for completing "preventive dental care" during pregnancy compared to the Non-Hispanic White population (AOR 1.38; 95% CI [1.09–1.74]). Non-Hispanic other (AOR 0.59; 95% CI [0.45–0.78]) and non-Hispanic Black populations (AOR 0.55; 95% CI [0.39–0.78]) had lower odds of preventive dental care compared to the non-Hispanic White population. Not receiving WIC during pregnancy (AOR 1.83; 95% CI [1.42–2.36]) was also associated with increased odds for obtaining preventive dental care during pregnancy. They found that mothers who were Hispanic and had more than 12 years of education had higher odds for preventive dental care receipt compared to non-Hispanic Whites. White women, more than 34 years of age, had no WIC and had a yearly income more than $52,001 were more likely to receive preventive oral health care during pregnancy compared to their respective counterparts. They concluded that dental and medical collaboration between dental and obstetric teams is encouraged to increase the number of women who receive preventive dental services.

D. Singhal et al., 2014

The objective of this study was to assess prenatal dental care needs, utilization and prenatal oral hygiene instructions ("oral health counseling") during pregnancy to identify the factors associated with having a dental visit and unmet dental need during pregnancy. This study examines Maryland women (n=4,537) who delivered a live infant during 2001–2003. Self-reported dental problems, dental visits and receipt of oral hygiene instructions were studied in a population where the majority of mothers were married, non-Hispanic White, between 26 and 35 years of age, with more than 12 years of education and an annual household income of over $40,000. Authors found that in spite of reported needs and current oral health recommendations less than half of pregnant women had a dental visit during their pregnancy, as well as one-third of women having unmet dental care needs (reported a problem but no dental visit during pregnancy). Less than half of sampled mothers reported visiting a dentist during pregnancy (48%) or oral hygiene instructions where a dentist or other health care worker talked to them about how to take care of their teeth and gums (48 %), while 25% of all women reported a dental problem during pregnancy. Among those who had a dental problem, 67% completed a problem-focused dental visit. Among those without a dental problem, 41% visited the dentist. Multivariate modeling revealed that racial minorities, unmarried women and those with annual income less than $40,000 were least likely to have a dental visit. Women who were unmarried, had low annual income, were above age 40, reported unintended pregnancy and received prenatal care later than desired were all most likely to have unmet dental needs. Their findings highlight the need for oral health interventions which improve dental care during pregnancy in this Maryland population.

E. Umer et al., 2016

The purpose of this study was to examine the association between sociodemographic, economic and health-related lifestyle factors and the receipt of pre-pregnancy dental cleaning in West Virginia mothers (*n*=3,050). Using data from 2009-2010, they found that approximately 47% of women visited a dentist during the 12 months before pregnancy. Results showed that pre-pregnant non-Hispanic White women were more likely to complete a dental cleaning compared to women from other races and ethnicities (OR 1.75; 95% CI1.01-3.04). Mothers with some college (OR 1.79; 95% CI [1.22-2.62]), teenage mothers (OR 2.75; 95% CI [1.86-4.06]), privately-insured (OR 2.65; 95% CI [1.98-3.55]) and those with unintended pregnancies (OR 1.3; 95% CI [1.04-1.64]) were more likely to have dental cleaning before pregnancy compared to women with less than a high school education, aged 20-29, uninsured and whose current pregnancy was unintended. They concluded that policy development to promote oral health should include identified factors associated with dental cleaning among women of child-bearing age.

F. Thompson et al., 2013

This Maryland study examined factors related to preventive dental care utilization before and during pregnancy. Data were collected from Maryland PRAMS of all live births during 2004-2008 (*n*=6,171). Employing multinomial logistic analyses, Thomas et al. assessed the predisposing and enabling factors associated with self-reported dental cleaning before and during pregnancy. White women (37%), older than 35 (38%) with more than 12 years of education (42%), intended pregnancies (35%) and those who received prenatal oral hygiene instructions (53%) were most likely to have a dental

cleaning before and during pregnancy. Thompson and colleagues found that women who responded "yes" to oral hygiene instructions during pregnancy were significantly more likely to have their teeth cleaned during pregnancy. Women who reported physical abuse twelve months before or during pregnancy (10%) without oral hygiene instructions during pregnancy (8%) were least likely to have a dental cleaning during both time periods. They reported that women with less than a high school education or a history of physical abuse along with non-Hispanic Black and Hispanic women were all less likely participate in preventive dental services before and during pregnancy. Additionally, lack of health insurance in early pregnancy was associated with notably lower rates of hygiene usage before and during pregnancy. Maternal study control variables (predisposing) were maternal age, race, education, marital status, smoking history, physical abuse history and pregnancy intendedness. Enabling factors were health insurance, physical abuse during pregnancy, prenatal oral hygiene instructions by a dental or other health care provider and prenatal care initiation. There were four different levels of preventive care; "No cleaning before or during pregnancy" served as the reference group. This study concluded that improved incorporation of oral health into obstetrics, especially among racial minorities, could be beneficial to both the health of the mother and her unborn child. They believed that to accomplish this goal, the importance of dental education, prevention and services usage should be included in community, state-wide, and national legislation and agendas.

G. Hwang et al., 2012

This quantitative study, using 2004–2006 data, investigated the association between maternal oral health encounters during the peripartum period and the risk of preterm delivery (<37 weeks). Analyzing three standard oral health questions, the 10

states included reflected a ≥70% weighted response rate. Non-Hispanic White, Non-Hispanic Black, and Hispanic women were included in the study. Weighted percentages and standard errors were used for all analyses (*n*=35,627). Preterm birth was the outcome of interest. Study control variables were the following socio-demographic factors (predicting dental utilization and preterm delivery): age at delivery, maternal education, annual household income, health insurance status (before pregnancy), timing of the first prenatal visit, total number of prenatal visits and maternal smoking status. Control variables for peri-partum morbidities were multiple gestation, diabetes, hypertension, placental problems (i.e. placental abruption or previa), and kidney/ bladder infections. After adjusting for known confounders, Hwang and others found that mothers not receiving dental care and not having a dental cleaning during pregnancy were at increased risk for giving birth prematurely (OR 1.15; CI [1.02–1.30]; OR 1.23; CI [1.08–1.41]) (2012).They also noted that among women with dental problems, not having a problem-focused visit was associated with higher risk of preterm birth (OR 1.28; CI [1.02-1.59]). Hwang et al. noted that periodontal treatment taking place in the second trimester may be too late to have substantial health impacts on oral disease status or preterm birth.

H. Center for Public Health Statistics and Informatics, 2011

The Center for Public Health Statistics and Informatics in the Ohio Department of Health from 2006-2008, using the Ohio PRAMS data, performed bivariate analyses of maternal characteristics and receipt of dental care during pregnancy. Researchers found only 40% of Ohio mothers reported oral health services during pregnancy. Specifically, non-Hispanic Black mothers had lower dental utilization rates during pregnancy when

compared to non-Hispanic White mothers. Medicaid recipients as well as unmarried or younger women were also less likely to obtain dental care. In contrast, mothers having more than 12 years of education were more likely to have dental services during pregnancy when compared to those with 12 or fewer years of education. Women giving birth to normal birth weight infants were also more likely to have dental services.

I. Lydon-Rochelle et al., 2004

This cross-sectional study, surveying Washington state residents who gave birth in 2000, tested the associations between risk factors responsive to intervention and the probability of dental care service usage during pregnancy. Using Washington State Department of Health PRAMS data, Lydon-Rochelle et al. examined associations between risk factors and dental care use during pregnancy according to self-reported dental problems. They also evaluated the relationship between risk factors and of reported dental problems according to receipt or nonreceipt of dental care. These authors examined dental utilization during pregnancy, classified by dental problem status, for risk factors of maternal age, marital status, race/ethnicity, educational level, income, parity, body mass index, smoking status (during the final three months), infant birth weight and gestational age. Fifty-eight percent did not report any dental care during pregnancy. Those with no dental problems and no dental cleaning had a greater risk for tobacco usage, obesity and lack of oral health counseling. Conversely, among mothers receiving oral health services, women who reported dental problems were more likely to be low income and Medicaid insurance recipients than women with no self-reported issues. The authors concluded that there is a need for oral health education, enrichment and guidance for obstetric care providers.

2.7 DENTAL CLEANING (DC) AND COMMUNITY WATER FLUORIDATION (CWF)

Data on the possible effect of DC and CWF on pregnancy outcomes is limited. Although cost-effective, the use of fluoride in the prevention of dental caries as well as the health benefits of CWF during pregnancy is not well substantiated (Zhang et al., 2019). In a Massachusetts PRAMS cross-sectional study by Zhang et al. from 2009 to 2016, they examined singleton live births (n=9,234) where the outcome was preterm birth. The exposures were: (1) dental cleaning alone during pregnancy; (2) CWF alone; and (3) dental cleaning and CWF combined (DC–CWF) (Zhang et al., 2019). The reference group consisted of women who did not have a dental cleaning during pregnancy nor CWF. They found that the overall prevalence preterm birth was 8.5%. In total, 58.7% of women had dental cleaning during pregnancy, and 63.6% lived in CWF areas (Zhang et al., 2019). Post confounder adjustment, the associations between dental cleaning alone and preterm birth (ARR 0.74; 95% CI [0.55–0.98]), and DC–CWF and preterm birth were significant (ARR 0.74; 95% CI [0.57–0.95]). The association between CWF alone and preterm birth was not significant (ARR 0.81; 95% CI [0.63–1.05]). Zhang and others concluded that the prevalence of preterm birth was lower in pregnant women who had DC only and DC–CWF (2019).

2.8 DENTAL CARIES IN MATERNAL AND CHILD ORAL OUTCOMES

Expectant mothers have increased incidence of gastric acid release into the oral cavity through vomiting and acid reflux. Vomiting contributes to decreased oral pH causing increased acidic environment and amplified susceptibility to dental caries or cavities. Adding to the problem, pregnancy food related behavior changes such as

increased food cravings, snacking and consumption of sugary foods also make pregnant women more susceptible to dental caries.

Studies show that systemic infection in the mother during pregnancy can be transmitted to the unborn fetus (Basha et al., 2015; Han et al., 2010). The rate of dental caries throughout the child's life is influenced by the oral health status of the mother during the prenatal period (Featherstone, 2008; Moimaz et al., 2014; Weintraub et al., 2010). The notion of childhood oral health starting in pregnancy is also supported by the American Academy of Pediatric Dentistry, who issued guidelines emphasizing the importance of maternal oral health and anticipatory guidance (Steinberg et al., 2013). Dental caries is an important oral disease for women of child-bearing age with regards to its maternal-child health connection (Boggess & Edelstein, 2006; Featherstone, 2008; Weintraub et al., 2010). High levels of cariogenic bacteria in mothers can lead to increased dental caries in the child (Silk et al., 2008). Mothers with extensive tooth decay and increased levels of salivary streptococci mutans will more effectively transmit infection (Boggess & Edelstein, 2006). The likelihood of transmitting infection to offspring is predictable based on the consistency of cariogenic oral flora in a mother's mouth over a period. Consequently, a woman's caries risk before and during pregnancy anticipates the caries rate during the child's first years of life (Boggess & Edelstein, 2006; Weintraub et al., 2010).

Prevention measures and quality dental care during pregnancy potentially decrease poor prenatal outcomes and the probability of Early Childhood Caries (ECC), the most common chronic condition in childhood. Data from the 1999-2004 National Health and Nutrition Examination Survey (NHANES) shows that one in four U.S.

women of childbearing age (15-44 years) are diagnosed with a minimum of one untreated carious tooth surface. These findings are worsened among socioeconomically disadvantaged women (Steinberg et al., 2013). According to Silk et al., high levels of cariogenic bacteria in mothers can lead to increased dental caries during childhood (2008). ECC has many deleterious outcomes for affected children. Among those are tooth decay, pain, systemic infection, missed school days and lowered ability to thrive in the classroom (Vamos, Thompson et al., 2015).

In a study conducted by Dye et al., using data from the Third National Health and Nutrition Examination Survey along with birth certificate records, the authors explored the maternal-child oral health status relationship (2011). This study focused on the child's caries experience and untreated caries status along with the mothers' untreated caries status. Tooth loss status together with additional control variables such as race, poverty status and age were included. Using collected data, they performed regression analyses on over one thousand mother/child pairs for children aged two through six years of age and found that there were elevated levels of childhood caries in children of mothers with dental caries when compared to mothers with no caries (untreated/treated) (Dye et al., 2011). Dye et al. concluded that the oral health status of the mother provides a significant forecast of the oral health status of their offspring due to the maternal child health connection (2011).

A similar relationship was observed in studies by Weintraub et al. (2010). In their study, they hypothesized that a mother's untreated caries was associated with increased likelihood, controlling for other factors such as demographics, with their child's (children < 18 yrs. old) untreated caries rate and severity (Weintraub et al., 2010). This population-

based study was conducted in a rural, primarily Hispanic, California community using interviews and dental examinations. They concluded that maternal untreated caries nearly doubled the risk of childhood cavities and increased the severity of dental decay by three surfaces (Weintraub et al., 2010). Boggess et al. also noted that women with low caries activity and salivary cariogenic flora were associated with lower caries rates in children (2006).

Interventions before, during and after pregnancy are scientifically supported in their effectiveness to reduce caries transmission (Boggess & Edelstein, 2006). Caries risk assessments guide practice implications for preventive plans for children (Dye et al., 2011). Moreover, information acquired pertaining to the oral health of the mother is useful in dental assessment to determine childhood caries risk (Dye et al., 2011). Every pregnant woman should be screened, counseled, then referred for dental treatment when required (Silk et al., 2008).

2.9 SAFETY OF DENTAL CARE IN PREGNANCY

According to the National Institutes of Health, the risk of miscarriage sooner than 20 weeks of pregnancy was between 15% and 20% among women who were aware of their pregnancy (Steinberg et al., 2013). Dental treatment was not found to increase the risk of miscarriage nor be a teratogen (any agent causing changes in the fetus) during pregnancy (Hemalatha et al., 2013; Steinberg et al., 2013). The risk of teratogenicity (the ability to cause birth defects) occurs prior to 12 weeks gestation (Steinberg et al., 2013). Dental and imaging procedures, medications or other medical treatments were not found to cause teratogenesis during this time (Hemalatha et al., 2013). Patients who received restorative treatment, extractions or root canal treatment therapy during the second

trimester of pregnancy were not associated with increased adverse birth outcomes rates compared to patients without treatment (Steinberg et al., 2013).

2.10 ORAL HEALTH CLINICAL PRACTICE GUIDELINES FOR PREGNANT WOMEN: ABSENCE OF PREVENTIVE CARE GUIDELINES

For over 10 years, a number of state organizations have distributed evidence-based guidelines on perinatal health, including California, New York, South Carolina and Washington (Sanders et al., 2017; Steinberg et al., 2013). As a result of these references as well as increased medical literature on the importance of oral health, the first national recommendations for pregnant women were issued in 2012. This national consensus statement and workgroup were sponsored by the American College of Obstetricians and Gynecologists (ACOG), American Dental Association (ADA) and the Maternal and Child Health Bureau of the Health Resources and Services Administration (MCHB) (Oral Health Care During Pregnancy Expert Workgroup, 2012; Vamos, Thompson et al., 2015).

The ACOG, ADA and MCHB report that dental care is safe and effective throughout all three trimesters of pregnancy, and should not be withheld because of pregnancy (American Academy of Pediatrics & American College of Obstetricians and Gynecologists [ACOG], 2012; Hemalatha et al., 2013; Kandan et al., 2011; Kumar & Samelson, 2009; Steinberg et al., 2013). According to published evidence-based guidelines, “Oral Health Care During Pregnancy: A National Consensus Statement Committee Opinion 569” and “Oral Health Care During Pregnancy and Through the Lifespan Oral Health Care,” health professionals should include oral health during the prenatal exam and recommend appropriate treatment to all pregnant patients (The

American College of Obstetricians and Gynecologists [ACOG] Committee on Health Care for Underserved Women, 2013; Oral Health Care During Pregnancy Expert Workgroup, 2012). During the initial prenatal visits, health care providers should assess a woman's oral health and educate patients on the relationship between oral and systemic health. Patients should also be informed of any clinical findings that require immediate attention while they are reassured about the safety of oral health services usage during pregnancy (American Academy of Pediatrics & ACOG, 2012). During pregnancy, standard diagnostic, preventive, diagnostic and restorative dental treatments, including periodontal therapy are considered safe and not attributable to adverse birth outcomes (American Academy of Pediatrics & ACOG, 2012; Kandan et al., 2011). However, there are no specific guidelines requiring oral health counseling or preventive oral care (dental cleaning) during pregnancy.

2.11 NATIONAL DENTAL UTILIZATION DURING PREGNANCY

In the United States, dental utilization rates during pregnancy are 23% to 43% (Lydon-Rochelle et al., 2004). A study by Gaffield et al., using PRAMS data from 1998, examined trends in U.S. oral health utilization services (2001). This study investigated dental care usage during pregnancy in four U.S. states. Mothers were interviewed within one year of giving birth. Gaffield et al. found that dental care utilization ranged from 22% to 34% (2001). In three of the four states, 12%-25% of respondents reported experiencing a dental problem and of those who had a problem only 44%-54% actually went for care (Gaffield et al., 2001). Research conducted using SC PRAMS data from 2004-2005 found that 60% of the pregnant women in South Carolina did not receive care, less than 40% received prenatal oral health education, and approximately 28% reported dental

complications during their pregnancy (Dobre et al., 2007). Another report using SC PRAMS data from 2012-2013 reported that less than 47% of South Carolina pregnant women received dental care, roughly 47% reported talking with a professional about oral health, and 21% indicated having a dental problem during pregnancy (Sanders et al., 2017). Of the 21% that answered "yes" to having a dental problem, 57% did not seek care (LaLa & Jones, n.d.).

National dental service utilization remains low with significant racial/ethnic disparities in maternal oral health behaviors (Hwang et al., 2012; Kaylor et al., 2010; Wall et al., 2012). In a multistate cross-sectional population-based surveillance study (n=35,267 mothers), Hwang and others found that compared to White mothers, Black and Hispanic women were less likely to ever have a dental cleaning (OR 0.64; CI [0.52–0.78]; OR 0.36; CI [0.29–0.46] respectively) or report a dental care during pregnancy (OR 0.87; CI [0.77–0.98]; OR 0.77; CI [0.64–0.91] respectively) (Hwang et al., 2012). In the same study, Black and Hispanic mothers were also less likely to have a dental cleaning before (OR 0.82; CI [0.72–0.94]; OR 0.60; CI [0.50–0.72] respectively) or during pregnancy (OR 0.68; CI [0.59–0.78]; OR 0.74; CI [0.61–0.90]) when compared to White mothers (2012). Barriers to oral health care utilization will be addressed in Section 2.13.

2.12 SYSTEMIC ORAL HEALTH DELIVERY ISSUES: A HISTORICAL AND POLITICAL REVIEW

Oral health care during pregnancy is often misunderstood and ignored by stakeholders such as providers, payers, and patients. These stakeholders may not have access to current evidence-based practice guidelines, through patient education or

professional care collaborations, to influence sound clinical and policy decision-making. At the individual level, there are many behavioral changes needed to improve oral health and utilization rates for the population. Even greater, reduction of systemic barriers associated with accessing oral health care improves health care for vulnerable target populations at large. Systemic issues associated with access to oral health care services include inadequate practice guidelines, deficient provider education and training, misguided patient beliefs, uninformed policy makers and insufficient payer financial support. All of these barriers reduce utilization and perpetuate a cycle of poor oral health outcomes, especially in pregnant women.

There are several documented barriers to dental care during pregnancy. Among the most noted are lack of provider knowledge, rejection of evidence-based practice guidelines, fear of malpractice legal proceedings, uptake and maintenance of adequate dental insurance, cultural and social myths, access to dental care and fetal safety limitations (The American College of Obstetricians and Gynecologists [ACOG] Committee on Health Care for Underserved Women, 2013; Hemalatha et al., 2013; Kandan et al., 2011; Kumar & Samelson, 2009). These barriers are perpetuated by the historical and political divide of medicine and dentistry. Despite their common origin, dental and medical services have developed as disconnected health care delivery systems.

In the United States, as a result of the historical separation of dentistry and medicine, dentistry is regarded as a separate practice and not a specialty service of medicine (Starr, 1982). Furthermore, dentistry emerged as an autonomous profession with different educational training, professional organizations and third-party payment systems ("Returning the Mouth to the Body," 2012; Starr, 1982). Systemically, the

historical and political divide between dentistry and medicine perpetuates existing barriers in access to oral health services, decreases service utilization and promotes an environment of underuse present in our current system ("Returning the Mouth to the Body," 2012; The American College of Obstetricians and Gynecologists [ACOG] Committee on Health Care for Underserved Women, 2013). Consequentially, the relationship of preventable chronic oral diseases, seen disproportionately in indigent populations, to overall health has long been ignored. Unnaturally the mouth, which serves as a mirror and gateway reflecting general health, has been separated from the body leading to profound underutilization patterns seen today (USDHHS, 2000).

Historical context exists for the formation of dentistry as an autonomous profession separated from medicine in the United States (McNeill, 1976; Starr, 1982). At present, dentistry is still not respected as a specialty of medicine. Moreover, it operates as a separate delivery system while ignoring its primary care linkages. Understanding the chronological events in the development of public health regulations and medical practice is essential to understanding the mouth's detachment from the body.

Authors McNeil and Starr provide historical context of this current separation. Both authors chronicle the social transformations of American civilization contributing to the development of medical practices and hygienic policies. According to McNeil, medicine began to make significant impacts on human survival rates and population growth around the 1850s (1976). These contributions improved quality of life for the population. Social transformations of the industrial revolution as well as major advances in communication and transport influenced the medical delivery system. Likewise, Starr outlines the rise of medicine as a sovereign profession. The quest for sovereignty often

involved eradicating competitors while striving for an elite status. Doctors did this by disqualifying competitors or sloughing off manual tasks to them. Conversely, according to Starr, the earlier village doctors built close relationships with their patients. The doctor would care for a farmer's livestock, tend to the family, pull teeth, sit all night with patients, and embalm the dead (1982). These tasks were later extended to dentists, nurses, and undertakers (Starr, 1982).

Dentistry developed as an autonomous profession because of the overabundance of oral disease and underabundance of qualified professionals to administer treatment. Furthermore, there was an accepted belief that dental work was mechanical in nature with no overall connection to the rest of the body (Starr, 1982). The health of the teeth was thought to have no influence on the human systemic well-being and function. These dominating views were in opposition to the future expansion of dentistry that resulted in improved education, clinical training and scientific-based research connecting oral health to overall health (Starr, 1982). In support of expansion, several influential leaders of the 1900s made attempts to connect oral health to systemic health. In fact, William Gies suggested that dentists should be called "oral physicians" in his 1926 Carnegie Foundation report (Geis, 1926). Gies, in writing about the adoption of an enlarged view of dentistry, would give rise to the accreditation of dentistry as a specialty of conventional medicine (1926). Despite efforts from Gies and others, closing the medical-dental delivery divide continues to be problematic even in the face of increasing awareness of oral-systemic health associations.

2.13 MEDICAL AND DENTAL COLLABORATION: BARRIERS TO ACCESS

Barriers to incorporating dental and medical care have historical, political and financial contexts. These impediments stem from traditions of education, practice, political behavior and insurance/payer methods. There are three major consequences that arise from the separation of the two institutions. These consequences are poor data management of patient records, diminished quality and continuity of care, and increased financial ambiguity.

First, there are issues in data collection and storage. There are separate statistical compilations of data for medical and dental conditions without unified analysis of present conditions (Archarya et al., 2012). The cultures of practice flow and tradition in medical and dental offices create a challenge in sharing patient information. Variances in statistical software are also problematic in the processing of referrals and patient clinical information (Archarya et al., 2012). Electronic patient record systems for medical and dental practice often have different objectives and languages. This lack of communication in data sharing fosters negative feelings among clinicians of medicine and dentistry.

Second, divisions between dentistry and medicine create environments where iatrogenic errors and reduced continuity are more likely. In practice, quality is reduced when a specialty of health care is conducted in solitary. The patient may suffer from overuse, for example excessive testing and misdiagnosis, when practitioners do not communicate. Many patients who use the Emergency Department (ED) as their dental home may present repeatedly to the ED. These visits usually stem from untreated dental caries which lead to abscess and infection. Hospitals are not equipped with proper dental staffing and often use nondefinitive and palliative treatment to treat preventable dental

complications. To compound this problem, physicians receive little or no training in oral health procedures; likewise, dentists receive inadequate training in integrative multisystem medical care ("Returning the Mouth to the Body," 2012). Thereby, a significant barrier to prenatal oral care is insufficient knowledge about the importance of dental care in pregnancy (Le et al., 2008; R. S.-Y. Lee et al., 2010; Saddki et al., 2010).

Third, medical and dental financing systems are completely divided. Separation of insurance policies for medical care and dental coverage has been the norm since the 1960s (Guay, 2006). Barriers to prenatal oral care included inability to pay for dental visits and lack of medical insurance (Center for Public Health Statistics and Informatics, Ohio Department of Health, 2011). Medical coverage through Medicaid is available; however, dental coverage is not always provided through Medicaid. States may elect to provide an adult Medicaid benefit providing select procedures low-income families, but many do not. Additionally, states display large amounts of fluctuation in the quantity and quality of services provided through Medicaid. Fortunately, children's dental benefits are more comprehensive and uniform across states. Children may receive government sponsored services through Medicaid, CHIP and State Exchanges (*Patient Protection and Affordable Care Act*, 2010). Lastly, adults may enroll in an employer-sponsored dental coverage plan. Individuals with part-time or no employment may not be eligible to receive employer-sponsored dental coverage plans. Many times, dental benefits are not offered or must be purchased as a separate plan. For these reasons, many dental plans are unaffordable and millions of Americans remain orally uninsured or underinsured.

As a result of the historical separation of medicine and dentistry, the dental system is not regarded as a specialty of medicine despite the primary care characteristics

it retains. This segregation enhances the barriers to dental financing leaving many uninsured and low-income individuals without options to affordable care. Thus, the products of segregation are poor data management of patient records, diminished quality/continuity of care, lack of transportation, reduced referrals, inadequate access and increased financial ambiguity (Le et al., 2008; R. S.-Y. Lee et al., 2010; Saddki et al., 2010). These issues foster an atmosphere where without major changes a disjointed delivery system continues.

2.14 HEALTH REFORM DURING THE STUDY PERIOD

The Patient Protection Affordable Care Act (PPACA), signed into law on March 23, 2010, did not legally require adults to have dental insurance. In this healthcare legislation, oral health services were not classified as Essential Health benefits. To obtain benefits through the Health Insurance Marketplace, there were two ways to obtain dental insurance coverage: marketplace health plans or stand-alone dental plans. Medicaid dental coverage was also available for individuals who qualified. Statewide, there is considerable variation across Medicaid programs related to dental services coverage and qualification guidelines. A number of states solely offer emergency dental benefits to adults, and therefore do not cover annual exams, preventive care or routine care (Kaiser Family Foundation, 2019). In South Carolina, low-income pregnant women may be Medicaid eligible through Optional Coverage for Women and Infants. Qualified pregnant women are one of the five mandatory Medicaid eligibility groups (Centers for Medicare & Medicaid Services, 2020). Eligible pregnant women must meet the following requirements: U.S. citizen, medically verified pregnancy, income at or under 185 percent of the federal poverty level in 2012. Full Medicaid eligible expectant mothers qualify for

emergency dental services (SC Department of Health and Human Services, 2020). According to the South Carolina Department of Health and Human Services (SCDHHS) in 2013, South Carolina, one of 16 states, offered only emergency dental benefits through Medicaid under the PPACA legislation (SC Department of Health and Human Services, 2020). Near the end of this study period, beginning December 1, 2014, South Carolina Medicaid began providing preventive dental benefits to nearly 300,000 adult Medicaid clients. Residents 21 and older with full Medicaid benefits are eligible for cleaning, fillings and extractions, with a $750 annual maximum benefit.

2.15 DENTISTS, GENERAL PRACTICIONERS, OBSTETRICIAN GYNECOLOGISTS (OBGYN) AND MIDWIVES' KNOWLEDGE AND PERCEPTIONS

Misconceptions held by prenatal care practitioners, including dentists, general practitioners, OBGYN and midwives' or patients themselves may influence utilization. This literature review will examine studies assessing expectant mothers and all prenatal care providers' knowledge, attitudes and behaviors about the importance and safety of dental care during pregnancy. Studies pertaining to current knowledge, beliefs and care decisions of prenatal care practitioners in relationship to underutilization of oral health services were examined. Qualitative, quantitative, primary and secondary studies were included.

In 2012, George and others conducted a systematic review of English language studies; using five data bases world-wide, they examined studies about knowledge, attitudes, behaviors, and barriers in connection with oral health care throughout pregnancy. This heterogenous systematic review examined and summarized the current

literature on dental and prenatal practitioners' perception of dental services delivery during pregnancy. Within these nine studies, the following professions were included: dentists, general practitioners, midwives and obstetrician/gynecologists. In this review, George et al. found the following:

1. Dentists

Among dentists who acknowledged the importance of maternal oral health, there was still hesitation about the appropriateness and safety of dental procedures during pregnancy. Several studies cited dentists' negative feelings about dental treatment during pregnancy as a factor in dental services uptake for pregnant women (George, Shamim et al., 2012; Strafford et al., 2008; Vamos, Walsh et al., 2015; Vieira, 2015). In a Nebraska study (n=371) by Salama et. al. surveying General Dentists, they found that 50% of providers surveyed did not provide prenatal counseling (2010). The most common reason cited for the failure to provide counseling was that it was not a priority for the office and the patients were not interested (Salama, 2010).

2. General Practitioners, Obstetrician/Gynecologists and Midwives

General practitioners and obstetrician/gynecologists failed to advise patients to seek care during preconception and pregnancy visits. General practitioners and midwives infrequently included oral health care during a prenatal care visit and were poorly informed about the consequences of poor maternal oral health (George, Shamim et al., 2012; Wooten et al., 2011). Among medical providers, oral health counseling and dental referrals were not included as part of the patient's prenatal care check-list (George, Shamim et al., 2012; Wooten et al., 2011). For obstetrician/gynecologists, George et al. found that they were very knowledgeable about perinatal oral health and encouraged

dental treatment procedures during pregnancy; however, due to the lack of oral health training, appointment time constraints and competing health demands, gynecologists rarely emphasized oral health during the prenatal care visit (2012). Eighty percent of obstetricians did not use oral health screening questions in their prenatal visits, and 94% did not routinely refer all patients to a dentist (Strafford et al., 2008). Midwives also expressed similar concerns of time and lack of oral training.

3. All Prenatal Care Practitioners

Prenatal care practitioners themselves reported "lack of knowledge" as one of top barriers pregnant women face in seeking oral health services (R. S.-Y. Lee et al., 2010; Vieira, 2015). Finances, including uptake of dental insurance, reimbursement rates, fear of litigation and cost, were also considered as substantial barriers facing many expectant mothers (Lee et al., 2010; Vamos, Walsh et al., 2015) . Overall, this systematic review concluded that there was no concrete consensus between dentist and prenatal care clinicians regarding dental services utilization during pregnancy.

2.16 ORAL HEALTH COUNSELING

Pregnancy provides a unique opportunity for oral health prevention and maintenance counseling that is advantageous to two people simultaneously: mother and baby (American Academy of Pediatrics & ACOG, 2012). Preconception counseling has emerged as an area of interest within the medical and dental communities because of the prospects it offers for promoting well-being for women and their children (Jackson et al., 2015). The nature of pregnancy gives providers a chance to teach women about achieving and maintaining good oral health while they are cognitively more amenable to change (The American College of Obstetricians and Gynecologists [ACOG] Committee on

Health Care for Underserved Women, 2013; Boggess & Edelstein, 2006; USDHHS, 2000; Vamos, Walsh et al., 2015). According to Boggess and Edelstein, maternal oral health counseling should educate women and their health care providers about the consequences of poor oral health and preventable oral diseases: periodontal disease and dental caries (2006). Effective oral health counseling should also emphasize the importance of dental health for mother and child as well as self-care behaviors at home (Kumar & Samelson, 2009). Educating women about the connection between their oral health and the health of their unborn child is an essential part of oral health practice intervention strategies.

Data on the range and scope that oral health is addressed in the context of prenatal care is scarce (Byrd et al., 2018). In a study by Byrd et al., researchers investigated Primary Care Physician (PCP) characteristics of providers who delivered oral health counseling to expectant mothers (2018). Oral health counseling provision (sometimes or rarely/never) were the primary outcome. The control variables of demographic/practice profile, oral health training, knowledge, attitudes, preparedness and clinical behaviors were assessed. They found that 233 out of 366 PCPs reported providing oral health counseling to pregnant women. Byrd and colleagues determined that providers who were more likely to provide counseling were female, underwent oral health training, and had positive oral health attitudes, knowledge and preparedness behaviors (Byrd et al., 2018). The authors concluded interventions which focus on provider attributes, oral health education and preparedness show promise in improving a pregnant woman's oral health and care.

Oral health prenatal counseling increases dental services utilization which is effective in the treatment of preventable oral health diseases (Lydon-Rochelle et al., 2004; Pihlstrom et al., 2005). Provision of oral health counseling by medical and obstetric providers is an easy, beneficial and low-cost intervention (The American College of Obstetricians and Gynecologists [ACOG] Committee on Health Care for Underserved Women, 2013; Boggess & Edelstein, 2006; Lydon-Rochelle et al., 2004). A cross-sectional population-based study by Lydon-Rochelle et al. examined factors associated with the likelihood of dental care use during pregnancy including prenatal, sociodemographic and health service factors amenable to intervention (2004). Using a stratified sample, they studied 1,592 respondents of the Washington PRAMS out of the 2,147 women who delivered a live-born infant in 2000. The participants were divided into two groups: women who did not report dental problems during pregnancy and those who did. Lydon-Rochelle and others examined the association of potential risk factors with receipt of dental care. They found that oral health counseling during pregnancy varied among the women who reported having dental problems during pregnancy and its absence was associated with a high risk of nonreceipt of dental care (OR 26.42; 95% CI [12.46, 56.02]) (Lydon-Rochelle et al., 2004). They also found that women who do not receive dental care during pregnancy are more likely to be obese or to smoke; therefore, the lack of dental care may be a marker for poor health (Lydon-Rochelle et al., 2004). The researchers concluded that there is a need for improved education and training of providers concerning oral health given the low rate of reported dental care counseling and association with increased utilization.

2.17 RESEARCH GAPS AND CONTRIBUTION OF THE CURRENT STUDY

2.17.1 PERIODONTAL DISEASE AND ADVERSE PREGNANCY OUTCOMES: DISSONANT FINDINGS

There is disagreement about the existence of the association between periodontal disease and adverse pregnancy outcomes (Souza et al., 2016). Since 1996, there have been clinical trials, observational studies, systematic reviews and interventional studies to collect evidence on the association between the clinical indicators of periodontal disease and the incidence of preterm or low birth weight births (Agueda et al., 2008). The results of these studies have been controversial and continued research is warranted in order to accept or deny a causal relationship (Basha et al., 2015; Michalowicz et al., 2009; Piscoya et al., 2012; Souza et al., 2016).

Recent systematic reviews found that there was sufficient evidence to support periodontal infection as a possible risk factor for preterm low birth weight infants; however, causality was unclear (Basha et al., 2015). According to Agueda and colleagues, the majority of intervention studies and systemic reviews support the association between maternal periodontitis and adverse pregnancy outcomes of preterm birth and low birth weight (2008). The association found in these studies did not imply causality as there may have been other factors which predispose mothers to adverse birth outcomes (Agueda et al., 2008; Piscoya et al., 2012). Differences between study results may occur because of non-homogenous study protocol leading to heterogeneity of sample groups. Heterogeneity can occur because of differences in the following: patient exclusion methodologies (external validity), periodontal examination timing, sample

maternal oral health at baseline and differences in adopted periodontal study definitions (Basha et al., 2015; Michalowicz et al., 2009; Piscoya et al., 2012; Souza et al., 2016).

First, dissimilarity in research finding on the connection between periodontitis and birth outcomes may be explained by variances in patient exclusion practices. In a study by Piscoya et al., Brazilian expectant mothers with the following conditions were left out: chronic diabetes, cardiac disease, systemic lupus, nephropathy and hypertension (before pregnancy), multiple pregnancy, uterine abnormalities and periodontal treatment during pregnancy. In their results, Piscoya and colleagues found that periodontitis remained strongly associated with prematurity preterm birth among sample patients, even after adjusting for possible confounders (2012). Guimaraes et al. excluded multiple pregnancies, mothers without live birth, spontaneous preterm labor, premature rupture of membrane, congenital anomalies, in vitro fertilization (IVF) and prematurity caused by pregnancy fetal and/or maternal factors (2012). Offenbacher et al. excluded pregnant patients younger than 18 years old and without a legal guardian, > 26 weeks gestation, multiple gestation, chronic hypertension, pregestational diabetes, heart murmur or heart valve disease, history of fenfluramine-phentermine use (without a normal echocardiogram), or any condition requiring dental antibiotic prophylaxis, human immunodeficiency virus (HIV), or births planned outside of the selected hospital for the study (2006). Offenbacher and colleagues found that maternal periodontitis, an independent risk factor for adverse birth outcomes, increases relative risk for preterm birth or spontaneous preterm birth (2006). The studies found a positive association between periodontal disease and birth outcomes.

Conversely, Souza et al. and Calabrese et al. did not find an association. Souza et al. excluded patients based on their medical histories with at least one of the following conditions: patients required dental antibiotic prophylaxis for dental procedures, periodontal treatment during pregnancy, less than four teeth or post-partum hospital stay greater than one week (2016). They concluded that there was no association between maternal periodontal disease and low birth weight. Calabrese et al. had nine exclusion criteria summarized as follows: Rh þ blood group, poor general health, medications during pregnancy other than dietary supplements of local/systemic antibiotic therapy for genito-urinary infections, multiple pregnancy, artificially conceived pregnancies (including fertility treatment), less than three prenatal visits (not including delivery), abnormal ultrasound scans or fetal development, and less than three teeth present in each quadrant (excluding third molars).

Another example of the variance in exclusion practices is age minimum and maximum (Corbella et al., 2016; Jacob & Nath, 2014). In a study by Corbella and others the age range of participants (13-36 years of age) could have caused an underestimation of the impact of periodontal disease on the adverse pregnancy outcomes. The inclusion of the lower age limit (13 years old) may change the impact of periodontal disease as both low and high maternal age are risk factors for adverse birth outcomes (Corbella et al., 2016; Jacob & Nath, 2014). Also, in a cross-sectional study by Guimarães et al. including women aged 14–46 years, advanced maternal age (known risk factor) may confound study outcomes (2012). Jacob et al. included mothers age 18-35 years to adjust for these age-related risk factors (2014). The results among both positive and negative association studies are difficult to compare because of the lack of uniform methodology in exclusion

practices. Although there are common exclusions to many studies such as multiple pregnancy or requirement for dental prophylaxis exclusion, there is no current consensus even between studies who documented similar conclusions concerning the association between preterm birth and low birth weight and periodontal disease.

Second, differences in study results may be explained by lack of homogeneity between sample groups of current studies as a result of periodontal examination timing (Corbella et al., 2016; Michalowicz et al., 2009). In contrast to the timing of Offenbacher et al., Michalowicz et al. in 2009 randomly selected women who received periodontal treatment before 21 weeks of gestation or after delivery. They conducted follow-up examinations between 29–32 weeks of gestation. Birth outcomes were compared between non-progressing and progressing groups (defined as > 3mm clinical attachment loss) in all individual women versus untreated controls. They found that the difference in newborn gestational age and mean birth weight was not statistically significant between women with and without disease progression. They concluded that periodontal disease progression was not associated with increased risk for prematurity or low birth weight. Michalowicz and colleagues noted that their examination timing may have not properly covered the increased risk for preterm birth or low birth weight infants (2009). They explained that last examination occurring at 32 weeks may have been too early and unrepresentative of the entire period of all preterm birth.

Third, heterogeneity of sample groups may also be found in the maternal periodontal oral health at baseline. Some studies did not specify the oral disease (periodontal) status at baseline; information concerning disease progression was thereby unavailable (Michalowicz et al., 2006; Offenbacher, Boggess et al., 2006; Offenbacher,

Lin et al., 2006). In a study by Offenbacher et al., researchers did not specify the baseline periodontal health. For this study, the authors noted that the association between pre-term birth and periodontal disease progression may only be present in previously healthy women (2006). Homogenous sample groups are needed to explore maternal periodontitis as a risk factor for adverse pregnancy outcomes, a relationship which may be present in some but not all populations (Souza et al., 2016).

Fourth, differences in study results may be explained by heterogeneity of adopted study definitions of periodontitis. Currently, there is no consensus regarding the investigative definition of periodontitis. A consensus is needed for results interpretation, sample comparisons, validation of clinical data, association strength measurements and statistical significance analyses (Corbella et al., 2016; Piscoya et al., 2012; Souza et al., 2016; Tejada et al., 2012). The following clinical measurements have been previously used in studies to define periodontitis: community periodontal treatment indexes, Periodontal Screening and Recording (PSR) scores, bleeding upon probing, depth of the periodontal sulcus or pocket (probing depth), and the clinical attachment loss readings. Variation among studies for the periodontal definition may also occur as a result dental site specificity, including the number, quadrant and location of teeth examined.

In a prospective case–control study by Tejada et al. assessing the association between maternal periodontitis and early preterm delivery (<35 weeks gestation) according to both U.S. and European consensus definitions (2012), periodontal examinations were performed on 345 women at the immediate postpartum period to identify periodontitis according to both consensus definitions. Tejada and colleagues found that all sampled women had periodontitis by the European consensus definitions;

however, when using the U.S. definitions, more cases had severe periodontitis than controls. They concluded that early preterm delivery is associated with periodontal disease when using the U.S. consensus definitions. Authors noted that the European definitions were insufficient due to the lack of discrimination power. To create more rigorous standards and precise measures of disease, some studies combine dental indicators or measurements of disease. These studies seek to reduce the possibility of obtaining false positive results and improve specificity (Corbella et al., 2016). Ultimately, the results of previous studies should be evaluated with caution due to the heterogeneity of periodontal disease definitions (Corbella et al., 2016).

This study will seek to address some of the heterogenous sample limitations of previous studies examining the association of periodontal disease as a mediating factor in birth outcomes. Each proposed reason along with this present study's contributions/relevance follow:

A. Patient selection and exclusion methodologies (external validity):

This population-based cross-sectional study will include all South Carolina mothers without exclusions of maternal risk factors associated with adverse birth outcomes, such as hypertension, diabetes, obesity, placental abruptions, chromosomal abnormalities or other related conditions. The exception is multiple births (plurality >1). Not excluding these risk factors, this research will control for known risk factors of preterm birth and low birth weight.

B. Proper controls:

During the multivariate analysis, the present study will control for predisposing, enabling, disabling and need factors as well as psychobiological and individual health

behavior and services utilization. See Figure 2.1 for details. Weighted data will represent the state-wide population and may be generalizable to states with similar demographics.

C. Periodontal examination timing, Sample maternal oral health at baseline and Differences in adopted periodontal study definitions:

This study does not address discrepancies in periodontal timing, maternal oral health at baseline or differences in adopted periodontal study definitions; nonetheless, survey reported oral health problems during pregnancy, dental utilization during pregnancy and dental cleaning before and during pregnancy will serve as proxy for oral disease. These variables will give a depiction of oral health status before and during pregnancy.

2.17.2 PRAMS RESEARCH GAPS AND NEED FOR SPECIFIC RESEARCH

There are four major contributions from this dissertation to current PRAMS research on maternal oral health utilization and birth outcomes. First, this work will add to the current knowledge base concerning the impact of oral health interventions (mutable factors), across medical and dental disciplines, on dental service utilization before and during pregnancy. Second, this research will conduce new information on the relationship between oral health status (proxied by dental cleaning and dental problem) on adverse outcomes of preterm birth and SGA, adjusting for previously undocumented psychobiological factors of maternal stress, psychological and physical abuse. Third, this work will include SGA in addition to preterm birth as an outcome variable. Fourth, this study will examine the independent association of dental insurance, a known predictor of usage, by including annual household income and financial stress variables previously unaccounted for in previous research.

There is a documented association of oral hygiene instruction ("oral health counseling") and dental utilization during pregnancy (Chenwi & Savitz, 2018; Hwang et al., 2012; Lydon-Rochelle et al., 2004; Muralidharan & Merrill, 2019; Thompson et al., 2013). To date, to my knowledge, there is no other maternal population-based study, including mothers representing the full spectrum of oral health status which examines the association between preconception oral health counseling by a medical provider and preventive dental utilization (dental cleaning). Previous PRAMS studies have examined the prevalence of oral hygiene instructions and its association with a dental visit (cleaning or problem-focused visit during pregnancy), adjusting for sociodemographic, predisposing and enabling factors. In these studies, the independent variable "oral health counseling" was researched as oral hygiene instructions given by a dentist or other health care worker during a dental visit (Chenwi & Savitz, 2018; Hwang et al., 2012; Lydon-Rochelle et al., 2004; Muralidharan & Merrill, 2019; Naavaal et al., 2019). In this case, the patient is already receiving dental care and the association of "counseling" cannot be properly tested; exposure and outcome are occurring at the same time.

This work will expand current literature analyses across medical and dental disciplines by examining preconception oral health counseling (advice by a medical provider to visit the dentist before pregnancy) and its association with dental utilization (dental cleaning by dentist or dental hygienist) before or during pregnancy. Additionally, current studies which examined oral hygiene instruction ("oral health counseling") during pregnancy did not adjust for psychobiological factors of maternal stress, psychological abuse or physical abuse that may prevail in various communities. Including these stress and abuse factors which are known barriers to care utilization may help to identify the

independent association of counseling (Abel et al., 2012; Kundu et al., 2014; Thompson et al., 2013; Vasiliou et al., 2016). This work will improve upon current studies by addressing missing confounding factors for preventive dental utilization as it relates to oral health interventions and treatment before and during pregnancy.

Related to adverse birth outcomes, two PRAMS studies have examined the relationship of dental problems and dental utilization during pregnancy with preterm birth (also called "preterm labor") (Hwang et al., 2012; Mattheus et al., 2016). These studies (see Section 2.6) also did not account for established relationship between maternal stress factors, psychological abuse or physical abuse and birth outcomes likely to distort the actual relationship between dental cleaning and preterm birth (Glover, 2014; Lima et al., 2018; Staneva et al., 2015). For low birth weight, Hwang et al. documented low birth weight as an infant characteristic "infant <2,500 grams" included in the univariate analysis but was not considered as an outcome variable of interest. Mattheus et al. did not include low birth weight in the univariate, bivariate or multivariable analyses. This work will add to this existing study by examining the relationship between dental utilization and low birth weight as a separate adverse birth outcome.

Lastly, some previous studies did not account for dental insurance, utilizing health insurance as a proxy for dental coverage (Hwang et al., 2012; Lydon-Rochelle et al., 2004). In 2012, a prenatal dental insurance uptake question was added to SC PRAMS Phase 7 survey. To improve upon more recent studies which adjusted for dental insurance, this research will test the independent impact of dental insurance specifically, by including financial stress and annual income as possible confounders not previously studied (Thompson et al., 2013).

2.18 THEORETICAL FRAMEWORK

For this study, the Andersen Health care utilization model was selected as the theoretical framework for variable selection and interpretation. The Behavioral Model of Health Services Use, developed in 1968, is a widely used model which was created by the U.S. health services researcher and medical sociologist, Ronald M. Andersen. Andersen's Behavioral Model has been used expansively in public health studies, especially the 1995 version most often applied in health services usage research. This model attempts to explain health care utilization including individual and population characteristics where a patients' needs coincide with the external health care environment. One study in particular, a systematic search and review, was conducted by Babitsch and others to assess the use and implementation of the Andersen model as the sole theoretic model. They found that the Andersen Model was frequently used as the theoretical background in the investigation of health services utilization having large variations in the categorization and operationalization of variables as well as modeled diseases (Babitsch et al., 2012). Additionally, this systematic review found that the majority of studies featuring the Andersen model used secondary data sets.

This study will also utilize secondary data to examine the perinatal oral health utilization behaviors, oral health interventions and perinatal birth outcomes of South Carolina mothers. For this reason, the Andersen Behavioral Model is the model of choice due to its multilevel design and appropriate incorporation of significant study variables and factors affecting oral health services usage. The model organizes the overall groupings of contextual classifications into individual and population characteristics that

are then divided into predisposing, enabling and need factors. These three major components as described as follows:

Predisposing factors. Contextual influences which predispose individuals to the use of health services include social and demographic factors. Predisposing factors are marital status, maternal education, maternal age, maternal race and Medicaid insurance (proxy for low SES).

Enabling factors. Enabling elements are conditions empowering services utilization. These factors include both financing and organizational influences. Enabling factors included oral hygiene instructions (by a dentist during pregnancy), oral health counseling by a medical professional (before pregnancy), prenatal health insurance, dental insurance uptake (during pregnancy), family income and rurality.

Need factors. The need elements are separated by levels of individual and population characteristics in later revisions of the Andersen Model. There is also a distinction between perceived need for health services (personal views and experiences, individual general health, functional state and illness symptoms) and evaluated need (professional assessments, objective measurements of a patients' health status and necessity of medical attention) (Andersen et al., 2007). Primary need factors are self-reported dental problem during pregnancy, perceived importance of oral health and pregnancy intendedness.

Using these three factors of predisposing, enabling and need, the Andersen Behavioral Model of Health Services Usage serves as a useful tool in explaining the role of professional interventions, such as counseling and referrals, in modifying health behaviors. Moreover, the Andersen Model explores the concept of mutability of enabling

factors. Enabling factors from the social or physical environment are services or aids that encourage the accomplishment of a healthier behavior. Highly mutable factors provide the most likelihood for success in increasing health promoting behaviors.

Policies and procedures which incorporate the provision of mutable elements such as oral health education and counseling by an obstetrician, primary care provider or other health care worker may well improve dental services utilization in the perinatal period. A coordinated effort between dental, primary care and obstetric/gynecologic disciplines to implement effective practice guidelines would increase maternal oral health service utilization and lead to improved health outcomes for both the mother and baby. This research seeks to bring awareness to oral health education, an effective and low-cost intervention with potentially significant impacts, on the oral health utilization and ultimately perinatal outcomes for expectant mothers.

Following the individual and population characteristics, the model continues with health behaviors and ultimately health outcomes. Biological Factors (previous history of low birth weight, previous history of pre-term birth, previous live births, hypertension, diabetes, medical risk factors, obesity/weight gain, newborn sex) and Psychobiological Factors (stress and physical abuse) were modeled. The control variables are expressed before the outcome variables (dependent variables) to show that they have been controlled for during the analysis of each independent variable.

In the model, personal health practices included drinking alcohol, smoking, exercise and vitamin consumption. Available preventive medical or dental treatment variables consisted of prenatal care initiation, preventive dental utilization (before or during pregnancy) and a problem-focused dental visit. Finally, the outcomes portion of

the model represents the evaluated health status of the patient. In this study, the variable outcomes are oral disease, preterm birth and SGA. Dental utilization is also considered as an outcome when evaluating the effect of dental counseling before pregnancy on dental utilization before or during pregnancy (see Manuscript I).

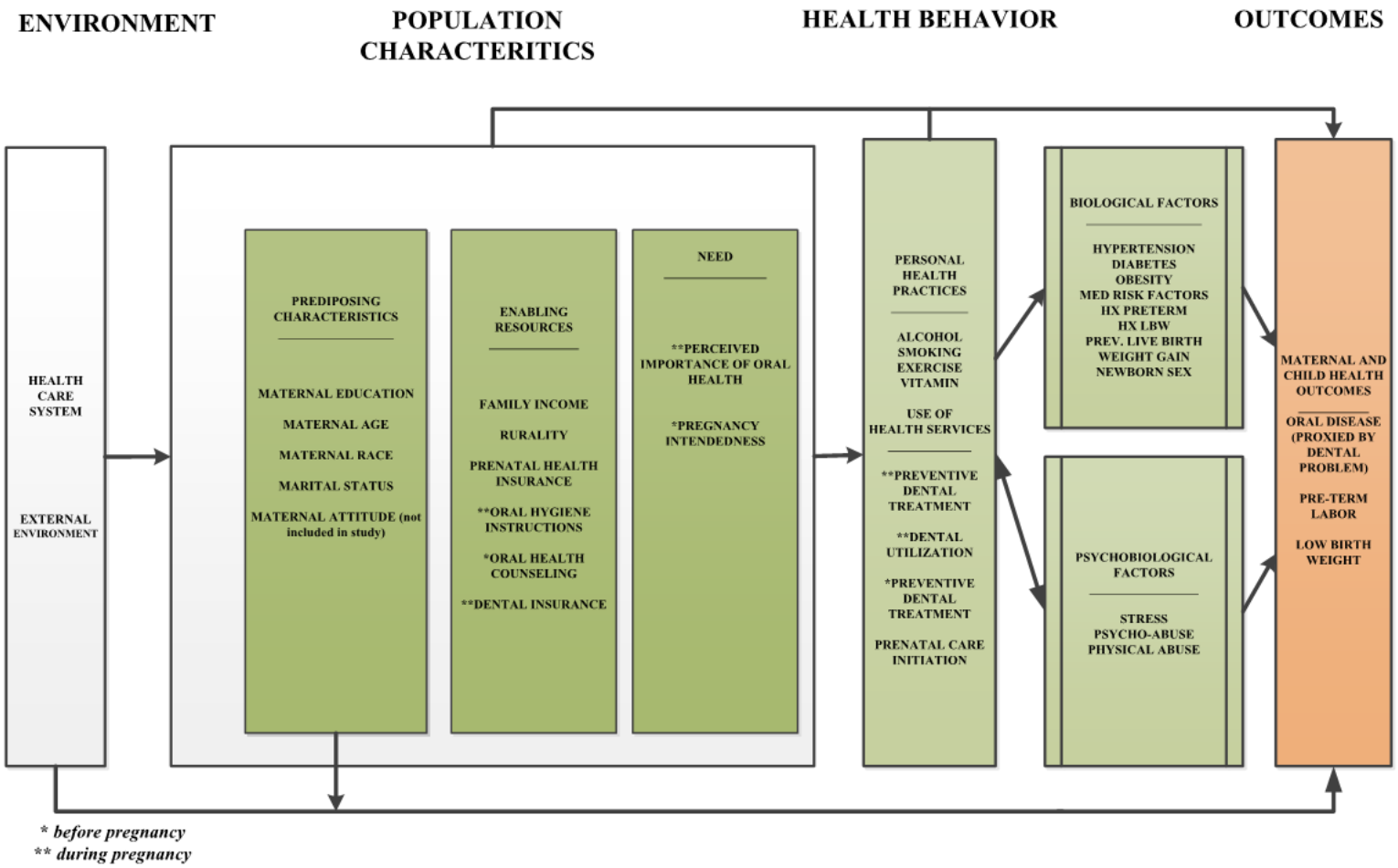

Figure 2.1. Adapted Andersen Healthcare Utilization Model.

Table 2.1: Studies Finding a Significant Association Between Periodontitis and Preterm Births or Low Birth Weight.

Reference/Setting/Timeframe	Sample	Results: OR/RR 95% CI	Conclusions
Radnai et al., 2004 "A Possible Association Between Preterm Birth and Early Periodontitis Pilot Study" Cross-sectional study, Hungarian National Health Service volunteers delivered at the University of Szeged, Department of Obstetrics and Gynecology *Timeframe not mentioned	**n:** 85 Postpartum women without any systemic disease **IG:** 41 preterm birth (threatening premature labor, preterm premature rupture of membranes, or spontaneous preterm birth, and/or the weight of the newborn was <=2,499 grams) **CG:** 44; delivery after the 37th gestational week, newborn's weight was >=2,500 grams	Preterm birth and Early Localized Periodontitis **OR:** 5.4600 **CI:** [1.7207-17.3244]	The results indicate that early localized periodontitis during pregnancy is an important risk factor for preterm birth. A significant association was found between preterm birth and early localized periodontitis.
Dortbudak et al., 2004 "Periodontitis, A Marker of Risk in Pregnancy for Preterm Birth" University of Vienna, Austria April 1999- July 2002	**n:** 36 women at risk for pregnancy complications and undergoing amniocentesis during 15^{th}-20^{th} week pregnancy	**OR:** 20.0 preterm delivery and periodontitis **CI:** [2.0–201.7] **OR:** 32.5:1 >60 CFU in sub-gingival plaque and preterm birth **CI**: [3.0–335.1]	Pregnant women with elevated amniotic fluid levels of PGE2, IL-6 and IL-8 and periodontitis are at high risk for premature birth.

Continued

Reference/Setting/Timeframe	Sample	Results: OR/RR 95% CI	Conclusions
Martins Moliterno et al., 2005 "Association Between Periodontitis and Low Birth Weight: A Case–Control Study" Carmela Dutra Maternity Hospital (public health service network) Rio de Janeiro, Brazil Timeframe not mentioned (Over a 14-month period)	**n**: 151 **IG:** 76 mothers (mean age 25.6 years), whose newborns' birth weight <2, and GA <37 weeks **CG**: 75 mothers (mean age 24.4 years), whose newborns birth weight >2,500 grams and with a GA >37 weeks	The significant associations with low birth weight newborns were periodontitis **OR:** 53.48 **CI:** [1.17; 10.36]	Periodontitis considered risk indicator for low birth weight in the sample.
Offenbacher, Boggess et al., 2006; Offenbacher, Lin et al., 2006 "Progressive Periodontal Disease and Risk of Very Preterm Delivery" Prospective multidisciplinary longitudinal study, Duke Obstetrics Clinic Enrolled 42-month period beginning in December of 1997	**n:** 1,020 pregnant women less than 26 weeks **CG:** 27.9% periodontally healthy **IG:** remaining mothers with antepartum gingivitis and periodontitis divided into 2 groups.	**CG**: preterm birth 11.2% versus moderate-severe periodontal disease: 28.6% (**ARR:** 1.6, **CI**: [1.1–2.3]) Antepartum moderate-severe periodontal disease: increased spontaneous preterm birth (15.2% versus 24.9%, **ARR:** 2.0, **CI:** [1.2–3.2]) Unadjusted rate very preterm birth: 6.4% periodontal disease progression 1.8% rate without disease progression (**ARR:** 2.4, 95% **CI:** [1.1–5.2])	Maternal periodontitis increases relative risk for preterm birth or spontaneous preterm birth. Periodontal disease progression (during pregnancy) independent risk factor for very preterm birth.

Continued

Reference/Setting/Timeframe	Sample	Results: OR/RR 95% CI	Conclusions
Pitiphat et al., 2007 "Maternal Periodontitis and Adverse Pregnancy Outcomes" Prospective U.S. cohort study of women first prenatal visit at Harvard Vanguard Medical Associates centers in E. Massachusetts Project Viva 1999-2002	**n:** 1,635 women who reported their periodontal status 72.7% White, 12.7% Black, 5.5% Asian, 5.5% Hispanic and 3.6% other race/ ethnicity, closely reflecting the profile of the U.S. population	**OR** associated with periodontitis 1.74**; CI:** [0.65–4.66] for preterm delivery and 2.11 **CI:** [0.76–5.86] for SGA individually. Preterm delivery and/ or SGA combined **OR:** 2.26 **CI:** [1.05–4.85]	Periodontitis is an independent risk factor for poor pregnancy outcome among middle-class women. Periodontitis is related with poor pregnancy outcome.
Marakoglu et al., 2008 "Periodontitis as A Risk Factor for Preterm Low Birth Weight" Case-control study in-patient women; Department of Family Physician at the Medical School of Cumhuriyet University, Sivas Province of Turkey *Timeframe not mentioned	**n**: 48 mothers, 20 preterm low birth weight deliveries were examined	Periodontitis **OR:** 3.6 **CI:** [1.06-12.18]	Periodontitis is an independent risk factor of a preterm low birth weight. Poor periodontal health status of the mother may be a potential risk factor for preterm low birth weight.

Continued

Reference/Setting/Timeframe	Sample	Results: OR/RR 95% CI	Conclusions
Tejada et al., 2012 "Association Between Early Preterm Birth and Periodontitis According to USA and European Consensus Definitions" Prospective case–control study at the maternity unit of the University Hospitals of Geneva, Geneva, Switzerland November 2007- March 2010	**n:** 84 women delivering between 22 and 346/7 weeks of gestation **CG:** women delivering at term (≥37 weeks) (*n*=345)	After adjustment for main confounders, the association between severe periodontitis and early preterm delivery persisted. **OR:** 2.38 **CI:** [1.36–4.14]	Early preterm delivery is associated with periodontitis with the USA consensus definitions. The European definitions were inadequate for the sample due to low discrimination power.
Guimarães et. al., 2012 "Very Low and Low Birth Weight Associated with Maternal Periodontitis" Cross-sectional study public maternity clinic, Minas Gerais, Brazil February 2004 to June 2005	**n:** 1,206 women who were examined at post-partum using two periodontitis definitions **CG**: birth weight, categorized as adequate (*n*=1,046) **IG**: low birth weight (*n*=145) and very low birth weight (*n*=15)	Ordinal logistic regression showed that maternal periodontitis was associated: Definition 2: low birth weight and very low birth weight **OR:** 2.0; **CI:** [1.39–2.90] Definition 1: low birth weight **OR:** 1.65; **CI:** [1.15–2.36]	Maternal periodontitis was associated with a decrease in mean birth weight, as well as with low birth weight and very low birth weight.

Continued

Reference/Setting/Timeframe	Sample	Results: OR/RR 95% CI	Conclusions
Piscoya et al., 2012 "Maternal Periodontitis as A Risk Factor for Prematurity" Case–control study maternity unit Hospital das Clínicas, Recife, Brazil November 2007- August 2008	**n:** 718 puerperae who experienced a spontaneous delivery **IG:** 360 premature cases **CG:** 358 full-term cases	Periodontitis was associated with prematurity **OR:** 6.95**; CI:** [3.69–13.09] Multivariate confounder adjustments **OR:** 6.05; **CI:** [3.01–12.16]	Periodontitis is strongly associated with prematurity. Regular periodontal examination and treatment is recommended during pregnancy.
Basha et al., 2015 "Maternal Periodontitis as a Possible Risk Factor for Preterm Birth and Low Birth Weight – A Prospective Study" Prospective study population at the Vanivilas Hospital (Community Maternal and Child Health Unit) in Bangalore City, India *Timeframe not mentioned	**n:** 307 pregnant women (18-28) years 1st prenatal examination within the first 22 weeks of gestation and with a minimum 20 natural permanent teeth **IG**: 126 periodontally involved **CG:** 181 periodontally healthy	A total of 133 (43.32%) of 307 preterm birth and or low birth weight, 37 (12.05%) and 96 (31.27%), respectively **IG**: preterm birth 15.87% **OR:** 4.54; **CI:** [1.98-5.46] low birth weight 34.25% **OR:** 5.32; **CI:** [2.01-6.79] **CG:** preterm birth 9.39% low birth weight 18.78% Significant association between periodontitis and preterm birth (p=0.03) and low birth weight (p=0.01)	Periodontitis is an independent risk factor for poor pregnancy outcome.

Continued

Reference/Setting/Timeframe	Sample	Results: OR/RR 95% CI	Conclusions
Corbella et al., 2016 "Adverse Pregnancy Outcomes and Periodontitis: A Systematic Review and Meta-Analysis Exploring Potential Association" Systematic review of case-control studies cohort studies (retrospective prospective, case reports and case series) of periodontal disease in relation to pregnancy outcomes Human studies published from 1965 to January 2015	**n:** a total of 22 studies accounting for a total of 17,053 subjects	**RR** periodontitis: 1.61 for preterm birth evaluated in 16 studies ($p < .001$) 1.65 for low birth weight evaluated in 10 studies ($p < .001$) 3.44 for preterm low birth weight evaluated in four studies	Low but existing association between periodontitis and adverse pregnancy outcomes. Authors performed corrections of biased methodologies and homogenization of heterogeneous studies.
IG: Intervention group **CG:** Control group **RR:** Risk Ratio **OR:** Odds Ratio **CI**: Confidence Interval			

Table 2.2: Studies Not Supporting Periodontitis as a Risk Factor for Preterm Birth and/or Low Birth Weight.

Reference/Setting/Timeframe	Sample	Results	Conclusions
Michalowicz et al., 2009 "Change in Periodontitis During Pregnancy and The Risk of Pre-Term Birth and Low Birth Weight" Random selection; Obstetrics and Periodontal Therapy Study Observational; Secondary data *Timeframe not mentioned	**n**: Birth outcomes 812 women and follow-up periodontal data for 722 **IG**: *n*=413 (periodontal treatment before 21 weeks gestation) **CG**: *n*=410 (periodontal treatment after delivery)	The distribution of gestational age (p >.01) and mean birth weight (3295 versus 3,184 grams, p=0.11) did not differ significantly between women with and without disease progression Gestational age and birth weight were not associated with disease progression (p >0.05)	Periodontal disease progression was not associated with an increased risk for delivering a pre-term or a low birth weight infant.
Calabrese et al., 2010 "Is There Any Association Between Periodontitis and Preterm Low Birth Weight?" Observational study University clinical setting, Perugia, Italy January 2005- September 2006	**n**: 120 pregnant women 6 patients lost to follow-up 114 remaining, 1 had an abortion, 20 (17%) delivered pre-term 11% low-weight newborns 9% preterm low birth weight newborns	2 definitions of periodontal disease: 29 women (24%) and 4 (3%) periodontal disease cases respectively	No association was detected between any of the two definitions of periodontal disease and any of the adverse pregnancy outcomes. This study was unable to provide evidence of association between periodontal disease and preterm low birth weight.

Continued

Reference/Setting/Timeframe	Sample	Results	Conclusions
Schenkein et al., 2012 "Birth Weight of Infants of Mothers with Aggressive Periodontitis" Prospective/retrospective study at the Virginia Commonwealth University Clinical Research Center for Periodontal Disease Subjects enrolled/examined 1976 – 2010, data collection began in 1994	**n**: 135 localized aggressive periodontitis (LAgP) subjects, 147 GAgP subjects, and 170 NP siblings of AgP subjects identified 85 LAgP subjects, 84 GAgP subjects, and 125 NP siblings completed questionnaires	No significant differences mean birth weights CG or AgP patients. Periodontally healthy controls: 13.2% of newborns born to siblings of AgP patients and 12.8% of newborns born to unrelated mothers weighed <2,500 grams 9.9% of those born to mothers with generalized AgP and 10.3% of those born to mothers with localized AgP weighed <2,500 grams	With AgP (rare), using prospective and retrospective data approaches, there was no evidence that AgP predisposes low birth weights. AgP versus chronic periodontal disease has unique biologic characteristics, and quite possibly the possible lack of its association with birth weight may be another such characteristic.
Souza et al., 2016 "Effect of Maternal Periodontitis and Low Birth Weight—A Case Control Study" Case-control study by Brazilian Unified Health System in Petrolina-PE and Juazeiro-BA, Brazil June 2009 to December 2011	**n:** 951 mothers **IG**: *n*=269 mothers of newborns with birth weight <2,500 grams **CG**: *n*=682 of mothers of newborns with birth weight >=2,500 grams	**IG**: frequency of periodontitis 16.4% and **CG**: 17.4% Periodontitis no association with low birth weight (**OR** crude: 0.92; 95% **CI:** [0.63–1.35]), confounders: (**AOR** 1.00; 95% **CI:** [0.61–1.68])	No association between maternal periodontal disease and low birth weight with confounder adjustment.

IG: Intervention Group **CG:** Control Group **CI:** Confidence Interval **RR:** Risk Ratio **OR:** Odds Ratio **PD:** Periodontitis
LAgP: Localized Aggressive Periodontitis **AgP:** Aggressive Periodontitis **GAgP:** Generalized Aggressive Periodontitis
NP: Periodontally Healthy

Table 2.3: Studies on Periodontal Therapy in Perinatal Period.

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Michalowicz et al., 2006 The Obstetrics and Periodontal Therapy (OPT) Study randomized, blinded, controlled trial; provider referred patients to Hennepin "Treatment of Periodontal Disease and the Risk of Preterm Birth" County Medical Center (MN), the University of Kentucky, the University of Mississippi Medical Center, and Harlem Hospital (NY)	**n:** 823 randomly assigned women between 13-17 weeks gestation and minimum 16 years of age/6 days gestation and single fetus **IG:** SRP before 21 weeks (413) **CG:** SRP after delivery, monthly tooth polishing and oral health instructions (410)	Periodontal treatment improved periodontitis measures ($p<0.001$) No significant risk of preterm delivery **(**$p=0.70$); hazard ratio for treatment group versus control group 0.93; (**CI:** [0.63-1.37]) No significant difference birth weight **(**3,239 grams versus 3,258 grams, $p=0.64$**)** or SGA (12.7% versus 12.3%; **OR**: 1.04; **CI**: [0.68-1.58])	Periodontal therapy is safe and improves periodontal disease in pregnant women; however, it is not significant with birth outcomes of preterm birth, low birth weight, or fetal growth restriction.

Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Tarannum & Faizuddin 2007 "Effect of Periodontal Therapy on Pregnancy Outcome in Women Affected by Periodontitis" Outpatients at the Department of OBGYN, Dr. B.R. Ambedkar Medical College and Hospital, Bangalore, Karnataka, India Enrolled in the study from August 2004 to August 2005	**n:** 200 healthy pregnant women aged 18 to 35 years; single gestation between 9 and 21weeks having periodontitis meeting dental inclusion criteria	There were no differences between the CG and IG in preterm birth (9.3% compared with 9.7%, **OR:** 1.05, **CI:** [0.7–1.58], p=.81), birth weight (3,450 compared with 3,410 grams, p=.12)	Non-surgical periodontal therapy can reduce the risk for preterm births in mothers who are affected by periodontitis. Additional multicentered, randomized, controlled clinical trials are required to confirm this link between periodontitis and preterm low birth weight.
			Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Newnham et al., 2009 "Treatment of Periodontal Disease During Pregnancy A Randomized Controlled Trial" Six obstetric sites in metropolitan Perth, Western Australia	At risk women examined for periodontal disease (*n*=3,737) maternal periodontal disease (*n*= 1,000) allocated at random to receive Periodontal Therapy **CG**: women with periodontal disease (*n*=542) receive Periodontal Therapymid-pregnancy commencing approximately 20 weeks **IG**: Periodontal Therapy6 weeks after the pregnancy (*n*=540)	**IG**: preterm birth 13.1% **CG**: preterm birth 11.5% (p=.316) Gestational age: <37 **OR:** 1.219; **CI:** [0.0893–1.664] <35 **OR:** 0.998; **CI:** [0.640 – 1.554] <32 **OR:** 1.138; **CI:** [0.637–2.033] low birth weight: no significant differences in **IG** and **CG** for mean birth weight/low birth weight classes	Treatment of periodontal disease is safe during pregnancy, but does not prevent preterm birth.
			Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Offenbacher et al., 2009 "Effects of Periodontal Therapy on Rate of Preterm Delivery A Randomized Controlled Trial" Enrollment between December 2003 and October 2007 Maternal Oral Therapy to Reduce Obstetric Risk Study - randomized, treatment masked, controlled clinical trial	**n:** randomized 1,806 patients and completed 1,760 evaluable patients **IG:** SRP early in the second trimester total (*n*=887) **CG:** SRP after delivery (*n*=884)	Periodontal care utilization: 2.35-fold increased odds of self-reported smoking during pregnancy **(CI:** [1.48–3.71]**)** 2.19-fold increased odds for diabetes **(CI:** [1.21–3.98]**)** 3.90-fold increased odds for Black race **(CI**: [2.31–6.61]**),** and higher maternal age. Interruption periodontal care during pregnancy no increased risk low-birth weight compared to no history periodontal care **(OR:** 0.96; **CI:** [0.60–1.52]**)**	Periodontal Therapy did not reduce the incidence of preterm birth.
			Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Macones et al., 2010 "Treatment of Localized Periodontal Disease in Pregnancy Does Not Reduce The Occurrence Of Preterm Birth: Results From the Periodontal Infections and Prematurity Study (PIPS)" Randomized Clinical Trial 756 subjects assigned randomly from Hospital of the University of Pennsylvania, Pennsylvania Hospital and Albert Einstein Medical Center	**IG:**376 women to scaling and root planing **CG:**380 women to control treatment	Active treatment did not reduce risk of SPTD at >35 weeks (**RR**: 1.19; **CI:** [0.62–2.28]) or composite neonatal morbidity (**RR**: 1.30; **CI**: [0.83–2.04]) Possible increase in risk SPTD at <35 weeks (**RR**: 3.01; **CI**: [0.95– 4.24])	Periodontal therapy does not reduce the incidence of SPTD.
			Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Hujoel et al., 2010 "Cessation of Periodontal Care During Pregnancy: Effect on Infant Birth Weight" Prior to and during pregnancy between 1993 and 2000 Case-control sample women eligible for dental insurance from the Washington Dental Service (WDS); linked to the Vital Record Birth Certificates of Washington State	**n:** 793 cases (infants <2,500 grams) and random sample of 3,172 controls (infants >=2,500 grams)	No significant difference between the incidence of preterm birth: **CG:** 52.4%; *n*=162 **IG:** 45.6%; *n*=160; p < 0.13 Strong and significant relationship between successful periodontal treatment and full-term birth **AOR:** 6.02; **CI:** [2.57–14.03]	Women who received periodontal care had genetic and environmental characteristics (smoking, diabetes and race) associated with increased risk for low birth weight infants. Periodontal care behaviors were unrelated to low-birth weight risk.
			Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Jeffcoat et al., 2011 "Periodontal Infection and Preterm Birth: Successful Periodontal Therapy Reduces The Risk of Preterm Birth" Randomized controlled, blinded clinical trial Hospital outpatient clinic	**n:** 322 pregnant women 6–20 weeks of gestation with periodontal disease **IG:**160 randomly assigned SRP, cleaning above and below the gum line, oral health instructions **CG:** 162 oral health instructions only, periodontal exams before and 20 weeks after SRP Results two groups: successful ("non-exposure") and unsuccessful ("exposure") treatment	11 Studies: Periodontal Therapy versus no Periodontal Therapy: **preterm birth** < 37 weeks (**RR:** 0.87, **CI:** [0.70-1.10] ***n*=**5,671 participants) **low birth weight** < 2,500 grams (9.70% with Periodontal Therapy versus 12.60% No Periodontal Therapy; **RR**: 0.67, **CI**: [0.48-0.95]) 7 studies: Periodontal Therapy versus no Periodontal Therapy: **preterm birth** < 35 weeks (**RR:** 1.19, **CI:** [0.81-1.76]; 2,557 participants) 2 studies: **preterm birth**< 32 weeks (**RR:** 1.35, **CI:** [0.78-2.32]; 2,755 participants) 3 studies: **low birth weight**< 1,500 grams (**RR:** 0.80, **CI:** [0.38-1.70]; 2,550 participants)	Preterm birth significantly more likely in patients refractory to periodontal treatment. Success of periodontal treatment determines benefit of Periodontal Therapy on preterm birth.

Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Iheozor-Ejiofor et al., 2017 "Treating Periodontal Disease for Preventing Adverse Birth Outcomes in Pregnant Women" Meta-Analysis All RCTs on the effects of Periodontal Therapy on perinatal and maternal morbidity and mortality which reported obstetric outcomes	15 RCTs (*n*=7,161 pregnant women) Maternal periodontitis (14 studies) or gingivitis (1 study)	**IG:** risks of preterm and spontaneous abortions or stillbirths respectively 49/413 (11.86%) and 5/413 (1.21%) **CG:** risks of preterm and spontaneous abortions or stillbirths respectively 52/410 (12.68%) and 14/410 (3.33%) After correction for bias using SACE (Survivor Average Casual Effect) preterm birth became statistically significant	Low quality evidence exists on the impact of Periodontal Therapy on low birth weight or preterm birth. Unclear which Periodontal Therapy treatments prevent adverse obstetric outcomes. More research is needed on Periodontal Therapy and obstetric outcomes.
			Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Merchant et al., 2018 "Periodontal Treatment Among Mothers with Mild To Moderate Periodontal Disease And Preterm Birth: Reanalysis of OPT Trial Data Accounting for Selective Survival" Randomized controlled trial Data from OPT (Obstetric Periodontal Therapy) Study Recruited from Hennepin County Medical Center (MN), the University of Kentucky, the University of Mississippi Medical Center and Harlem Hospital (NY).	**IG:** 413 participants received up to four visits for SRP and oral health instructions before 21 weeks **CG:** 410 participants received up to four visits consisting of dental exam during study and SRP after delivery	**IG:** risks of preterm and spontaneous abortions or stillbirths respectively 49/413 (11.86%) and 5/413 (1.21%) **CG:** risks of preterm and spontaneous abortions or stillbirths respectively 52/410 (12.68%) and 14/410 (3.33%) After correction for bias using SACE (Survivor Average Casual Effect) preterm birth became statistically significant.	There is beneficial effect of Periodontal Therapy on preterm birth in mild to moderate periodontally involved mothers before 21 weeks gestation.

Continued

Reference/Setting/Timeframe	Sample	Results OR/RR 95% CI	Conclusions
Govindasamy et al., 2020 "The Influence of Nonsurgical Periodontal Therapy on the Occurrence of Adverse Pregnancy Outcomes: A Systematic Review of the Current Evidence" Systemic Review Studies using the databases PUBMED, MEDLINE, CINAHL and EMBASE on the randomized controlled trials evaluating the influence of periodontal treatment on adverse pregnancy outcomes from 2000 to 2018	761 pregnant women from 19 trials. Majority of participants in the second trimester of pregnancy.	**Occurrence of preterm birth:** **IG:** Received periodontal therapy ranged 0% to 53.5% **CG:** Range was 6.38%–72%. **Occurrence of low birth weight:** **IG:** Received periodontal therapy ranged from 0% to 36% **CG:** Varied from 1.15% to 53.9%	Nonsurgical periodontal therapy is safe and is significantly associated with reduction of adverse pregnancy outcomes among high-risk patients.
			Continued

Table 2.4: Previous PRAMS Dental Care Studies.

Reference/Data Years/State	Sample	Results Odds Ratio (OR)/Risk Ratio (RR), 95% Confidence Interval (CI)	Conclusions
Naavaal et al., 2019 2012-2014 Virginia PRAMS	*n*=1,344 Virginia resident mothers who delivered live birth	56% before pregnancy dental cleaning visit, 47% of during pregnancy dental cleaning visit. Dental insurance (**OR:** 3.5; 95% **CI:** [2.17–5.67]) and oral health knowledge (**OR:** 2.8; 95% **CI:** [1.42–5.48]) associated with before pregnancy dental visit. Dental insurance (**OR:** 3.5; 95% **CI:** [2.17–5.67]) and oral health knowledge (**OR:** 2.8; 95% **CI:** [1.42–5.48]) associated before pregnancy dental visit. During pregnancy dental visit associated with dental insurance (**OR:** 5.8; 95% **CI:** [2.80–11.97]), before pregnancy dental visit (**OR** 20.72, 95% **CI:** [11.14–38.54]), and oral health promotion by health provider (**OR:** 12.37, 95% **CI:** [7.31–20.93])	Preventive dental visit before and during pregnancy low among Virginia women. Improvement: dental care during pregnancy requires improve routine dental visits before pregnancy, access to dental insurance, and health care provider oral health promotion to promote oral health.
			Continued

Reference/Data Years/State	Sample	Results Odds Ratio (OR)/Risk Ratio (RR), 95% Confidence Interval (CI)	Conclusions
Muralidharan & Merrill, 2019 2014-2015 Utah PRAMS	*n*=2,793 Utah resident mothers who delivered live birth	Knew such care was important 1.4 (**CI:** [1.1–2.0]) times more likely to have teeth cleaned during pregnancy. Dental insurance 1.9 (**CI:** [1.5–2.4]) times more likely to have their teeth cleaned and 1.6 (**CI:** [1.2–2.2]) times more likely to go to dentist for needed for treatment.	Knowledge of its importance during pregnancy, dental/health care worker talk about how to care for their teeth and gums, and dental insurance during pregnancy are positively associated with dental care during pregnancy.
Chenwi & Savitz, 2018 2012-2015 Rhode Island	*n*=4,687 Rhode Island resident mothers who delivered live birth	Hispanic population higher likelihood for preventive dental care during pregnancy compared to non-Hispanic White (**AOR:** 1.38; **CI: [**1.09–1.74]) Lower for the non-Hispanic other (**AOR:** 0.59; **CI:** [0.45–0.78]) and non-Hispanic Black populations (**AOR:** 0.55; **CI:** [0.39–0.78]) compared to the non-Hispanic White. No WIC during pregnancy (**AOR:** 1.83; **CI:** [1.42–2.36]) associated with increased odds preventive dental care during pregnancy.	Preventive dental care in Rhode Island did not meet the perinatal and Infant Oral Health Quality Improvement 60% minor population target.

Continued

Reference/Data Years/State	Sample	Results Odds Ratio (OR)/Risk Ratio (RR), 95% Confidence Interval (CI)	Conclusions
Umer et al., 2016 2009-2010 West Virginia PRAMS	*n*=3,050 West Virginia resident mothers who delivered live birth	White more likely teeth cleaned 12 months before pregnancy compared to other (**OR:** 1.75; **CI:** [1.01-3.04]); more than HS education (**OR:** 1.79; **CI:** [1.22-2.62]) Women < 20 years old (**OR** 2.75; **CI:** [1.86-4.06]) Health Insurance, Pregnancy Intention were also associated.	Factors associated with dental cleaning can impact to develop and implement oral care promotion efforts by health care workers and policy makers for women of childbearing age.

Continued

Reference/Data Years/State	Sample	Results Odds Ratio (OR)/Risk Ratio (RR), 95% Confidence Interval (CI)	Conclusions
Singhal et al., 2014 2001-2003 Maryland PRAMS	*n*=4,537 Maryland resident mothers who delivered live- birth	Odds of dental visit during pregnancy: Black women (**AOR:** 0.62) and women from other race (**AOR:** 0.57) lower odds than White women. Annual household income of <$40,000 less than half as likely as > $40,000 Insurance before pregnant (**AOR:** 1.40) WIC program (**AOR:** 1.63) more likely than uninsured Odds of unmet dental need during pregnancy: unmarried (**AOR:** 2.49), unintended pregnancy (**AOR** 1.64) and no prenatal care as early as they desired (**AOR:** 1.89) more likely unmet dental need Age > 40 years (**AOR:** 4.09) and ages 26-35 years (**AOR:** 1.99) higher odds unmet dental need than < 20 years of age. Annual household income $8,000–$19,000 (**AOR:** 3.13) and $20,000–$39,000 (**AOR:** 1.90) more likely to have an unmet dental need during pregnancy than women with annual income of >$40,000.	Oral health needs during pregnancy under-addressed by current prenatal care delivery system in Maryland. Unmarried women, racial-ethnic minorities, low income women, unintended pregnancies, late prenatal care and uninsured at risk for no dental care even with unmet need. Interventions should target encourage collaboration and continuity among dentist and prenatal care providers.

Continued

Reference/Data Years/State	Sample	Results Odds Ratio (OR)/Risk Ratio (RR), 95% Confidence Interval (CI)	Conclusions
Thompson et al., 2013 2004-2008 Maryland PRAMS	*n*=6,171 Maryland mothers who delivered live birth ages 18-53	DC before and during pregnancy Black (**RRR:**0.38**,** p=0.0001), Asian (**RRR:** 0.35, p=0.0001) Hispanic (**RRR:** 0.36, p=0.0001) than White DC before pregnancy Black (**RRR:** 0.70, p=0.01), Asian (**RRR**: 0.59, p=0.01) Hispanic women (**RRR**: 0.42, p=0.0001) than for White pregnancy (**RRR**: 0.61, p=0.0001) History physical abuse before pregnancy (**RRR**: 0.44, p=0.01) Smoked 3 months before pregnancy (**RRR**: 0.72, p=0.05). Women 12 or more years education (**RRR:** 3.10, p=0.0001; **RRR:** 5.07, p=0.0001).	Dental cleaning is associated with insurance, oral health counseling and maternal factors such as race, ethnicity, education and history of physical abuse in Maryland mothers.
Hwang et al., 2012 10 States, PRAMS, 2004–2006 States: Alaska, Arkansas, Maine, Michigan, Mississippi, Nebraska, New York, Ohio, South Carolina, and Utah	*n*= 35,267 Black, White and Hispanic women in 10 states	Mothers no dental care during pregnancy and no dental cleaning during pregnancy higher risk for preterm birth (**OR:** 1.15; **CI:** [1.02–1.30]; **OR:** 1.23; **CI:** [1.08–1.41])	Significant racial and ethnic disparities in oral health experiences. Improvement needed at the policy level to ensure access/insurance and awareness of oral health importance for patients and providers.

Continued

Reference/Data Years/State	Sample	Results Odds Ratio (OR)/Risk Ratio (RR), 95% Confidence Interval (CI)	Conclusions
Center for Public Health Statistics and Informatics, Ohio PRAMS, Ohio Department of Health, 2011 Ohio PRAMS 2006-2008	*n*=1,539 Ohio resident mothers who delivered live birth	40% no dental care during their pregnancy BNH less likely to receive dental care during pregnancy than WNH >12 years education more likely to receive dental care during pregnancy than those with <12 years education Medicaid and unmarried or younger less likely to receive dental care during pregnancy Normal birth weight infants more likely receive dental care	Disparity among Medicaid versus other mothers in the receipt of dental care during pregnancy. Women should be educated on oral health prevention, diagnosis and treatment. Routine care and treatment safe and beneficial.

Continued

Reference/Data Years/State	Sample	Results Odds Ratio (OR)/Risk Ratio (RR), 95% Confidence Interval (CI)	Conclusions
Lydon-Rochelle et al., 2004 January 1-December 31, 2000 Washington State Department of Health's PRAMS	*n*=1,592 Washington state respondents who delivered a live-born infant	<u>Risk of No Care (No dental problem):</u> Oral health counseling during their pregnancy (**OR:** 22.32; **CI:** [14.22, 35.02]) Overweight/Obese women **(OR**: 1.9 **CI**: [1.1, 3.1]), (**OR:** 1.9; **CI:** [l.5, 3.3]) Smoking during the final 3 months of pregnancy **(CI:** [1.5, 8.1]) Ever smoked were similar (**OR:** 3.6; **CI:** [1.6, 8.1]) <u>Risk of No Care (dental problem):</u> No counseling during (**OR:** 26.42; **CI:** [12.46, 56.02]) Low monthly income (in the $1200 to $2099 range) reports of dental problems (**OR:** 2.32; **CI:** [1.01, 5.3]) Medicaid or ever having smoked (**OR:** 2.64; **CI:** [1.13, 6.19])	<u>Without dental problems:</u> elevated risks of not receiving dental care were associated with not being counseled on oral health care, obesity, and either smoking during the final three months of pregnancy or ever having smoked. <u>With or without dental problem:</u> Similar increased risk associated no dental care and no oral health counseling. <u>Received Dental Care:</u> Association with dental problems significant for lower monthly incomes, Medicaid, and ever having smoked. Relationship between low socioeconomic status and likelihood no dental care. No significant association between late prenatal care and dental care use.

CHAPTER 3

RESEARCH METHODS

3.1 RESEARCH OBJECTIVES

The objective of this cross-sectional study is to study the association of oral health counseling before pregnancy with preventive dental services usage during pregnancy, adjusting for dental insurance. Secondly, we will assess the relationship between dental cleaning before or during pregnancy and birth outcomes of preterm birth and SGA. The objectives of this study are tri-fold:

1a. Examine the association between oral health counseling before pregnancy by a health care worker and preventive dental service utilization (having teeth cleaned by a dentist or dental hygienist before or during pregnancy), adjusting for dental insurance status and dental problem during pregnancy.

1b. Document characteristics associated with receiving preventive dental services before or during pregnancy versus neither before nor during pregnancy including demographic profile, insurance status and other study control variables.

2. Assess the association of preventive dental service utilization (having teeth cleaned by a dentist or dental hygienist anytime during the 12 months before pregnancy or during pregnancy) with preterm birth.

3. Assess the association of preventive dental service utilization (having teeth cleaned by a dentist or dental hygienist anytime during the 12 months before pregnancy or during pregnancy) with SGA.

3.2 RESEARCH QUESTIONS

There are three research questions:

1a. Is oral health counseling by a medical provider before pregnancy associated with preventive oral health services usage during pregnancy, adjusting for related control variables?

1b. What is the demographic profile of mothers who received preventive dental services (before or during pregnancy), including other study control variables?

2. Is utilization of preventive dental services before or during pregnancy associated with preterm birth, adjusting for related control variables?

3. Is utilization of preventive dental services before or during pregnancy associated with SGA, adjusting for related control variables?

3.3 RESEARCH HYPOTHESES

1. Mothers who received oral health counseling before pregnancy by a healthcare worker are more likely to seek preventive dental treatment during pregnancy.

The null hypothesis and alternative hypothesis for this study objective #1 are as follows:

H0 = The is no difference in preventive dental services usage in South Carolina mothers who reported oral health counseling before pregnancy compared to those that did not.

H1 = There is a difference in preventive dental services usage between mothers who reported oral health counseling by a health care worker and those that did not; utilization is not equal.

2. Women who reported usage of preventive dental treatment (having teeth cleaned by a dentist or dental hygienist anytime during the 12 months before pregnancy or during pregnancy compared to neither before nor during), are less likely to experience preterm birth.

The null hypothesis and alternative hypothesis of this study are as follows:

H0 = There is no difference in the likelihood of preterm birth in South Carolina mothers who used preventive dental services (dental cleaning) before or during pregnancy.

H1 = There is a difference in the likelihood of preterm birth in South Carolina mothers by who used preventive dental services (dental cleaning) before or during pregnancy.

3. Women who reported usage of preventive dental treatment (having teeth cleaned by a dentist or dental hygienist anytime during the 12 months before pregnancy or during pregnancy compared to neither before nor during), are less likely to experience SGA.

The null hypothesis and alternative hypothesis of this study are as follows:

H0 = There is no difference in the likelihood of SGA in South Carolina mothers who had preventive dental services (dental cleaning before or during pregnancy) compared to those who did not.

H1 = There is a difference in the likelihood of SGA in South Carolina mothers who had preventive dental services (dental cleaning before or during pregnancy) compared to those who did not.

3.4 DESCRIPTION OF METHODS

3.4.1 UNIT OF ANALYSIS

Aim 1: mother

Aim 2: a. mother b. single newborn to a mother

Aim 3: single newborn to a mother

3.4.2 DATA: PRAMS

The database for this research is SC PRAMS. PRAMS is conducted by the Centers for Disease Control and Prevention's (CDC) Division of Reproductive Health in collaboration with the South Carolina Department of Health and Environmental Control. SC PRAMS is an ongoing population-based surveillance system of maternal experiences that occur before, during and after pregnancy. PRAMS is a mixed-mode survey employing mailed and telephone survey contact. Legal birth certificate registry records (mandatory federal and state reporting) are used to select samples that are representative of all resident women who delivered a live-born infant in the state. PRAMS is the largest on-going population-based surveillance system of pregnant women. Statewide, approximately 200 women are contacted monthly by way of mailed surveys and other corresponding letters (up to five communications), and telephone interviews (up to 15 phone attempts) to non-respondents of mailed surveys (Shulman et al., 2018)

Resident mothers, 2-6 months after birth, are randomly sampled from the South Carolina's live birth registry which contains both resident and occurrence data (non-residents giving birth in SC). From these respondents, PRAMS has four criteria: residency, birth location, plurality and live birth status. These criteria must be satisfied simultaneously for PRAMS inclusion. First, only resident births (taking place in South

Carolina by South Carolina residents) were included. Occurrence births were excluded. Second, those giving birth in the surrounding counties of neighboring states by SC residents were excluded. Third, only live births are included in the PRAMS survey sample, excluding early and late miscarriages and stillbirths. Fourth, multiple gestations of more than four (plurality >4) were excluded from the PRAMS sample. Finally, women with plurality between two and four during a single gestation period were sampled at equal rates to women with singleton births. Only one infant from any qualified multiple gestation is randomly selected for sample inclusion.

3.4.3 INCLUSION CRITERIA

For this study, only single births were included. Twin and multiple births were excluded from the study sample. See Figure 3.1

3.4.4 STUDY SAMPLE

There was a sample size of 3,191 mothers representing an estimated population size of 229,609 South Carolina resident women who delivered live births in South Carolina during the 2012-2015 study period (SC Department of Health and Environmental Control, 2019). The final data set provided 93 variables. SCPRAMS surveillance data and SC legal birth certificate registry data were linked for weighting to depict all SC births within a given year. New mothers were identified by state birth certificate file sampling and stratification procedures.

Stratification procedures vary by state. In South Carolina, stratification was based solely on birth weight. South Carolina registered birth certificate data were used to draw stratified random samples from selected mothers. Sample stratification procedures were decided at the state-level to target subpopulations of a designated health interest groups

for oversampling. To obtain maximum high-risk data collection, mothers of low birth weight infants were over-sampled. Heavier weights were placed on survey respondents of normal birth weight newborns.

Weights are assigned using state-specific sample frame ratios by the CDC. SC PRAMS Phase 7 (2012-2015) sampling frame ratios were as follows: 1:1 very low birth weight (<1,500 grams), 1:7 moderately low birth weight (1,500-<2,500 grams) and 1:69 normal birth weight (=> 2,500 grams). After the appropriate ratio sampling for 2012-2015 was met, response rates for SC PRAMS were 48% in 2012, 53% in 2013, 50% in 2014 and 45% in 2015. There was an oversampling of very low birth weight, low birth weight and pre-term mothers; however, the data were not skewed to very low birth weight or newborns. After weighting procedures, PRAMS national methodology including stratification procedures are reliable and generalizable to the entire population.

During the period of this study, response rates for federal health surveys in general decreased. Accordingly, thresholds have been reduced to meet the declining response rates during this period. CDC enforces a response rate threshold for insertion of data into reports, publications and publicly disseminated information. Since 2007, an average of 75% of U.S. states participating in PRAMS have fulfilled or surpassed the threshold rate (Shulman et al., 2018). The response rate CDC threshold was established as 70% until 2006; successive levels were 65% in 2007 to 2011, 60% from 2012 to 2014, and 55% from 2015 to 2016 (Shulman et al., 2018). For the study years of this research, the CDC inclusion threshold was 60% (2012-2014) and 55% (2015); therefore, South Carolina was not included in the national data set for these years. States that are not

included in the national data set may utilize their weighted data for internal health department and state-wide research.

3.5 VARIABLE DEFINITIONS

3.5.1 DEPENDENT VARIABLES

The dependent variables for research question one are the status of preventive dental services utilization before (PRE_DDS) and during (DDS_CLN) pregnancy. The corresponding survey question 7h. read, “I had my teeth cleaned by a dentist or dental hygienist.” Mothers were requested to provide information for the time period, “at any time during the 12 months before you got pregnant with your new baby, did you do any of the following things?” The during pregnancy cleaning variable corresponded to question 28c. which read, “I had my teeth cleaned by a dentist or dental hygienist.” Participants were given prior instructions for the entirety of question 28 in the following way: “This question is about the care of your teeth during most recent pregnancy. For each item for the before and during cleaning, respondents were instructed to check No if it is not true or does not apply to you or Yes if it is true.”

For research question two, the dependent variable created was preterm birth. These questions examined the association between pregnant women who experienced preterm birth and reported dental cleaning before [PRE_DDS] and during [DDS_CLN] pregnancy. Preterm birth categorial binary variables (yes/no) were created from data retrieved from continuous birth certificate data for gestational age (wks.) The continuous variable gestational age given in weeks, [GEST_WKS] , was used to create a new dichotomous categorical variable (yes/no) for preterm birth, [PTB]. Preterm birth was considered as birth occurring before 37 weeks gestation; term birth was considered as

birth occurring at 37 weeks or more (The American College of Obstetricians and Gynecologists Committee on Obstetric Practice & Society for Maternal-Fetal Medicine, 2013).

For research question three, the dependent variable SGA was created. This question examined the association between SGA and dental cleaning before [PRE_DDS] and during [DDS_CLN] pregnancy. SGA categorial binary variable (yes/no) was created from data retrieved from continuous birth certificate data for continuous birth weight, newborn sex and gestational age (wks.), creating a new dichotomous categorical variable (yes/no) for SGA. SGA was defined as birth weight below the 10th percentile adjusted for newborn sex and gestational age. (National Institutes of Health, 2020).

3.5.2 INDEPENDENT VARIABLES

Enabling Factors

The dichotomous independent variable for research question one, oral health counseling [BPG_DDS], examined the association between oral health counseling by a medical provider before pregnancy and dental cleaning during pregnancy [DDS_CLN]. The corresponding survey question 11d. on the SC PRAMS Phase 7 questionnaire which read "Visiting a dentist or dental hygienist before pregnancy" was basis for the independent variable. Participants were given prior instructions for the entirety of question 11 in the following way: "Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker talk with you about any of the things listed below? Please count only discussions, not reading materials or videos. For each item check No if no one talked with you about it or Yes if someone talked with you about it."

Health Behavior

The independent variables for research questions two and three, preventive oral health services utilization, investigated the association between pregnant women who experienced poor birth outcomes such as SGA and preterm birth with reported utilization of preventive dental care. The corresponding survey question 7h. read "I had my teeth cleaned by a dentist or dental hygienist." Mothers were requested to provide information for the time period, "at any time during the 12 months before you got pregnant with your new baby, did you do any of the following things?" The during pregnancy cleaning variable corresponded to question 28c. which read, "I had my teeth cleaned by a dentist or dental hygienist." Participants were given prior instructions for the entirety of question 28 in the following way: "This question is about the care of your teeth during your most recent pregnancy. For each item, check No if it is not true or does not apply to you or Yes if it is true."

Need Factors

There were no need factors which served as an independent variable of interest.

3.5.3 CONTROL VARIABLES

Demographic variables (predisposing factors) of rurality, household income, maternal age, race, marital status and education were analyzed. Control variables selected for this study were shown to be associated with one of more of the following outcome variables: oral health services utilization, preterm birth and SGA. The control variables included were dental insurance (enabling factor), dental-problem (need factor), hypertension, diabetes, obesity, weight gain (biological factors), stress factors, violence (psychobiological factors), prenatal care (yes/no), maternal health behaviors (exercise

and prenatal vitamin), smoking before and during pregnancy, drug use (before, during), alcohol use (before, during). These aforementioned control variables were biological or psychobiological factors associated with preventive utilization, preterm birth or SGA. These variables were controlled for to determine the true significance of the independent variables on the dependent variable. Additional information about control variable sources or variable classification not found in Table 3.4 follows.

A. Rurality

Geographic eligibility for the dichotomous variable (yes/no) rurality, [RURAL], was determined by the Federal Office of Rural Health Policy (FORHP). According to the FORHP, rural counties were those counties that were not designated as parts of Metropolitan Areas (MAs) by the Office of Management and Budget (OMB) (United States Census Bureau, n.d.). In this study, any county in South Carolina that was not a part of a Metropolitan Area, as designated by OMB, was considered rural. To account for rural Census tracts located within large Metropolitan counties, the Office of Rural Health Policy used the Goldsmith modification, identifying sub-county sections of rurality. This method allows parts of designated metropolitan counties to be designated as rural. Additionally, counties classified as Micropolitan were classified as non-Metropolitan (U.S. Health Resources & Services Administration, 2020).

B. Prepregnancy Maternal Body Mass Index (BMI)

The categorical variable maternal preconception BMI was notated as [MOM_PRE_BMI_CAT]. The participants' preconception BMI was classified into four categories by South Carolina Department of Health & Environmental Control

(SCDHEC), based on WHO and ACOG standards for weight gain. These categories were: underweight, normal weight, overweight and obese.

C. Maternal Weight Gain

Maternal weight gain [MOMLBS] and maternal preconception BMI [MOM_PRE_BMI_CAT] were used to create the variable for new weight gain [NewWghtGain]. New weight gain has three categories: less than recommended, recommended, and more than recommended. Actual maternal weight was not provided in the analytic data file from SCDHEC to protect individual confidentiality. See Table 3.3.

D. Low Birth Weight

Low Birth Weight categorial binary variables (yes/no) was created from data retrieved from continuous birth certificate data for birth weight (g). The continuous variable for fetal birth weight (g), [GRAM] in birth certificate data, was used to create the categorical variable for fetal birth weight, [BIRTH WEIGHT]. Birth weight was classified according to the most current data available from the WHO and CDC. The dichotomous categorical variable for low birth weight was created for the outcome variable. Babies weighing less than 2,500 grams (5.51 pounds) were classified as low birth weight. Further distinctions very low birth weight (<1,500 grams or 3.31 pounds) and extremely low birth weight (<1,000 grams or 2.2 pounds) were created. Normal term birth weight was 2,500–4,500 grams (5.51 pounds – 9.92 pounds). Babies weighing more than 4,500 grams were considered overweight (American College of Obstetricians and Gynecologist, n.d.; Chatfield, 2001; Guimarães et al., 2012).

E. Maternal Age

Maternal age, [_MAT_AGE_GROUP], was aggregated into four yearly groupings (1=<20; 2=20-34; 3=35-39; 4=40+) by SCDHEC. These categories were based on evidence-based literature on the effect of age on birth outcomes (Koo et al., 2012).

F. Partner Violence

1. Physical Abuse

Women were considered physically abused if they reported that their husband or partner pushed, hit, slapped, kicked, choked, or physically hurt them in any other way. Mothers were surveyed concerning the time period 12 months before pregnancy and during their most recent pregnancy (Questions #43 and #44). Prepregnant experience of physical abuse by a husband or partner was labeled as a dichotomous variable (yes/no) and similarly dichotomous variable for physical abuse during pregnancy. Women were not surveyed concerning abuse by persons other than their husband or partner.

2. Psychological/Sexual Abuse

Information on a woman's experience with several types of psychological abuse was measured by using four survey questions about their mental feelings during their most recent pregnancy. Women were considered psychologically abused if they said that their husband or partner threatened, frightened, controlled or forced them to take part in any undesired sexual act (question #77 a, b, c, d). The experience of partner-related psychological abuse was labeled as a dichotomous variable (yes/no) if any one of the four questions had an affirmative response. In an alternative approach, the total score, sum of the number of items present, was examined.

G. Stress

PRAMS mothers were surveyed concerning 14 stressful events during the 12 months before their new infant was born and during their most recent pregnancy. Question 42 c. "I moved to a new address" was removed because moving to a new address could be either a positive or negative experience, possibly resulting from either an increase or decrease in financial means (Stone et al., 2015). Single binary (yes/no) variables were used for mothers experiencing any of the remaining 13 stressful events. The stressful events were grouped into four categories: traumatic stress, financial stress, partner-related stress and emotional stress based on PRAMS published studies on prenatal stress factors and pregnancy (Ahluwalia et al., 2001; Association of Maternal & Child Health Programs, 2013; Stone et al., 2015).

These events were: **Traumatic:** (d) mother homeless, (l) mom or husband/partner jail, (m) someone close drinking or drugs. **Financial:** (e) husband/partner lost job, (f) mother lost job, (g) mom or partner cut in work hours/pay, (k) problems paying bills. **Partner-related:** (b) separated or divorced from my husband or partner, (i) argued husband/partner more, (j. husband/partner didn't want pregnancy. **Emotional:** (a) close family member sick/ n hospital, (h) apart from my husband/partner for work, (n) someone very close to me died.

Presence of traumatic stress was measured as Yes/No if any one of the three items was present. Similarly, emotional stress, financial and partner-related stress were treated in this way. Each stress type will be assessed individually.

3.5.4 DATA ANALYSIS

SC PRAMS Phase 7 (2012-2015) survey data were used to perform all analyses. After the original data set was received digitally from the SCDHEC Department of Biostatistics, data collection, cleaning, recoding and updating were completed. Sample procedural content, frequencies and percentages were computed for all variables during the preliminary analysis to check the consistencies of the received data. All statistical analyses in this quantitative study were conducted in SAS version 9.4, using strata and individual level survey weights to produce estimates representative of all mothers of South Carolina. Multicollinearity and heteroscedasticity of the variables will be checked by appropriate methods. Analysis results were considered statistically significant when p-values were less than 0.05. The detailed analysis plan follows for each research question.

Research Question 1:

Descriptive analysis was performed to describe the prevalence of prepregnancy dental counseling and dental services utilization during pregnancy. Since both dependent and independent variables are binary categorical, a Pearson's chi square test was used to test for the bivariate association between dental counseling and dental services utilization. In order to estimate the effect of dental counseling on dental services utilization after adjusting for the control variables, a multivariable logistic regression was estimated as specified. The full model used all available control variables and a best set of control variables was retained after iteratively comparing the Akaike Information Criterion (AIC) values.

Model 1 Dental Cleaning Before or During Pregnancy

Logit[Preventive Dental Utilization (Dental Cleaning Before or During Pregnancy) = 1] = $\beta_0 + \beta_1$ Preconception Oral Health Counseling + β_2 Dental Problem (During Pregnancy) +

β_3 Maternal Age Group + β_4 Maternal Race + β_5 Maternal Education + β_6 Rurality + β_7 Marital status + β_8 Annual Household Income + β_9 Dental Insurance + β_{10} Smoking (Before) + β_{11} Smoking (During) + β_{12} Prenatal Care Initiation+ β_{13} Prenatal Insurance + β_{14} Dental Problem + β_{15} Pregnancy Intendedness + β_{16} Dental Knowledge + β_{17} Medical Risk Factors + β_{18} Previous Live Birth + β_{19} Hypertension + β_{20} Diabetes + β_{21} Previous low birth weight + β_{22} Previous Preterm Birth + β_{23} Drinking (Before) + β_{24} Drinking (During) + β_{25} Exercise + β_{26} Vitamin Consumption + β_{27} Physical Abuse (Before or During Prepregnancy) + β_{28} Traumatic Stress (Any) + β_{29} Financial Stress (Any) + β_{30} Partner-Related Stress (Any) + β_{31} Emotional Stress (Any) + β_{32} Prepregnancy BMI Category + β_{33} Psychological Abuse (Any) + $\boldsymbol{\beta_{34}}$[1] Preconception Oral Health Counseling × (Dental Insurance + Annual Household Income + Dental Problem + Medical Risk Factor + Physical Abuse (Before or During) + Traumatic Stress + Financial Stress + Partner Stress + Emotional Stress).[2]

Research Questions 2 and 3:

Descriptive analysis was performed to describe the rates of preterm birth and SGA. Since both dependent and independent variables are binary, Pearson's chi square test was conducted to measure the bivariate association between dental services utilization and birth outcomes (preterm birth, SGA). In order to adjust control variables,

[1] This bold symbol means it is a vector containing individual coefficients for all the interactions.
[2] Interactions were tested individually one-by-one in separate models; The final model was estimated only with selected interactions having a p-value of less than .1.

multivariable logistic regression was performed using following Model 3 (preterm birth) and 4 (SGA). Stepwise regression method was used to find the best fitted model.

Model 2: Preterm Birth

Logit [preterm birth = 1] = β_o + β_1 Preventive Dental Utilization (Dental Cleaning Before or During Pregnancy) + β_2 Maternal Age Group + β_3 Maternal Race + β_4 Maternal Education + β_5 Rurality + β_6 Marital Status + β_7 Annual Household Income + β_8 Smoking (Before) + β_9 Smoking (During) + β_{10} Prenatal Care Initiation+ β_{11} Prenatal Insurance + β_{12} Dental Problem + β_{13} Pregnancy Intendedness + β_{14} Medical Risk Factors + β_{15} Previous Live Birth + β_{16} Hypertension + β_{17} Diabetes + β_{18} Previous Low Birth Weight + β_{19} Previous Preterm Birth + β_{20} New Weight Gain + β_{21} Newborn Sex + β_{22} Drinking (Before) + β_{23} Drinking (During) + β_{24} Exercise + β_{25} Vitamin Consumption + β_{26} Physical Abuse (Before or During Prepregnancy) + β_{27} Traumatic Stress (Any) + β_{28} Financial Stress (Any) + β_{29} Partner-Related Stress (Any) + β_{30} Emotional Stress (Any) + β_{31} Prepregnancy BMI Category + β_{32} Psychological Abuse (Any) + $\boldsymbol{\beta}_{33}$[3] Dental Cleaning Before Pregnancy × (Prenatal Care Initiation + Medical Risk Factors + Hypertension + Diabetes + Previous Preterm Birth + Smoking (During) + Drinking (During) + Exercise + Vitamin Consumption + Physical Abuse (Before or During) + Traumatic Stress + Financial Stress + Partner-Related Stress + Emotional Stress).[4]

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[3] This bold symbol means it is a vector containing individual coefficients for all the interactions.

[4] Interactions were tested individually one-by-one in separate models; The final model was estimated only with selected interactions having a p-value of less than .1.

Model 3: Small for Gestational Age

Logit[SGA = 1] = β_o + β_1 Preventive Dental Utilization (Dental Cleaning Before or During Pregnancy) + β_2 Age + β_3 Race + β_4 Education + β_5 Rurality + β_6 Marital Status + β_7 Annual Household Income + β_8 Smoking (Before) + β_9 Smoking (During) + β_{10} First Prenatal Care Visit + β_{11} Prenatal Insurance + β_{12} Dental Problem + β_{13} Pregnancy Intendedness + β_{14} Medical Risk Factors + β_{15} Previous Live Birth + β_{16} Hypertension + β_{17} Diabetes + β_{18} Previous SGA + β_{19} Previous Preterm Birth + β_{20} Drinking (Before) + β_{21} Drinking (After) + β_{22} Exercise + β_{23} Vitamin Consumption + β_{24} Physical Abuse (Before or During Prepregnancy) + β_{25} Traumatic Stress (Any) + β_{26} Financial Stress (Any) + β_{27} Partner-Related Stress (Any) + β_{28} Emotional Stress (Any) + β_{29} Prepregnancy BMI Category + β_{30} Psychological Abuse (Any) + $\boldsymbol{\beta_{31}}$[5] Preterm Birth Interactions of Dental Cleaning Before Pregnancy × (First Prenatal Care Visit + Medical Risk Factors + Hypertension + Diabetes + Previous Preterm Birth + Smoking (During) + Drinking (During) + Exercise + Vitamin Consumption + Physical Abuse (Before or During) + Traumatic Stress + Financial Stress + Partner-Related Stress + Emotional Stress).[6]

[5] This bold symbol means it is a vector containing individual coefficients for all the interactions.

[6] Interactions were tested individually one-by-one in separate models; The final model was estimated only with selected interactions having a p-value of less than .1.

3.6 PRAMS DATA QUALITY AND ETHICS

3.6.1 QUALITY CONTROL MEASURES

PRAMS quality is ensured by many unique characteristics as well as its integration of several quality control measures. First, PRAMS is the only U.S. national surveillance system which exclusively samples pregnant women on pregnancy and perinatal health issues. Moreover, no U.S. general population-based survey oversamples pregnant women to achieve a representative sample. (Lydon-Rochelle et al., 2004). Second, PRAMS collects data over the entire perinatal period including preconception, pregnancy and postpartum periods covering numerous maternal and infant health indicators, subpopulation inequalities, outcomes, and population comparison capabilities across the nation. PRAMS surveillance acquires data on health factors, utilization, and practices of pregnant women. Third, the CDC institutional review board reviews and approves the general PRAMS procedures and practices; they are subsequently evaluated and approved by the local health department institutional review board. Fourth, PRAMS mailed and telephone surveys utilize quality control monitoring by supervisors to assure that survey administration and data entry are performed correctly (Shulman et al., 2018). Data entry confirmation is mandatory for at least 10% of mail and telephone surveys, even though many states complete 100% verification of mailed surveys (Shulman et al., 2018). Within a survey, item nonresponse rates are low at 1-2% except household income questions which have a 6% nonresponse rate (Shulman et al., 2018). Item nonresponses are not imputed and are considered missing data.

3.6.2 INFORMED CONSENT

An informed consent is a required part of the SC PRAMS surveillance process. Each mailed document contains a note explaining the recipient's rights. Implied consent is given when the survey is complete; therefore, no written consent is involved. During phone interviews, there is verbal delivery of the informed consent document. Women under 18 years of age are allowed to participate fully by making decisions on behalf of their children through emancipation.

3.6.3 PATIENT CONFIDENTIALITY

For identifiable data protection as well as participant confidentiality, the analytic file received for analysis in this research was completely deidentified by SC DHEC Maternal and Child Health Bureau. Any data that would allow for the potential identification of patients, including some birth certificate data, was excluded. To determine rurality, no geographic indicator smaller than the county level was included in the file. SC PRAMS surveillance data (Phase 7/ 2012-2015) was requested in writing after receipt of Institutional Review Board (IRB) approval from Office of Public Health Statistics & Information Services (PHSIS) in the SCDHEC in Columbia, South Carolina. The deidentified data provided was stored and analyzed on the password protected personal computer of the principal investigator, Dr. Monique Williams, with an encrypted hard drive.

3.7 STUDY LIMITATIONS

The limitations of this study are seven-fold:

1. The data completeness rate in SC PRAMS 2012-2015 Birth Certificate data was 100% but only 45-53 % for survey responses (H. Davis, personal communication,

June 24, 2020). The CDC threshold response rate for inclusion in nationwide analysis was 60% from 2012 to 2014, and 55% from 2015 to 2016 (Shulman et al., 2018). South Carolina was excluded from national analysis by the CDC due to not meeting these thresholds for all the years of this study. To make the data representative and generalizable to the population, the CDC provides weights to account for the stratified sampling and utilizing South Carolina birth certificate information to produce the final weighted values for SC PRAMS.

2. Recall bias may occur due to the retrospective recall by mothers of their dental services utilization after delivery. Self-reporting of health services may not be accurate, prone for reporting bias (under/over reporting). The PRAMS methodology is designed to minimize recall bias by having mothers complete the survey within 2-9 months of delivery. Still, questions about the time before pregnancy might be more prone to recall bias than those related to more recent events.

3. Only live births were included. Early and late miscarriages, abortions and stillbirths were excluded. This information would be valuable in studying mortality and mortality related morbidities associated with dental problems.

4. The determination of the clinical oral health status/clinical condition of the mother using dental or medical records was not possible. In addition, a participant's actual reason for seeking dental treatment was also not available. In this analysis, the medical reason for a dental treatment event was not asked in the PRAMs Phase 7 standard or state-specific questions. Therefore, the clinical reason for a dental visit was not available.

5. Barriers to utilization or reasons for not seeking care were not specifically questioned in Phase 7 (2012-2015) of SC PRAMS. Specific causes for lack of utilization could not be determined based on the questions available. Collection of this self-reported questionnaire data would have been helpful to understand the specific barriers to access for dental services such as transportation or fear of dental treatment during pregnancy.

6. Cross-sectional survey study design (exposure and outcome data collected at the same time) prevented making definitive conclusions on temporal and directional associations of independent and dependent variables. Wording of the oral health questions did not allow timing determination of oral disease at the medical or dental visit. Barriers to seeking care were not included in the Phase 7 survey.

7. Findings from this study may not be generalizable to other states other than South Carolina. States have varying sociodemographic factors within the population affecting their health behaviors.

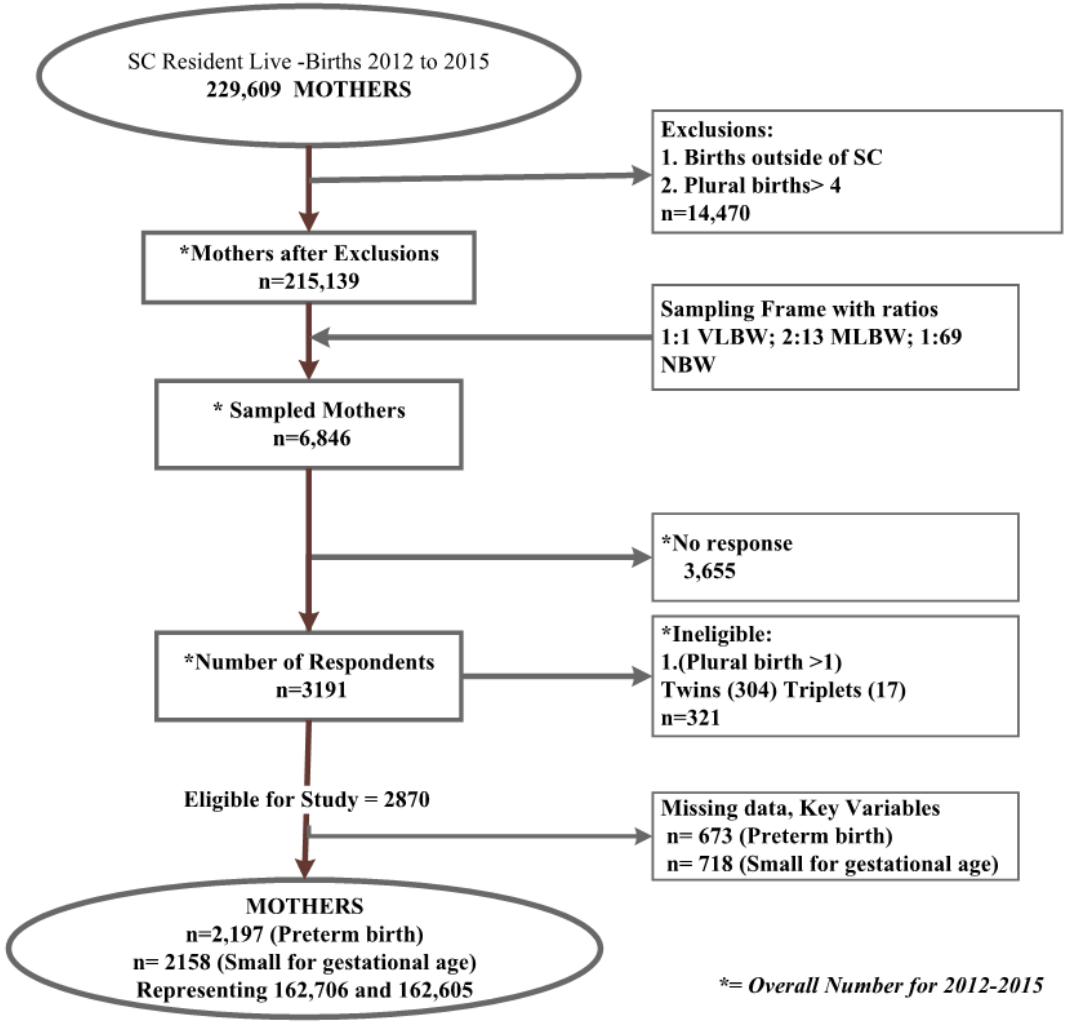

Figure 3.1. SC PRAMS Sample Flow Preterm Birth and SGA.

Table 3.1: Birth Statistics for Residents (All Races) of South Carolina.

Year	Total Resident Births	Eligible for SC PRAMS*	CDC Target Response Rate (%)	Response Rate (%)	Number Sampled (Overall)	Target Number of Respondents (Overall)	Actual Number of Respondents (Overall)
2012	57,100	53,668	65	48	1,255	816	620
2013	56,743	53,329	60	53	1,883	1,130	949
2014	57,631	53,988	60	50	1,834	1,100	855
2015	58,135	54,154	60	45	1,874	1,124	767
2012-2015	229,609	215,139			6,846	4,170	3,191
Source: South Carolina Department of Health and Environment Control							
**Number of live births that occurred in SC to resident moms with plurality is <4*							

Table 3.2: SC PRAMS Data Sampling Stratification (By Birthweight).

	Very low birth weight (<1,500 grams)			Moderately low birth weight (1,500-<2,500 grams)			Normal birth weight (2,500 grams+)		
Year	Sampled	Respondents	Response rate	Sampled	Respondents	Response rate	Sampled	Respondents	Response rate
2012	565	288	51%	332	162	49%	358	170	48%
2013	873	447	51%	471	212	45%	539	290	53%
2014	819	369	45%	477	211	44%	538	275	51%
2015	848	344	41%	485	176	36%	541	247	46%
2012-2015	3,105	1,448	47%	1,765	761	43%	1,976	982	50%
Source: South Carolina Department of Health and Environment Control									
***2012-2015 sampling stratifications: 1 out of every 1 very low birth weight infant; 2 out of every 13 moderately low birth weight infants; 1 out of 69 normal birth weight infants*									

Table 3.3: WHO and CDC Recommended Weight Gain for Pregnant Women.

.	Singleton Births	
Pre-pregnancy Weight Category	**Body Mass Index**	**Recommended Range of Total Weight Gain (lbs.)**
Underweight	Less than 18.5	28–40
Normal Weight	18.5–24.9	25–35
Overweight	25–29.9	15–25
Obese	30 and greater	11–20

Table 3.4: Study Variables.

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Dependent Variables				
Outcome				
Preventive dental services utilization	DDS_ CLN	**28. This question is about the care of your teeth *during your most recent* pregnancy.** c. I had teeth cleaned by a dentist or dental hygienist	Does utilization of preventive dental care affect birth outcomes: pre-term labor (preterm birth) and SGA?	Teeth cleaned by a dentist or dental hygienist during pregnancy (yes or no)
Preventive dental services utilization	PRE_DDS	**7. At any time during *12 months before* you got pregnant with your new baby, did you do any of the following things?** h. I had my teeth cleaned by a dentist or a dental hygienist	Does utilization of preventive dental care affect birth outcomes: pre-term labor (preterm birth) and SGA?	Teeth cleaned by a dentist or dental hygienist before pregnancy (yes or no)
Low Birth Weight	LBW	Birth Certificate Data	Does utilization of preventive dental care during pregnancy affect SGA?	Live birth with LBW <2,500 grams (yes or no)
Birth Weight Category	Birth weight_03cat	Birth Certificate Data	Does utilization of preventive dental care during pregnancy affect SGA?	Live birth with very-SGA (<1,500 grams), SGA (1,500 to 2,499 grams), normal weight (2,500 to 4,500 grams)

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Preterm Birth	PTB	Birth Certificate Data	Does utilization of preventive dental care during pregnancy affect pre-term labor?	Live birth before 37 weeks gestation (yes or no)
Small for Gestational Age	SGA	Birth Certificate Data	Does utilization of preventive dental care during pregnancy affect pre-term labor?	Birth weight below the 10th percentile adjusted for newborn sex and gestational age. (yes or no)
Independent Variables				
Enabling Factors				
Preconception oral health counseling	BPG_DDS	**11. *Before* you got pregnant with your new baby, did a doctor, nurse, or other health care worker talk with you about any of the things listed below?** d. Visiting a dentist or dental hygienist before pregnancy	Does oral health counseling by a medical provider before pregnancy impact preventive oral health services usage during pregnancy?	Prepregnancy oral health counseling pregnancy (yes or no)
Control Variables				
Predisposing Factors				
Maternal Age Group	@_MAT_AGE_ GROUP MAT_AGE_GR OUP_nf	Birth Certificate Data	Dental utilization, SGA, or preterm birth is associated with maternal age.	Below 35 Years; 35 Years or More

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Maternal Race	_MATERNAL_ RACE maternal_race_n 2rf	Birth Certificate Data	Race is associated with dental utilization, SGA, or preterm birth.	White and Other; Black
Maternal Education	_MAT_EDU_Y RS mat_edu_yrs3f	Birth Certificate Data	Maternal education is associated with dental utilization.	Below 12 Years; 12 Years; More than 12 Years
Marital Status	_MARITALSTA TUS maritlstatus_nf	Birth Certificate Data	There are reported differences in health care utilization by marital status. Marital status is associated with preterm birth and SGA.	Unmarried; Married
Prenatal Health Insurance	_PRENATAL_I NS	**21. During *your most recent pregnancy*, what kind of *health insurance* did you have to pay for your *prenatal* care?** Check ALL that apply	Poverty may impact dental utilization, preterm birth or SGA.	Type of health insurance to pay for prenatal care: Medicaid; Private/Insurance/ Military/Other; Uninsured
Need Factors				
Dental Problem	DDS_PROB	**28. This question is about the care of your teeth *during your most recent* pregnancy.** e. I needed to see a dentist for a **problem**	What is the association between having a dental problem during pregnancy and experiencing poor birth outcomes, such as SGA and preterm birth?	Having a dental problem during pregnancy (yes or no)

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Oral Health Knowledge	DDS_CARE	**28. This question is about the care of your teeth *during your most recent* pregnancy.** a. I knew it was important for me to care for my teeth and gums during my pregnancy	Oral health knowledge is associated with utilization.	Knew the importance of oral care during pregnancy (yes or no)
Pregnancy Intendedness	PGINTENT PG_TRY	**13. Thinking back to just before you got pregnant with your new baby, how did you feel about becoming pregnant?** **15. When you got pregnant with your new baby, were you trying to get pregnant?**	Unintended pregnancy is associated with birth outcomes.	Trying to get pregnant (yes or no)
Enabling Factors				
Rurality	RURAL	Birth Certificate Data	Rurality is associated with utilization. Number of providers which varies in urban versus rural areas is associated with access to care.	Rural; Non-rural

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Income	INCOME7 INCOME7nf	**During the 12 months before your new baby was born, what was your yearly total household income before taxes?** Include your income, your husband's or partner's income, and any other income you may have received.	Dental utilization, SGA, or preterm birth is associated with income.	$0 to $19,000; $19,001 to $37,000; $37,001 to $67,000; $67,001 or More
Prenatal Care Initiation	PNC_1STU PNC_1ST PNC_1ST_n2f ERLY6PNC	**18. How many weeks *or* months pregnant were you when you had your first visit for prenatal care?** **19. Did you get prenatal care as early as you wanted?**	Prenatal care existence, frequency or timing is associated with birth outcomes: preterm birth and SGA and dental utilization.	Timely (13 Weeks or Earlier); Delayed (After 13 Weeks)
Dental Insurance	DDS_INS	**28. This question is about the care of your teeth <u>during</u> your most recent pregnancy.** d. I had insurance to cover dental care during my pregnancy	Dental insurance is associated with dental utilization.	Dental insurance during pregnancy (yes or no)
Biological Factors				
Prepregnancy BMI	MOM_PRE_BMI_CAT	**1. How tall are *you* without shoes?** **_____**Feet ____ Inches **OR** ____ Centimeters **2. *Just before* you got pregnant with your new baby, how much did you weigh?** _____Pounds **OR** __kilos	Prepregnancy BMI is associated with birth outcomes: SGA or preterm birth. Risk of not receiving dental care is associated with BMI.	Underweight (<18.5); Normal weight (18.5-24.9); Overweight (30.0) and Obese >30.0)

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Medical Risk Factors	MM_NOM MM_NOMD	Birth Certificate Data	The presence of pregnancy related medical risk factors confound the possible association between dental utilization and birth outcomes.	Mothers having any of the following: diabetes, hypertension, previous preterm birth, infertility treatments/enhancers, reproductive technology assistance and previous cesarean (yes or no)
Newborn Sex	SEX SEX_nf	Birth Certificate Data	Newborn sex (male or female) is associated with birth weight.	Male; Female
Previous Live Births	PRE_LB YY4_LLB PRE_LB_nf	**4. Before you got pregnant with your new baby, did you ever have any other newborns who were born alive?** Birth Certificate Data	Previous live births or the timing of the birth previous to most recent birth is associated with birth outcomes.	Number of Previous Live Births: None; One; Two or More

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Maternal Weight Gain	NEWWGHTGAINF PGWT_GNU PGWT_GN	**49. By the end of your most recent pregnancy, how much weight had you gained?** -I gained _____ pounds -I didn't gain any weight, but I lost __pounds -My weight didn't change during my pregnancy -I don't know	Obesity is associated with birth outcomes and dental utilization.	Weight gain during pregnancy: Less than Recommended; Recommended; More than Recommended
Hypertension	MM_HBP	Birth Certificate Data	Hypertension during pregnancy is associated with birth outcomes: preterm birth and SGA.	Hypertension during pregnancy (yes or no)
Diabetes	MM_DIAB BD_DIABf	Birth Certificate Data	Gestational diabetes is associated with birth outcomes: preterm birth and SGA.	Neither Before nor During Diabetes; Diabetes Before; During Only
Previous SGA	PREV_LBW	**5. Did the baby born *just before* your new one weigh 5 pounds, 8 ounces (2.5 kilos) or *less* at birth?**	Previous SGA delivery is associated with subsequent birth weight outcomes.	Previous SGA <2,500 grams (yes or no)
Previous preterm birth	PREV_PRE P_PRTERM	**6. Was the baby *just before* your new one born *earlier* than 3 weeks before his or her due date?** Birth Certificate Data	History of previous preterm birth is associated with subsequent birth outcomes: preterm birth and SGA.	Previous preterm birth <37 weeks gestation (yes or no)

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Health Behaviors				
Preventive dental services utilization	DDS_ CLN	**28. This question is about the care of your teeth *during your most recent* pregnancy.** c. I had teeth cleaned by a dentist or dental hygienist	Does utilization of preventive dental care affect birth outcomes: pre-term labor and SGA?	Teeth cleaned by a dentist or dental hygienist during pregnancy (yes or no)
Preventive dental services utilization	PRE_DDS	**7. At any time during *12 months before* you got pregnant with your new baby, did you do any of the following things?** h. I had my teeth cleaned by a dentist or a dental hygienist	Does utilization of preventive dental care affect birth outcomes: pre-term labor and SGA?	Teeth cleaned by a dentist or dental hygienist before pregnancy (yes or no)
Smoking	SMOKE_BEFORE. SMOKE_DURING SMOKE_NOW	**35. Have you smoked any cigarettes in the *past 2 years*?** **36. In the *3 months before* you got pregnant, how many cigarettes did you smoke on an average day?** A pack has 20 cigarettes. **37. In the *last 3 months* of your pregnancy, how many cigarettes did you smoke on an average day?** A pack has 20 cigarettes. **38. How many cigarettes do you smoke on an average day now?** A pack has 20 cigarettes.	Smoking is associated with oral and general health outcomes.	Smoked cigarettes (last two years, three months before, last three months) (yes or no)

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Drinking	DRK_2YRS SMK6_3B_RAW SMK6_3L_RAW SMK6_3N_RAW	**39. Have you had any alcoholic drinks in the *past 2 years*?** A drink is 1 glass of wine, wine cooler, can or bottle of beer, shot of liquor, or mixed drink. **40. During the *3 months before* you got pregnant, how many alcoholic drinks did you have in an average week?** **41. During the *last 3 months* of your pregnancy, how many alcoholic drinks did you have in an average week?**	Alcohol consumption is associated with birth outcomes.	Consumed alcohol (last two years, three months before, last three months) (yes or no)
Exercise	EXERAPWK EXER3WK EXERAPWK_n2f	**73. Thinking back to after you found out you were pregnant, how many times did you exercise or play sports per week?** (Include walking briskly, jogging, aerobics, swimming, etc. for ½ hour or more) **74. During how many months of this pregnancy did you exercise or play sports at least 3 times a week?** _____ months	Exercise or the frequency of exercise during pregnancy may be associated. Exercise reflects healthy lifestyle behaviors.	<Three Times per Week; Three or More Times per Week

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Vitamin Consumption	VITAMIN VITAMIN_n2f	**9. During the *month before* you got pregnant with your new baby, how many times a week did you take a multivitamin, a prenatal vitamin, or a folic acid vitamin?**	Vitamin consumption during pregnancy is associated with birth outcomes and defects.	0-3 Times per Week; 4-7 Times per Week
Psychobiological Factors				
Physical Abuse	PAB6HUS	**43. During the *12 months before you got pregnant* with your new baby, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?**	Does physical abuse by the husband or partner before pregnancy affect SGA or preterm birth?	Experienced partner-related physical abuse before pregnancy (yes or no)
Physical Abuse	PAD6HUS	**44. During *your most recent pregnancy*, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?**	Does physical abuse by the husband or partner before pregnancy affect SGA or preterm birth?	Experienced partner-related physical abuse before pregnancy (yes or no)
Psychological Abuse (a)	HDP_SAF	**77. This question is about things that may have happened during *your most recent* pregnancy.** a. My husband or partner threatened me or made me feel unsafe in some way	Does psychological abuse during pregnancy by a husband or partner affect SGA or preterm birth?	Experienced any of the four psychological abuse factors (a-d) by husband/partner during pregnancy ((yes or no)
				Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Psychological Abuse (b)	HDP_ANGR	**77. This question is about things that may have happened during *your most recent* pregnancy.** b. I was frightened for my safety or my family's safety because of the anger or threats of my husband or partner	Does psychological abuse during pregnancy by a husband or partner affect SGA or preterm birth?	Experienced any of the four psychological abuse factors (a-d) by husband/partner during pregnancy ((yes or no)
Psychological Abuse (c)	HDP_CTRL	**77. This question is about things that may have happened during *your most recent* pregnancy.** c. My husband or partner tried to control my daily activities, for example, controlling who I could talk to or where I could go	Does psychological abuse during pregnancy by a husband or partner affect SGA or preterm birth?	Experienced any of the four psychological abuse factors (a-d) by husband/partner during pregnancy ((yes or no)
Psychological Abuse (d)	HDP_SEX	**77. This question is about things that may have happened during *your most recent* pregnancy.** d. My husband or partner forced me to take part in touching or any sexual activity when I did not want	Does psychological abuse during pregnancy by a husband or partner affect SGA or preterm birth?	Experienced any of the four psychological abuse factors (a-d) by husband/partner during pregnancy ((yes or no)
Stress Variables: Traumatic, Financial, Partner-Related, and Emotional. Source: (Ahluwalia et al., 2001; Association of Maternal & Child Health Programs, 2013; Centers for Disease Control and Prevention, 2008; Stone et al., 2015)				
Traumatic Stress				
				Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Homelessness	STRS_HOME	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** d. I was homeless or had to sleep outside, in a car, or in a shelter	Does traumatic stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the traumatic stress factors (yes or no)
Mom or husband/partner jail	STRS_JL3	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** l. My husband or partner, or I went to jail	Does traumatic stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the traumatic stress factors (yes or no)
Someone close drinking or drugs	STRS_DRG	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** m. Someone very close to me had a problem with drinking or drugs	Does traumatic stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the traumatic stress factors (yes or no)
Financial Stress				

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Husband/partner lost job	STRS_JOB	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** e. My husband or partner lost his job	Does financial stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the financial stress factors (yes or no)
Mother lost job	STRS_WRK	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** f. I lost my job even though I wanted to go on working	Does financial stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the financial stress factors (yes or no)
Mother or Partner reduction in pay	STRS_PAY	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** g. My husband, partner, or I had a cut in work hours or pay	Does financial stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the financial stress factors (yes or no)
Problems paying bills	STRS_BIL	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** k. I had problems paying the rent, mortgage, or other bills	Does financial stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the financial stress factors (yes or no)

Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Partner-Related Stress				
Separated or divorced	STRS_DV3	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** b. I got separated or divorced from my husband or partner	Does partner-related stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the partner-related stress factors (yes or no)
Argued with husband/partner more	STRS_ARG	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** i. I argued with my husband or partner more than usual	Does partner-related stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the partner-related stress factors (yes or no)
Husband/partner didn't want pregnancy	STRS_PG	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** j. My husband or partner said he didn't want me to be pregnant	Does partner-related stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the partner-related stress factors (yes or no)
Emotional Stress				
				Continued

Variable Name	Variable Code	PRAMS Survey Question (if applicable)	Research Question/ Control Variable Rationale	Variable Explanation
Close family member sick/ in hospital	STRS_FM3	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** a. A close family member was very sick and had to go into the hospital	Does emotional stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the emotional stress factors (yes or no)
Apart from my husband/partner for work	STRS_AWY	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** h. I was apart from my husband or partner due to military deployment or extended work-related travel	Does emotional stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the emotional stress factors (yes or no)
Someone very close to me died.	STRS_DH3	**42. This question is about the things that may have happened during the *12 months before your new baby was born.*** n. Someone very close to me died	Does emotional stress during the12 months before birth impact SGA or preterm birth?	The presence of any of the emotional stress factors (yes or no)

CHAPTER 4

MANUSCRIPT I

ASSOCIATION OF PRECONCEPTION ORAL HEALTH COUNSELING WITH MATERNAL PREVENTIVE DENTAL SERVICES UTILIZATION[7]

4.1 ABSTRACT

Dental cleaning is a safe and effective prevention against oral diseases including gingivitis and periodontitis working by reducing harmful bacteria which can be transferred from mother to child (Featherstone, 2008; Hemalatha et al., 2013; Johnson et al., 2006; Kurien et al., 2013; Moimaz et al., 2014; Steinberg et al., 2013). Despite the benefits and safety of dental services during pregnancy, utilization is low even among women with dental problems. This study examines maternal preventive dental services utilization by analyzing the role of medical preconception oral health counseling in dental cleaning behaviors before or during pregnancy.

Population-based cross-sectional surveillance 2012-2015 data from the South Carolina Pregnancy Risk Assessment Monitoring System (SC PRAMS) were analyzed in SAS using weighted Univariate, Rao-Scott Chi-squared tests and multivariate logistic

[7] Monique Williams, DDS, PhD, Sudha Xirasagar, MBBS, PhD, Peiyin Hung, PhD, Nicole Hair, PhD, Jihong Liu, PhD. To be submitted to the Journal of the American Dental Association.

regression to estimate adjusted odds ratios (AOR). Among the 2,870 surveyed mothers, 8% received preconception oral health counseling and 59% had received dental cleaning before or during pregnancy. Preconception oral health counseling by a medical provider was associated with five-fold higher odds of dental cleaning relative to no counseling in both univariable and adjusted multivariable logistic regression analyses (OR 5.668; 95% CI [2.760, 11.639]; p <.0001) and (AOR 4.994; 95% CI [1.972, 12.649]; p < 0.0007) respectively.

Provision of oral health counseling by a medical provider before pregnancy is an effective low-cost intervention which impacts maternal preventive dental services utilization. Improved oral health guidelines for women of reproductive age may diminish the current dental underutilization patterns seen in the perinatal period.

4.2 INTRODUCTION

In South Carolina, about 9.2 % of newborns have low birth weight and 11.2% are born prematurely creating an unsurmountable burden on the health care system and community as a whole (Dobre et al., 2007). Current evidence suggests that periodontal disease may have an association with adverse birth outcomes and treatment might reduce these negative effects (Corbella et al., 2016; Guimarães et al., 2012; Piscoya et al., 2012; Pitiphat et al., 2007). Yet, national dental utilization rates during pregnancy remain low (23% to 43%) (Lydon-Rochelle et al., 2004). Statewide in 2012-2013, less than 47% of South Carolina pregnant women received dental services, 47% had oral health counseling, and 21% experienced a dental problem during pregnancy (Sanders et al., 2017). Of this 21%, 57% did not seek care (Sanders et al., 2017).

The American Academy of Pediatrics (AAP) and the American Academy of Obstetrician and Gynecologists (ACOG) recommend the continuation of routine dental care in pregnancy (American Academy of Pediatrics & American College of Obstetricians and Gynecologists [ACOG], 2012). Further, advisory guidelines for prenatal care recommend that obstetricians should complete an oral health assessment and make preventive dental care referrals during the first prenatal visit (American Academy of Pediatrics & ACOG, 2012). Despite the guidelines, preventive dental care during pregnancy is not universal, and the care received may be too late to prevent adverse birth outcomes (Hwang et al., 2012). Currently, there are no guidelines recommending prepregnancy oral health counseling, assessment or referrals for women intending to become pregnant. Moreover, oral health is not included in the perinatal care guidelines for prepregnancy counseling, nor is it included in the reproductive health screening recommendations (American Academy of Pediatrics & ACOG, 2012). This study will examine whether preconception oral health counseling defined as advice to visit a dentist for preventive dental cleaning impacts maternal perinatal dental cleaning service utilization. Research to address the factors which improve preventive dental care use may enable interventions to improve preventive dental service utilization by pregnant women (Andersen et al., 2007; Cibulka et al., 2011; Institute of Medicine [IOM], 2011).

Several studies based on Pregnancy Risk Assessment Monitoring System (PRAMS) data have documented that prenatal oral hygiene instructions during a dental visit (labeled “oral health counseling”) was associated with higher odds of dental cleaning during pregnancy (Chenwi & Savitz, 2018; Hwang et al., 2012; Lydon-Rochelle et al., 2004; Muralidharan & Merrill, 2019; Naavaal et al., 2019; Thompson et al., 2013).

A key weakness of previous PRAMS studies was in interpreting oral hygiene instructions (on how to care for teeth and gums) during a dental visit as oral health counseling (Hwang et al., 2012; Lydon-Rochelle et al., 2004; Thompson et al., 2013). Recent studies continued to use this interpretation to examine the impact of oral health counseling on dental utilization (Chenwi & Savitz, 2018; Muralidharan & Merrill, 2019; Naavaal et al., 2019; Singhal et al., 2014). All of these studies were thus limited to examining the association of oral self-care instructions among those who were receiving dental care. This does not equate to counseling to guide mothers towards the dental professional intervention of dental cleaning. To reduce periodontitis which causes adverse maternal and child outcomes, dental cleaning by a dental professional is the key. Therefore, this study defines preventive oral health counseling as prepregnancy counseling by a woman's medical/gynecological provider to seek dental care.

Another limitation of existing studies that examined oral health service utilization did not account for certain enabling or impeding variables that impact patients, such as dental insurance coverage, income and financial stress (Hwang et al., 2012; Thompson et al., 2013; Vasiliou et al., 2016). Previous studies did not account for dental insurance, utilizing health insurance as a proxy for dental coverage (Hwang et al., 2012; Lydon-Rochelle et al., 2004). In 2012, a prenatal dental insurance uptake question was added to SC PRAMS Phase 7 survey. To improve upon more recent studies which adjusted for dental insurance, this research will test the independent impact of financial factors in women's dental cleaning utilization decisions, dental insurance, and confounding effects of financial stress and annual income, factors that were not previously studied (Kundu et al., 2014; Nkansah-Amankra et al., 2010; Vasiliou et al., 2016).

Lastly, previous studies did not examine the role of key psychosocial barriers such as maternal physical abuse (before and during pregnancy) and maternal stress (during pregnancy) which may impact mothers' ability to access dental care (Abel et al., 2012; Kundu et al., 2014; Vasiliou et al., 2016). Studies which evaluated stress or domestic violence during pregnancy found significant differences in both oral healthcare practices and oral health status of women who had these experiences compared to women that did not (Kundu et al., 2014; Nkansah-Amankra et al., 2010; Vasiliou et al., 2016). In this study, we account for psychobiological factors in our assessment of the association of preconception oral health counseling with dental cleaning utilization before and during pregnancy among South Carolina mothers.

Our study is important in light of the known role of routine dental cleaning in the prevention of periodontitis, and the documented association of periodontitis with adverse birth outcomes (Guimarães et al., 2012; Piscoya et al., 2012; Pitiphat et al., 2007; Tejada et al., 2012; Tonetti et al., 2015). Understanding the role of oral health counseling in women's preventive dental care utilization is an essential step to inform practice guidelines for routine health and wellness care of women of reproductive age.

Preconception oral health counseling is advice given by a medical provider during a medical visit before pregnancy to visit a dentist. Such counseling represents an opportunity to enhance oral health knowledge and facilitate proactive consultations with a dentist or dental hygienist (Byrd et al., 2018; The American College of Obstetricians and Gynecologists [ACOG] Committee on Health Care for Underserved Women, 2013). Mothers who report receiving oral health education before their current pregnancy and have heard about the possible connection between poor maternal oral health and adverse

pregnancy outcomes were more likely to have a dental visit (type unspecified) during pregnancy (Al Habashneh et al., 2005; Saddki et al., 2010). This population-based study assesses whether preconception oral health counseling given specifically by a medical provider is associated with preventive dental cleaning before or during pregnancy, here after called dental cleaning. It contributes to the evidence base for oral health-related standards of care during womens' well care visits and prenatal care visits. We use an adapted Healthcare Utilization Model proposed by Andersen et al. to model the association of preconception oral health counseling with dental cleaning before or during pregnancy.

4.3 METHODS

A. Conceptual Framework

Andersen's model of healthcare utilization was used as a conceptual model to analyze factors that result in realized use of health services, including dental cleaning. See Figure 4.1. According to this conceptual model, usage of health care services, dental care, is comprised of three components: predisposing factors, enabling factors, and need factors. The study used these groupings of variables affecting oral health services use.

B. Data

This study used SC PRAMS data collected during 2012-2015. De-identified data from the PRAMS survey linked with birth certificate data were received from the South Carolina Department of Environmental Control (SCDHEC). These data are collected by SCDHEC and the Centers for Disease Control and Prevention (CDC). PRAMS is a cross sectional survey of mothers, the largest ongoing population-based, perinatal health status surveillance system covering maternal health before, during and after pregnancy

(Shulman et al., 2018). The data include self-reported morbidities, practices, and experiences of mothers who recently delivered a live-born infant (Shulman et al., 2018). PRAMS oversamples mothers of low birth weight (LBW) infants. Survey weights are assigned using state-specific sampling frame ratios by the CDC. For SC PRAMS Phase 7 (2012-2015), the sampling ratios out of total eligible births were as follows: 1:1 very LBW (< 1,500 grams, i.e. every mother with very LBW birth), 1:7 moderately LBW (1,500 – 2,499 grams) and 1:69 normal birth weight (≥ 2,500 grams) (*CDC - Methodology - Pregnancy Risk Assessment Monitoring System - Reproductive Health*, 2018). This study was approved by the South Carolina Department of Health and Environmental Control Data Oversight Committee and exempt from IRB review by the University of South Carolina Institutional Review Board.

C. Sample

Figure 4.2 shows the exclusions applied by the PRAMS sampling procedure and our study exclusion criteria. Sample respondents were 3,191 mothers out of a total 215,139 South Carolina survey-eligible mothers, contributed by 620, 949, 855, and 767 mothers respectively from consecutive survey years from 2012-2015. Survey response rates were 48%, 53%, 50% and 45% respectively during 2012-2015 (SC Department of Health and Environmental Control, 2019). Study exclusions were 321 mothers with multiple births for a final study sample of 2,870 mothers aged 12 to 46 years.

D. Dependent Variable

Preventive dental utilization before or during pregnancy was the outcome of interest. Participants were asked if they had their teeth cleaned by a dentist or dental hygienist before or during their most recent pregnancy. The sample consisted of very few

mothers who had dental cleaning only during pregnancy or only before pregnancy resulting in null findings in these groups. Given the chronicity of periodontitis, it was determined appropriate to classify mothers into two groups, those with dental cleaning before or/and during pregnancy and those who did not receive dental cleaning.

E. Independent Variables

Oral health counseling by a doctor, nurse, or other health care worker during a medical visit before pregnancy was the primary exposure variable of interest. Respondents were asked if a doctor, nurse or other health care worker talked with them about visiting a dentist or dental hygienist before pregnancy. (Viewing videos or print material are not included in the PRAMS question.) The secondary variable of interest was dental insurance coverage during pregnancy. Appendix A presents the questions as asked in PRAMS that were used in the study.

F. Control Variables

Control variables were selected consistent with Andersen's Model of Healthcare Utilization, subject to availability in PRAMS data. Analysis accounted for predisposing, enabling, need, personal health practices, biological, and psychological factors that may influence the outcome of interest, dental cleaning utilization. Predisposing variables included race (White, Black and Other), age (>35 and <35), marital status (married, unmarried) and education (<12 years, 12 years, and more than 12 years). Enabling variables included annual household income ($0 to $19,000, $19,001 to $37,000, $37,001 to $67,000, $67,001 or more), rurality and prenatal health insurance coverage. Need factors were presence of a dental problem during pregnancy, perceived importance of oral health and pregnancy intent prior to pregnancy. Personal health practices were

smoking, alcohol use, exercise and vitamin consumption. Biological factors were maternal Body Mass Index (BMI), previous live birth, hypertension, diabetes, other medical risk factors, previous low birth weight and previous preterm birth. History of adverse birth outcomes was included because it may generate greater health consciousness and proactive actions in future pregnancies.

Psychobiological control variables were stress, psychological abuse and physical abuse. To account for stress variables, 13 out of 14 PRAMS questions on stressful events during the 12 months before the birth were used (see Appendix A) (Ahluwalia et al., 2001; Association of Maternal & Child Health Programs, 2013; Stone et al., 2015). The PRAMS survey included questions on the occurrence of 14 stressful events during the 12 months before birth. One question was excluded (question 42 c. "I moved to a new address") because moving may be a positive experience associated with a change in financial means (Stone et al., 2015). Questions were grouped into four categories: traumatic stress, financial stress, partner-related stress and emotional stress, per published studies on pregnancy and prenatal psychological stress for logistic regression analyses (Ahluwalia et al., 2001; Association of Maternal & Child Health Programs, 2013; Stone et al., 2015). Traumatic stress was considered to exist if the mother reported one or more of the following: (a) homeless during pregnancy, (b) the mother or husband/partner were in jail anytime during the pregnancy, or (c) close family member with drinking or drug problem. Similarly, financial stress was coded yes if (a) husband/partner lost job, (b) mother lost job, (c) mother or partner had reduction in work hours/pay, or (d) had problems paying bills. Partner-related stress was coded yes if one or more of the following were present: (a) separated or divorced from husband or partner, (b) had

repeated arguments with husband/partner, or (c) husband/partner didn't want pregnancy. Finally, emotional stress included (a) close family member sick/ in hospital, (b) living apart from my husband/partner for work reasons, or (c) close family member died. Physical abuse was coded yes if the mother reported being physically pushed, hit, slapped, kicked, choked or hurt in any way by husband or partner before pregnancy or during pregnancy.

G. Statistical Analyses

Analyses were conducted in SAS version 9.4 and observations were assigned survey weights applicable to each survey year provided by SC DHEC. Data for the survey years were pooled and SC population-based estimates for the associations of interest were calculated across the four-year period with 95% confidence intervals (CIs). Univariate statistics (mean, standard deviation, median, interquartile range, frequency, and proportions) were used to describe the sample. Differences in preventive dental utilization by oral health counseling status was assessed after accounting for dental care knowledge, dental care utilization for a dental problem, dental insurance, and other control variables. Bivariate distributions were assessed using the Rao-Scott weighted Chi-square tests. Univariable logistic regressions of the dependent variable, dental cleaning before or during pregnancy, on the study variables of interest and control variables were assessed.

Survey-weighted multivariable logistic regression modeling was done to study associations of preconception oral health counseling with dental cleaning. For all multiple regressions, the starting point was the full model with all variables included per study conceptual framework. Final model selection was conducted using backward, stepwise,

manual variable removal one by one based on the highest p-value in an iteration, until only the key independent variables associated with the hypothesis, demographic variables and variables known to be associated with dental cleaning (e.g. dental insurance) and statistically significant covariates with $p \leq 0.05$ remained in the model. Crude and adjusted odds ratios (AOR) and 95% CIs are reported. Observations with missing data on any independent variable in the model were excluded from analysis.

4.4 RESULTS

A. Sample Characteristics

Table 4.1 presents the sample characteristics at baseline. Majority of mothers were White (61%), urban (85.64%), married (52%), aged below 35 (87%), had 12 or more years of education (59%), and covered by Medicaid (55%). Most women were non-smokers (87%) and 37% had annual income below $19,000 per year during pregnancy. The prevalence of maternal/pregnancy characteristics were normal weight (43%), timely prenatal care at 13 weeks or earlier (94%), unintended pregnancy (59%), diabetes and hypertension during pregnancy (8% and 9% respectively), medical risk factor potentially detrimental for birth outcomes (23%) (preeclamptic toxemia, other hypertension, diabetes, obesity, placental abruption, chromosomal abnormalities, etc.). Considerable proportions of mothers reported no regular exercise each week during pregnancy (36%) and no prenatal vitamin consumption (59%).

B. Oral Health Guidance and Dental Cleaning Utilization

Among sampled mothers, 8% received preconception oral health counseling from their regular doctor, and 47% received oral hygiene instructions at a dental visit during pregnancy. Of all sampled mothers, 54% had a dental cleaning before pregnancy, 44%

during pregnancy, and 59% had dental cleaning either before or during pregnancy. Majority had dental insurance coverage during pregnancy (62%), 23% reported having an oral health problem during pregnancy, and 13% sought dental care.

C. Maternal Characteristics by Dental Cleaning Status

Table 4.1 also presents respondent distribution by dental cleaning status. Mothers who were White, privately insured, married, normal weight, had intended to get pregnant, non-smokers, and did not have medical risk factors during pregnancy were significantly more likely than the respective comparison categories to receive dental cleaning before or during pregnancy. Mothers who did not experience financial or partner-related stress or physical abuse, exercised more than three times per week, and consumed multivitamins prior to pregnancy were more likely to have had dental cleaning. Women who received preconception oral health counseling, had dental insurance, received dental problem-related treatment, and reported oral hygiene instructions were more likely to have dental cleaning.

D. Univariable and Multiple Regression Analyses

Table 4.2 shows the univariable logistic regression findings and the adjusted associations between oral health counseling and dental cleaning utilization. Preconception oral counseling was consistently associated with five-fold higher odds of having had dental cleaning relative to no counseling in both univariable and adjusted multivariable logistic regression analyses (OR 5.67; 95% CI [2.76, 11.64]; $p < .0001$) and (AOR 4.99; 95% CI [1.97, 12.65]; $p < 0.0007$) respectively. Dental insurance during pregnancy was also associated with significantly higher odds of dental cleaning, relative to those without dental insurance in both univariable and adjusted analyses (Univariable:

OR 5.67; 95% CI [4.25, 7.56]; p < 0.001; Multivariable regression: AOR 4.97; 95% CI [3.42, 7.22]; p < 0.001).

Other significant covariates in the adjusted analysis are notable. Dental knowledge (understanding the importance of oral care during pregnancy) was associated with nearly three-fold odds of dental cleaning relative to no dental awareness (AOR 2.84; 95% CI [1.494, 5.300]; p < 0.0014). Smoking during pregnancy was associated with half the odds of dental cleaning versus non-smokers (AOR 0.485; 95% CI [0.269, 0.874]; p < 0.0162). Mothers with medical risk factors had 44% lower odds of having a dental cleaning (AOR 0.557; 95% CI [0.377, 0.822]; p < 0.0033). Personal health-related habits of exercising at least three times per week and vitamin consumption were significantly associated with higher odds of dental cleaning (AOR 1.507; 95% CI [1.051, 2.161]; p < 0.0258) and (AOR 1.479; 95% CI [1.005, 2.176]; p < 0.0472) respectively. The psychobiological factors of stress or abuse, physical abuse, financial stress, and partner-related stress were significantly associated with dental cleaning in the unadjusted regression analyses, but were not associated with dental cleaning after controlling for other maternal sociodemographic, socioeconomic and clinical factors.

4.5 DISCUSSION

This population-based study may be the first study to demonstrate a positive association between preconception oral health counseling by a medical provider and preventive dental cleaning before or during pregnancy after accounting for other confounding factors. Previous research interpreted oral hygiene instructions given by a dental care provider as “oral health counseling” and reported that it was significantly associated with dental cleaning during pregnancy (Hwang et al., 2012; Thompson et al.,

2013). Oral hygiene instructions are given before or after dental cleaning by a dentist or dental staff, both instruction and cleaning occur in the same visit, and therefore oral hygiene instruction is not a valid variable to predict dental cleaning. By comparison our study finds that medical providers' prepregnancy counseling regarding oral health and to visit a dentist had the highest effect size in predicting the likelihood of mothers' utilization of dental cleaning. We also found that awareness of dental health (knowledge of the importance of dental care during pregnancy) was associated with greater preventive dental services use, showing the importance of patient education for improving health services utilization behavior (Kloetzel et al., 2011; Rosenstock, 1974).Our study offers new evidence for including oral health counseling as a standard of care in preconception health and wellness care for women of reproductive age (Johnson et al., 2006).

Dental insurance, a robust and consistent predictor in previous studies, showed an independent and similar effect size in predicting dental cleaning utilization as oral health counseling (AOR 5.386; 95% CI [3.669, 7.907]; $p < 0.0001$). No association was found between other financial factors (e.g. insurance types, income and financial stress) and dental cleaning utilization. Our study is also consistent with the documented studies showing that women who smoked had worse oral health and dental care usage than non-smokers. Mothers who smoked during pregnancy were 52% less likely to have dental cleaning (Csikar et al., 2016; H.-J. Lee et al., 2014). Lack of access to dental care for mothers who smoke may exacerbate birth outcomes among smoking mothers. This study may be the first study to report on the association of positive self-care habits, exercise and vitamin consumption during pregnancy with dental cleaning. Our findings showing a

positive association is consistent with other literature reporting co-occurrence of positive personal healthcare practices.

This study has some limitations related to survey design, response rate and self-report bias. First, recall bias is possible due to retrospective data collection after a variable time following delivery, 2-9 months (under/over reporting). Second, cross-sectional survey design (exposure and outcome data collected at the same time) weakens the validity of conclusions on temporal and directional associations between the independent and dependent variables. Third, the findings may not be generalizable to other states. States may have varying sociodemographic conditions and dental provider access that affects the population's health behaviors. Fourth, the survey did not include questions on the barriers to utilization or reasons for not seeking care, e.g. residential distance from the nearest dental office, having personal transportation to travel to the dentist office. However, in our study, rural residence was not associated with dental cleaning use. Finally, the wording of the preconception oral health counseling question did not distinguish between assessment and referral for dental care. Despite the survey limitations, the study offers evidence showing that prenatal counseling to seek dental care is associated with the subsequent use of dental cleaning services.

4.6 CONCLUSION

Oral health counseling improves preventive dental care utilization and is a simple and low-cost intervention to potentially reduce the incidence of adverse birth outcomes (Boggess & Edelstein, 2006; Lydon-Rochelle et al., 2004; The American College of Obstetricians and Gynecologists [ACOG] Committee on Health Care for Underserved Women, 2013). In South Carolina, mothers without preconception oral health counseling

were at significantly higher risk of not getting a dental cleaning before or during pregnancy. Our findings support previous research on the importance of cross-professional collaboration between medical and dental providers to improve birth outcomes (D'Angelo et al., 2007; Johnson et al., 2006).

4.7 SUPPLEMENTAL INFORMATION: PRAMS SURVEY QUESTIONS USED IN THE STUDY

History of low birth weight in the preceding pregnancy: Did the baby born just before your new one weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth?

No

Yes

History of preterm birth in the preceding pregnancy: Was the baby just before your new one born earlier than 3 weeks before his or her due date?

No

Yes

Proactive health/self-care behaviors: At any time during the *12 months before* you got pregnant with your new baby, did you do any of the following things? For each item, check **No** if you did not do it or **Yes** if you did it.

No Yes

a. I was dieting (changing my eating habits) to lose weight

b. I was exercising 3 or more days of the week

c. I was regularly taking prescription medicines other than birth control

d. I visited a health care worker and was checked for diabetes

e. I visited a health care worker and was checked for high blood pressure

f. I visited a health care worker and was checked for depression or anxiety

g. I talked to a health care worker about my family medical history

h. I had my teeth cleaned by a dentist or dental hygienist

Weekly multivitamin consumption: During the *month before* you got pregnant with your new baby, how many times a week did you take a multivitamin, a prenatal vitamin, or a folic acid vitamin?

I didn't take a multivitamin, prenatal vitamin, or folic acid vitamin in the *month before* I got pregnant

1 to 3 times a week

4 to 6 times a week

Every day of the week

Pregnancy Intention: When you got pregnant with your new baby, were you trying to get pregnant?

No

Yes → Go to Question 18

Timeliness of prenatal care initiation: How many weeks or months pregnant were you when you had your first visit for prenatal care? Do not count a visit that was only for a pregnancy test or only for WIC (the Special Supplemental Nutrition Program for Women, Infants, and Children).

Weeks OR Months

Medical Preconception Counseling: *Before* you got pregnant with your new baby, did a doctor, nurse, or other health care worker talk with you about any of the things listed below? *Please count only discussions*, not reading materials or videos.

For each item, check No if no one talked with you about it or Yes if someone talked with you about it.

No Yes

a. Taking vitamins with folic acid before pregnancy

b. Being a healthy weight before pregnancy

c. Getting my vaccines updated before pregnancy

d. Visiting a dentist or dental hygienist before pregnancy

e. Getting counseling for any genetic diseases that run in my family

f. Controlling any medical conditions such as diabetes and high blood pressure

g. Getting counseling or treatment for depression or anxiety

h. The safety of using prescription or over-the-counter medicines during pregnancy

i. How smoking during pregnancy can affect a baby

j. How drinking alcohol during pregnancy can affect a baby

k. How using illegal drugs during pregnancy can affect a baby

Type of health insurance for prenatal care: During your most recent pregnancy, what kind of health insurance did you have to pay for your prenatal care? Check ALL that apply.

Private health insurance from my job or the job of my husband, partner, or parents

Private health insurance purchased directly from an insurance company

Medicaid (required: state Medicaid name)

State-specific option (Other government plan or program such as SCHIP/CHIP or health reform exchange program)

State-specific option (Other government plan or program not listed above such as state MCH program, indigent program or family planning program, etc.)

State-specific option (TRICARE or other military health care)

State-specific option (IHS or tribal)

Some other kind of health insurance => Please tell us_____

I did not have any health insurance to pay for my prenatal care

Prenatal oral health knowledge and experiences: This question is about the care of your teeth *during your most recent* pregnancy. For each item, check **No** if it is not true or does not apply to you or **Yes** if it is true.

No Yes

a. I knew it was important to care for my teeth and gums during my pregnancy

b. A dental or other health care worker talked with me about how to care for my teeth and gums

c. I had my teeth cleaned by a dentist or dental hygienist

d I had insurance to cover dental care during my pregnancy

e. I needed to see a dentist for a **problem**

f. I went to a dentist or dental clinic about a **problem**

Prepregnancy Cigarette Smoking: In the *3 months before* you got pregnant, how many cigarettes did you smoke on an average day? A pack has 20 cigarettes.

41 cigarettes or more

21 to 40 cigarettes

11 to 20 cigarettes

6 to 10 cigarettes

1 to 5 cigarettes

Less than 1 cigarette

I didn't smoke then

Prenatal cigarette smoking: In the *last 3 months* of your pregnancy, how many cigarettes did you smoke on an average day? A pack has 20 cigarettes.

41 cigarettes or more

21 to 40 cigarettes

11 to 20 cigarettes

6 to 10 cigarettes

1 to 5 cigarettes

Less than 1 cigarette

I didn't smoke then

Prepregnancy alcohol consumption: During the *3 months before* you got pregnant, how many alcoholic drinks did you have in an average week?

14 drinks or more a week

7 to 13 drinks a week

4 to 6 drinks a week

1 to 3 drinks a week

Less than 1 drink a week

I didn't drink then

Prenatal alcohol consumption: During the *last 3 months* of your pregnancy, how many alcoholic drinks did you have in an average week?

14 drinks or more a week

7 to 13 drinks a week

4 to 6 drinks a week

1 to 3 drinks a week

Less than 1 drink a week

I didn't drink then

Maternal new weight gain: By the end of *your most recent* pregnancy, how much weight had you gained? Check ONE answer and fill in blank if needed.

I gained _____ pounds

I didn't gain any weight, but I lost_____ pounds

My weight didn't change during my pregnancy

I don't know

Maternal Stress Experiences before and during pregnancy: This question is about things that may have happened during the *12 months before your new baby was born*.

For each item, check **No** if it did not happen to you or **Yes** if it did. (It may help to look at the calendar when you answer these questions.)

No Yes

a. A close family member was very sick and had to go into the hospital

b. I got separated or divorced from my husband or partner

c. I moved to a new address

d. I was homeless or had to sleep outside, in a car, or in a shelter

e. My husband or partner lost his job

f. I lost my job even though I wanted to go on working

g. My husband, partner, or I had a cut in work hours or pay.

h. I was apart from my husband or partner due to military deployment or extended work-related travel

i. I argued with my husband or partner more than usual

j. My husband or partner said he didn't want me to be pregnant

k. I had problems paying the rent, mortgage, or other bills

l. My husband, partner, or I went to jail

m. Someone very close to me had a problem with drinking or drugs

n. Someone very close to me died

Physical abuse experiences before pregnancy: During the *12 months before you got pregnant* with your new baby, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?

No

Yes

Physical abuse experiences during pregnancy: During *your most recent* pregnancy, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?

No

Yes

Prenatal weekly exercise: Thinking back to after you found out you were pregnant, how many times did you exercise or play sports per week? (Include walking briskly, jogging, aerobics, swimming, etc. for ½ hour or more.)

0 times

1 time

2 times

3 times

4 times

5 or more times

Partner-related psychological abuse during pregnancy: This question is about things that may have happened during *your most recent* pregnancy. For each thing, check **No** if it did not happen to you or **Yes** if it did.

No Yes

a. My husband or partner threatened me or made me feel unsafe in some way

b. I was frightened for my safety or my family's safety because of the anger or threats of my husband or partner

c. My husband or partner tried to control my daily activities, for example, controlling who I could talk to or where I could go

d. My husband or partner forced me to take part in touching or any sexual activity when I did not want to

Total annual household income: During the *12 months before* your new baby was born, what was your yearly total household income before taxes? Include your income, your husband's or partner's income, and any other income you may have received. *All information will be kept private* and will not affect any services you are now getting.

$0 to $15,000

$15,001 to $19,000

$19,001 to $22,000

$22,001 to $26,000

$26,001 to $29,000

$29,001 to $37,000

$37,001 to $44,000

$44,001 to $52,000

$52,001 to $56,000

$56,001 to $67,000

$67,001 to $79,000

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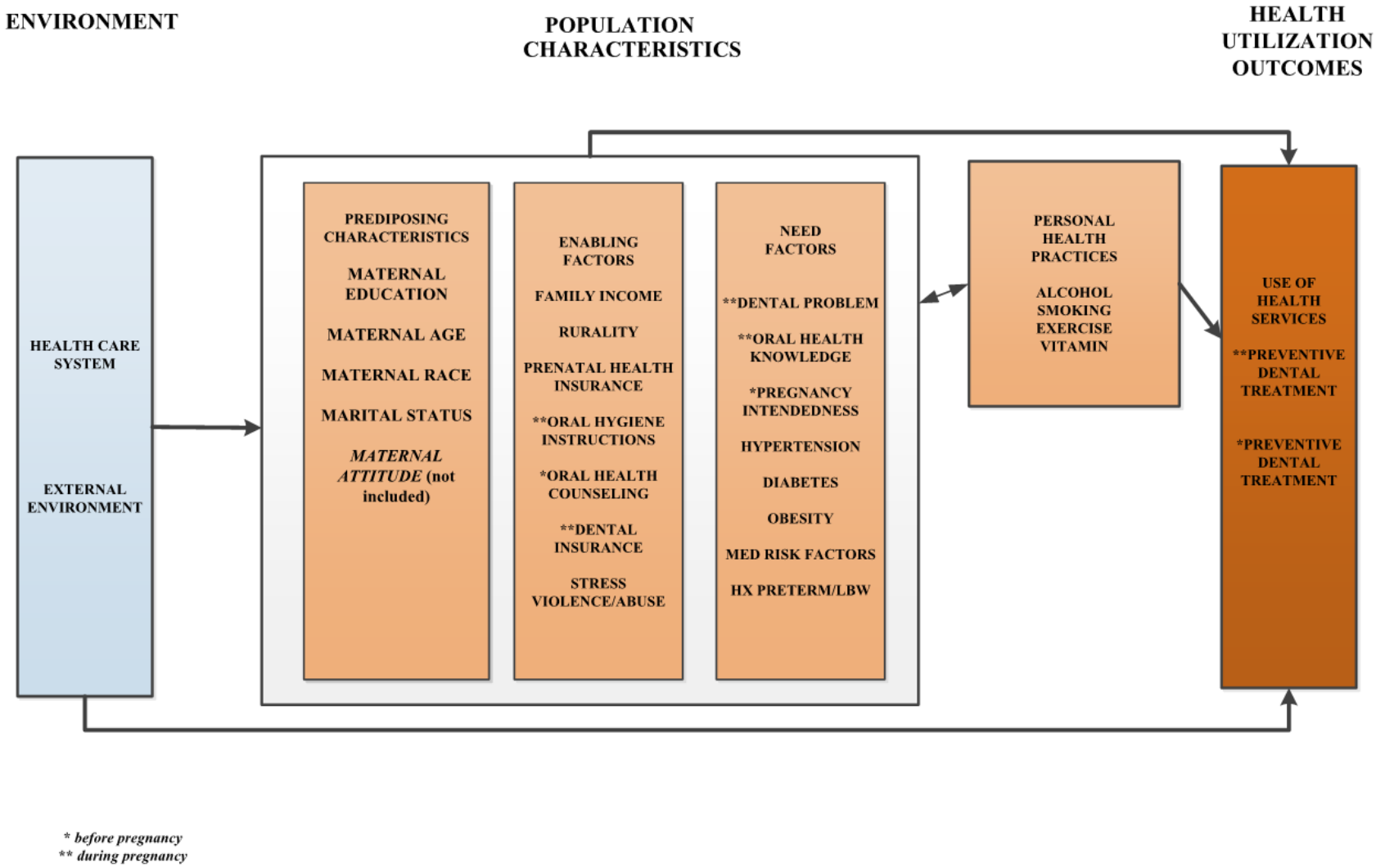

Figure 4.1. Adapted Andersen Healthcare Utilization Model.

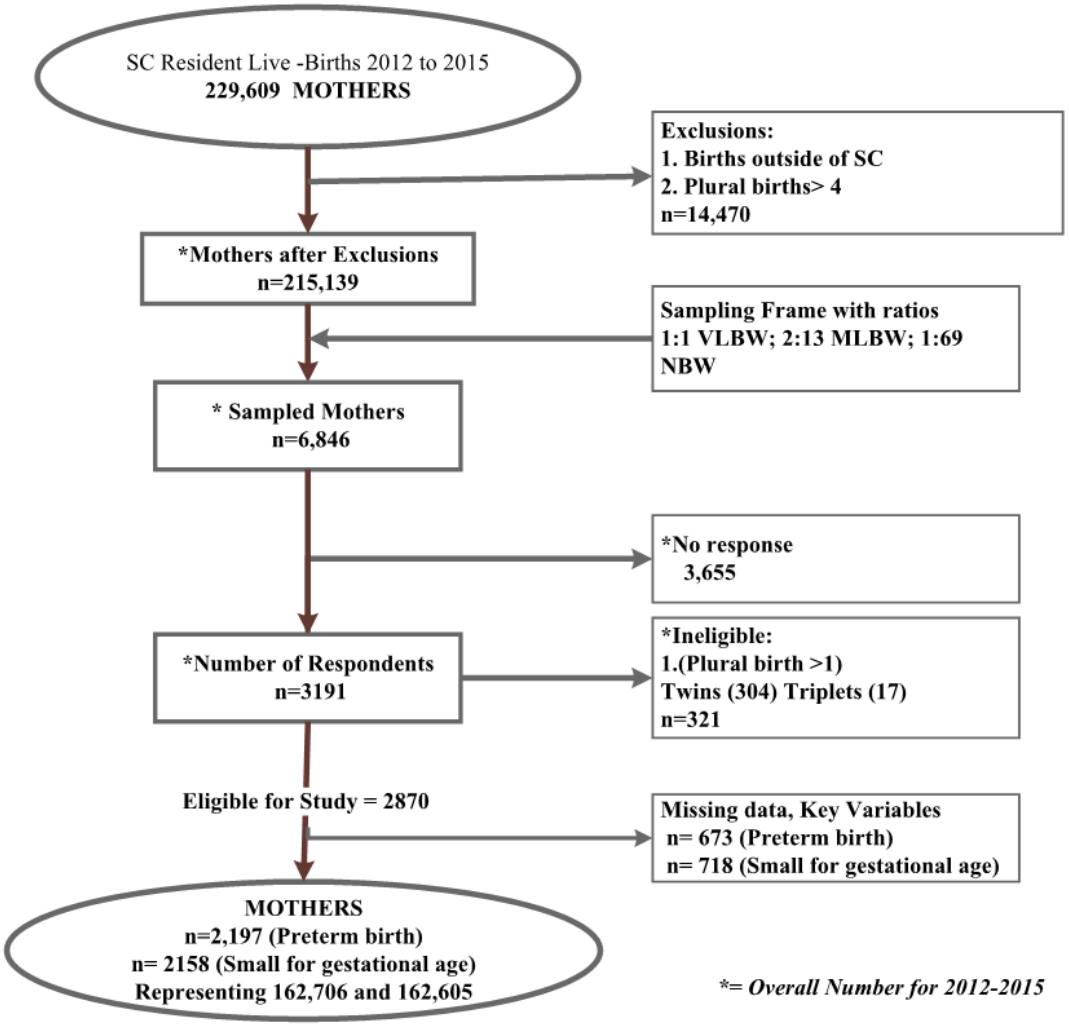

Figure 4.2. SC PRAMS Sample Flow Chart for Dental Cleaning (Before or During).

Table 4.1: Study Cohort Sociodemographic Characteristics and Dental Experiences Classified by Dental Cleaning Status.

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Dental Cleaning Before or During Pregnancy (Weighted %)		
	n=2,870 mothers	**Yes=1,546 mothers**	**No=1,253 mothers**	**p value**
Predisposing Factors				
Age				
Below 35 Years	2,417 (86.97)	1,278 (58.11)	1,079 (41.89)	0.1736
35 Years or More	453 (13.03)	268 (64.30)	174 (35.70)	
Missing	0			
Race				
White	1,504 (61.27)	870 (62.09)	607 (37.91)	**0.0238**
Black	1,106 (29.55)	551 (55.24)	520 (44.76)	
Other	260 (9.18)	125 (48.91)	126 (51.09)	
Missing	0			
Education				
> 12 Years	1,766 (59.36)	1,071 (64.91)	665 (35.09)	**<.0001**
12 Years	667 (23.82)	297 (50.11)	347 (49.89)	
Under 12 Years	424 (16.81)	171 (49.60)	235 (50.40)	
Missing	13			
Marital Status				
Married	1,443 (52.1)	881 (64.31)	534 (35.69)	**0.0004**
Unmarried	1,427 (47.9)	665 (52.94)	719 (47.06)	
Missing	0			
Enabling/ Disabling Factors				
Household Income (Annual)				

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Dental Cleaning Before or During Pregnancy (Weighted %)		
	n=2,870 mothers	**Yes=1,546 mothers**	**No=1,253 mothers**	**p value**
$0 To $19,000	1,057 (37.13)	436 (48.23)	593 (51.77)	**<.0001**
$19,001 To $37,000	645 (24.85)	314 (49.86)	324 (50.14)	
$37,001 To $67,000	432 (15.02)	293 (70.34)	137 (29.66)	
$67,001 Or More	523 (23.00)	415 (80.43)	100 (19.57)	
Missing	213			
Health Insurance				
Medicaid	1,564 (54.75)	692 (48.32)	836 (51.68)	**<.0001**
Private/Military/Other	1,083 (40.14)	775 (76.32)	294 (23.68)	
Uninsured	112 (5.11)	43 (46.63)	65 (53.37)	
Missing	111			
Dental Insurance				
Insured	1,090 (38.30)	1,196 (74.81)	485 (25.19)	**<.0001**
Uninsured	1,688 (61.69)	341 (34.37)	738 (65.63)	
Missing	92			
Rurality				
Urban	2,407 (85.64)	1,307 (60.11)	1,042 (38.90)	0.0734
Rural	463 (14.36)	239 (51.66)	211 (48.34)	
Missing	0			
Preconception Oral Counseling				
Counseled	261 (8.43)	217 (87.99)	36 (12.01)	**<.0001**
Not Counseled	2,609 (91.57)	1,329 (56.38)	1,217 (43.62)	
Missing	0			
Oral Hygiene Instructions				

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Dental Cleaning Before or During Pregnancy (Weighted %)		
	n=2,870 mothers	**Yes=1,546 mothers**	**No=1,253 mothers**	**p value**
Received	1,266 (47.06)	1,017 (82.23)	243 (17.77)	**<.0001**
No Receipt	1,545 (52.94)	525 (37.852)	1,008 (62.15)	
Missing	59			
Physical Abuse Before				
Yes	130 (4.42)	47 (36.10)	79 (63.90)	**0.0038**
No	2,695 (96.58)	1,485 (59.98)	1,163 (40.02)	
Missing	45			
Physical Abuse During				
Yes	112 (2.85)	42 (34.29)	68 (65.71)	**0.0059**
No	2,714 (97.15)	1,490 (58.90)	1,175 (40.10)	
Missing	44			
Psychological Abuse				
Yes	142 (4.94)	67 (57.08)	72 (42.92)	0.7654
No	2,646 (95.06)	1,450 (59.31)	1,149 (40.69)	
Missing	82			
Traumatic Stress				
Yes	463 (17.91)	218 (55.45)	238(44.55)	0.3149
No	2,366 (82.09)	1,319 (59.81)	1,005 (40.19)	
Missing	41			
Financial Stress				
Yes	1,101 (37.33)	503 (49.87)	578 (50.13)	**<.0001**
No	1,728 (62.67)	1,034 (64.44)	665(35.56)	
Missing	41			

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Dental Cleaning Before or During Pregnancy (Weighted %)		
	n=2,870 mothers	**Yes=1,546 mothers**	**No=1,253 mothers**	**p value**
Partner-Related Stress				
Yes	923 (30.63)	435 (51.70)	474 (48.30)	**0.0029**
No	1,906 (69.37)	1,102 (62.26)	769 (37.74)	
Missing	41			
Emotional Stress				
Yes	1,050 (38.73)	572 (59.01)	459 (40.99)	0.9963
No	1,781 (61.27)	965 (59.03)	785 (40.97)	
Missing	39			
Need Factors				
Dental Problem				
Problem	636 (23.12)	304 (53.43)	323 (46.57)	0.0874
No Problem	2,168 (76.88)	1,228 (60.21)	927 (39.79)	
Missing	66			
Dental Knowledge				
Knowledge	2,425 (87.74)	1,421 (62.28)	981 (37.72)	**<.0001**
No Knowledge	393 (12.26)	125 (34.76)	267 (65.24)	
Missing	52			
Pregnancy Intention				
Trying	1,078 (40.96)	674 (67.86)	384 (32.14)	**<.0001**
Not Trying	1,662 (59.04)	807 (52.94)	813 (47.06)	
Missing	130			
Hypertension				
Yes	539 (8.58)	279 (54.29)	250 (45.71)	0.3596

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Dental Cleaning Before or During Pregnancy (Weighted %)		
	n=2,870 mothers	**Yes=1,546 mothers**	**No=1,253 mothers**	**p value**
No	2,331 (91.42)	1,267 (59.34)	1,003 (40.66)	
Missing	0			
Diabetes				
Yes	180 (7.24)	85 (50.46)	92 (49.54)	0.1344
No	2,690 (92.76)	1,461 (59.58)	1,161 (40.42)	
Missing	0			
Pre-BMI Category				
Underweight	244 (8.44)	111 (62.54)	118 (37.46)	**0.0295**
Normal	1,112 (42.80)	646 63.14)	439 (36.85)	
Overweight	673 (23.51)	378 (57.92)	284 42.08)	
Obese	841 (25.24)	411 (51.48)	412 (48.52)	
Missing	0			
Medical Risk Factors				
Yes	1,058 (22.47)	521 (49.87)	510 (50.13)	**0.0016**
No	1,812 (77.53)	1,025 (61.54)	743 (38.46)	
Missing	0			
History PTB				
Yes	377 (8.51)	168 (51.72)	198 (48.28)	0.0835
No	1,098 (52.47)	584 (57.06)	493 (42.94)	
No Previous Live Birth	1,314 (39.02)	753 (63.07)	526 (36.93)	
Missing	81			
History LBW				
Yes	378 (8.85)	175 (57.35)	194 (42.65)	0.1261

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Dental Cleaning Before or During Pregnancy (Weighted %)		
	n=2,870 mothers	**Yes=1,546 mothers**	**No=1,253 mothers**	**p value**
No	1,092 (52.17)	575 (56.30)	494 (43.70)	
No Previous Live Birth	1,315 (38.98)	754 (63.07)	526 (36.93)	
Missing	85			
Personal Health Practices				
Alcohol (During)				
Yes	167 (7.95)	93 (61.42)	71 (38.58)	0.6429
No	2,703 (92.05)	1,453 (58.69)	1,182 (41.31)	
Missing	0			
Smoke (During)				
Yes	376 (12.77)	125 (34.95)	244 (65.05)	**<.0001**
No	2,494 (87.23)	1,421 (62.50)	1,009 (37.50)	
Missing	0			
Exercise				
0-3 Times Per Week	2,023 (69.08)	1,048 (56.12)	945 (43.88)	**0.0127**
3-7 Times Per Week	771 (30.91)	466 (64.72)	1,048 (35.28)	
Missing	76			
Multivitamin				
Yes	1,134 (41.35)	731 (69.66)	379 (30.34)	**<.0001**
No	1,608 (58.65)	753 (51.86)	817 (48.14)	
Missing	128			

Table 4.2: Logistic Regression Analyses Showing the Association of Preconception Oral Health Counseling With Dental Cleaning.

Variable	Univariable logistic Regression results			Adjusted associations, Full Model			Adjusted associations, Selected Model by backward selection		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Preconception Oral Health Counseling (Yes)	5.668	2.760, 11.639	**<.0001**	4.983	1.818, 13.656	**0.0018**	4.994	1.972, 12.649	**0.0007**
Maternal Age (35 years or more versus Below 35 years)	1.298	0.891, 1.892	0.1743	1.074	0.659, 1.751	0.7734	1.002	0.630, 1.594	0.9936
Maternal Race (Black versus White and Other)	0.809	0.603, 1.085	0.1572	0.835	0.527, 1.324	0.4440	0.813	0.531, 1.245	0.3403
Maternal Education (12 years or more versus Below 12 years)	1.574	1.091, 2.270	**0.0152**	1.068	0.590, 1.935	0.8274	-	-	-
Marital Status (Married versus Unmarried)	1.602	1.232, 2.082	**0.0004**	0.606	0.370, 0.991	**0.0459**	0.638	0.401, 1.016	0.0584

Continued

Variable	Univariable logistic Regression results			Adjusted associations, Full Model			Adjusted associations, Selected Model by backward selection		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Rurality (Yes)	0.709	0.486, 1.035	0.0746	1.093	0.637, 1.874	0.7474			
Income ($19,001 - $37,000 versus $0 - $19,000)	1.068	0.750, 1.521	0.7172	1.013	0.634, 1.617	0.9579	0.937	0.604, 1.452	0.7704
Income ($37,001 - $67,000 versus $0 - $19,000)	2.546	1.673, 3.874	**<.0001**	1.442	0.734, 2.834	0.2881	1.587	0.873, 2.885	0.1301
Income (≥ $67,001 versus $0 - $19,000)	4.413	2.979, 6.539	**<.0001**	1.800	0.843, 3.844	0.1286	2.014	1.098, 3.693	0.0236
First PNC Visit (Delayed: After 13 weeks versus Timely: 13 weeks or earlier)	0.631	0.375, 1.064	0.0843	0.898	0.433, 1.864	0.7736	-	-	-
Dental Insurance (Yes)	5.670	4.253, 7.560	**<.0001**	5.031	3.405, 7.434	**<.0001**	4.972	3.423, 7.223	**<.0001**

Continued

Variable	Univariable logistic Regression results			Adjusted associations, Full Model			Adjusted associations, Selected Model by backward selection		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Prenatal Insurance (Medicaid versus Uninsured)	1.070	0.570, 2.009	0.8333	0.614	0.228, 1.649	0.3327	-	-	-
Prenatal Insurance (Private Insurance/Military/Other versus Uninsured)	3.689	1.944, 7.000	**<.0001**	0.847	0.300, 2.390	0.7532	-	-	-
Dental Problem During Pregnancy (Yes)	0.758	0.552, 1.042	0.0880	1.326	0.882, 1.993	0.1753	-	-	-
Pregnancy Intendedness (Yes)	1.877	1.428, 2.467	**<.0001**	1.111	0.744, 1.658	0.6072	-	-	-
Dental Knowledge (Yes)	3.099	2.039, 4.710	**<.0001**	3.024	1.597, 5.724	**0.0007**	2.814	1.494, 5.300	**0.0014**

Continued

Variable	Univariable logistic Regression results			Adjusted associations, Full Model			Adjusted associations, Selected Model by backward selection		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
PRE-BMI (Obese versus Normal)	0.619	0.447, 0.858	**0.0040**	0.780	0.495, 1.229	0.2841	-	-	-
PRE-BMI (Overweight versus Normal)	0.803	0.578, 1.118	0.1939	1.033	0.668, 1.598	0.8841	-	-	-
PRE-BMI (Underweight versus Normal)	0.974	0.589, 1.610	0.9189	1.516	0.768, 2.992	0.2304	-	-	-
Medical Risk Factors (Yes)	0.622	0.462, 0.837	**0.0017**	0.485	0.257, 0.913	**0.0250**	0.557	0.377, 0.822	**0.0033**
Previous Live Birth (Yes)	0.769	0.589, 1.004	**0.0537**	0.817	0.559, 1.194	0.2971	-	-	-
Hypertension (Yes)	0.814	0.523, 1.267	0.3610	1.215	0.574, 2.574	0.6103	-	-	-
Gestational Diabetes (Gestational Diabetes versus Never Diabetic)	0.803	0.524, 1.229	0.3118	1.163	0.580, 2.331	0.6700	-	-	-
Diabetes (Pre-Existing Diabetes versus Never Diabetic)	1.259	0.597, 2.654	0.5449	0.942	0.300, 2.953	0.9180	-	-	-

Continued

Variable	Univariable logistic Regression results			Adjusted associations, Full Model			Adjusted associations, Selected Model by backward selection		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Previous Low Birth Weight (Yes)	0.926	0.592, 1.450	0.7382	1.962	0.838, 4.591	0.1203	-	-	-
Previous Preterm Birth (Yes)	0.725	0.456, 1.153	0.1747	0.659	0.307, 1.416	0.2847	-	-	-
Smoke (Before, Yes)	0.495	0.368, 0.665	**<.0001**	0.910	0.547, 1.513	0.7156	-	-	-
Smoking (During, Yes)	0.322	0.214, 0.485	**<.0001**	0.584	0.289, 1.180	0.1338	0.485	0.269, 0.874	**0.0162**
Drinking (Before, Yes)	1.059	0.815, 1.378	0.6666	0.906	0.616, 1.334	0.6180	-	-	-
Drinking (During, Yes)	1.121	0.692, 1.817	0.6431	0.893	0.467, 1.708	0.7324	-	-	-
Exercise per Week (3 ≥ Times versus < 3 Times)	1.434	1.079, 1.906	**0.0129**	1.472	1.007, 2.152	**0.0461**	1.507	1.051, 2.161	**0.0258**
Multivitamin Consumption (Yes)	2.131	1.615, 2.813	**<.0001**	1.411	0.944, 2.109	0.0935	1.479	1.005, 2.176	**0.0472**
Physical Abuse (Yes)	0.383	0.202, 0.723	**0.0031**	0.556	0.186, 1.657	0.2918	-	-	-

Continued

Variable	Univariable logistic Regression results			Adjusted associations, Full Model			Adjusted associations, Selected Model by backward selection		
	Odds Ratio (OR)	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**
Psychological Abuse (Yes)	0.912	0.499, 1.667	0.7639	1.707	0.735, 3.966	0.2132	-	-	-
Traumatic Stress (Yes)	0.836	0.590, 1.185	0.3150	1.138	0.686, 1.888	0.6160	-	-	-
Financial Stress (Yes)	0.549	0.419, 0.720	**<.0001**	0.894	0.604, 1.325	0.5782	-	-	-
Partner-Related Stress (Yes)	0.649	0.488, 0.863	**0.0030**	0.944	0.621, 1.434	0.7869	-	-	-
Emotional Stress (Yes)	0.999	0.764, 1.307	0.9963	1.369	0.941, 1.993	0.1009	-	-	-

*Final selected model excluded variables with p values >0.05 except for demographic variables.

CHAPTER 5

MANUSCRIPT II

DOES MATERNAL USE OF PREVENTIVE DENTAL CARE SERVICES IMPACT PRETERM BIRTH AND SMALL FOR GESTATIONAL AGE BIRTH RISKS? A POPULATION-BASED STUDY[8]

5.1 ABSTRACT

Poor oral health status in pregnant women is connected to unfavorable birth outcomes, specifically periodontal disease (periodontitis), an oral inflammatory condition which is shown to be a risk factor for preterm birth and low birth weight (Dortbudak et al., 2005; Guimarães et al., 2012; Tejada et al., 2012). In the United States, oral disease is common during pregnancy yet dental services underutilization persists (Chung et al., 2014). We aimed to assess the association of maternal preventive dental utilization with preterm birth (<37 weeks) and small for gestational age (SGA) (gestational age below the 10th percentile).

Cross-sectional 2012-2015 population-based surveillance data from the South Carolina Pregnancy Risk Assessment Monitoring System (SC PRAMS) survey were analyzed using weighted analyses in SAS. Dental cleaning is associated with mitigation

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of preterm birth and SGA risks among sub-groups of women varying by smoking status and stress reporting. Nonsmokers who cleaned were 62% less likely to experience preterm birth compared to non-smoking women who did not (AOR 0.377; CI [0.201, 0.706]; p=0.0023). No reduction was noted in women who smoked. Among women who experienced any traumatic stress during pregnancy, dental cleaning was associated with reduced likelihood of preterm birth versus no cleaning (AOR 0.241; CI [0.098, 0.594]; p=0.0020). With respect to SGA, smokers who cleaned had 70% lower odds of SGA than smokers with no cleaning (AOR 0.302; CI [0.097, 0.945]; p=0.04). Obstetric care guideline changes to preventive dental utilization among women of reproductive age may improve birth outcomes.

5.2 INTRODUCTION

Dental cleaning before and during pregnancy is important for maternal health outcomes in light of the documented susceptibility of mothers to oral deterioration in pregnancy (Johnson et al., 2006). Complex physiological changes in pregnancy cause vomiting, acid reflux and food preference-related changes, predisposing expectant mothers to dental problems. Hormonal changes of pregnancy add to the problem by triggering systemic changes including inflammatory responses that predispose pregnant mothers to gingivitis and periodontitis (periodontal disease) (Eklund, 2009; Kurien et al., 2013; Markou et al., 2009; Steinberg et al., 2013). The association of periodontal disease with adverse maternal and infant health outcomes is documented. In a systematic review and metanalysis (22 studies; 17,053 subjects), the odds of births that were both preterm and low birth weight births for those with periodontitis were about 2.4 relative to mothers without periodontitis (Corbella et al., 2016). In South Carolina, 1 in 9 newborns (11.2%

of live births) was born preterm and 1 in 10 newborns (9.7 % of live births) had low birth weight in 2017 (Centers for Disease Control and Prevention, 2017). Nationally, South Carolina ranked 7th for preterm birth and 5th for low birth weight, exceeding the national averages of 9.9 and 8.3 respectively (Centers for Disease Control and Prevention, 2017).

The biological mechanisms involved in the relationship between periodontal disease and adverse birth outcomes remain uncertain (Steinberg et al., 2013). Three main theories of causation are proposed: bacterial infection hypothesis, inflammatory mediator theory, and genetic/environmental/host susceptibility theory (Kawar & Alrayyes, 2011). Biologically, a mother's oral bacteria may be transmitted through the blood and amniotic fluid causing intrauterine infection complications (Bohrer et al., 2012b; Han et al., 2010; Kawar & Alrayyes, 2011). Preterm birth may also be caused by microbial infection activating proinflammatory cytokines at the maternal-fetal interface and signaling labor to begin (Kawar & Alrayyes, 2011). Finally, periodontitis and preterm birth are thought to share a common genetic basis with unique polymorphisms that trigger production of these cytokines (Tarannum & Faizuddin, 2007).

Periodontal therapy, which is shown to mitigate oral inflammatory conditions, has been postulated as a potential tool to improve birth outcomes among women with periodontitis or gingivitis (Jeffcoat et al., 2011; López et al., 2005; Merchant et al., 2018; Radnai et al., 2009). Previous Randomized Clinical Trials (RCT), about 30 trials, have shown conflicting results regarding the impact of periodontal therapy during pregnancy on pregnancy outcomes (Iheozor-Ejiofor et al., 2017; Polyzos et al., 2010). Uncertainty regarding the evidence garnered from these trials is due to a variety of reasons - low-quality evidence due to selection bias, small sample sizes, heterogeneity of study

definitions, periodontal treatment initiated during late pregnancy, as well as heterogeneity of study participant characteristics (Iheozor-Ejiofor et al., 2017; Polyzos et al., 2010). Heterogeneity includes inconsistencies in periodontal outcome reporting (Macones et al., 2010; Michalowicz et al., 2006; Radnai et al., 2009; Tarannum & Faizuddin, 2007), differences in disease severity studied and differences in clinical definitions of periodontal disease (Jeffcoat et al., 2003; Sadatmansouri et al., 2006), varying exclusion of patients by birth outcome categories (Offenbacher et al., 2009; Radnai et al., 2009), dissimilarity in study and control groups at baseline (López et al., 2002, 2005; Macones et al., 2010; Offenbacher, Boggess et al., 2006; Offenbacher, Lin et al., 2006; Oliveira et al., 2011) and differential participant attrition (Farrell (nee Moore) et al., 2006; López et al., 2002; Offenbacher, Boggess et al., 2006; Offenbacher, Lin et al., 2006).

Birth outcome findings from RCTs of periodontal therapy during pregnancy that recruited mothers with established periodontitis do not apply to the full range of mothers with a range of oral health status, especially those with healthy gums and those with incipient or low-grade gingivitis. Compared to preventive dental services before pregnancy (prophylaxis), periodontal therapy in the first, second, third trimester may be rather late to impact existing oral disease state in patients with established periodontitis (Michalowicz et al., 2006). Late initiation may neutralize any potential positive effects due to the prolonged adverse biological processes involved that may impact birth outcomes due to existing damage or the chronicity of periodontal disease (Boggess & Edelstein, 2006; Michalowicz et al., 2006). It is possible that improved birth outcomes may be achieved by periodontal treatment in the preconception period or in early

pregnancy (Bobetsis et al., 2006; Boggess & Edelstein, 2006; Farrell (nee Moore) et al., 2006).

Given the known link of periodontal disease with cardiovascular disease, stroke, diabetes and adverse pregnancy outcomes, there is a need for population-based studies that include mothers representing the full spectrum of oral health status and other adverse birth outcome determinants that prevail in the community – demographic, biologic and psychosocial (Zhao et al., 2019). To date, only one study used the data from Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based sample to study the association between oral care and preterm births (Hwang et al., 2012) Hwang et al. studied the birth outcomes of 35,267 mothers in 10 states from 2004-2006 to analyze the association of any dental care and dental cleaning during pregnancy and the risk of preterm birth (<37 weeks gestation). After adjusting for age, income, education, insurance status before pregnancy, adequacy of prenatal care, smoking, multiple gestation, maternal morbidities: diabetes, hypertension, placental problems, and kidney/bladder infections, their results showed that no dental visit (purpose or type of treatment not specified) labeled as "dental care" during pregnancy, was associated with 15% higher odds of preterm birth (Hwang et al., 2012). Mothers who did not have a dental visit during pregnancy (treatment type unavailable) also had 23% higher odds of delivering a preterm infant (Hwang et al., 2012).

Till date, there is no documentation of the specific association of preventive dental services utilization (dental cleaning) with gestational size or low birth weight among a population-based sample of women with the full range of oral health status, from healthy gums to severe periodontitis. Further, the only documented studies on

preterm labor or preterm birth which examine the relationship between dental care or dental problem during pregnancy lack adjustment for recently documented risk factors, maternal stress, psychological abuse, and physical abuse which may be associated with adverse birth outcomes (Association of Maternal & Child Health Programs, 2013; Hwang et al., 2012; Mattheus et al., 2016; Nkansah-Amankra et al., 2010). Psychological stress is negatively associated with self-rated oral health status (general oral health and oral pain), and the association is moderated by dental care utilization and dental insurance status (Vasiliou et al., 2016). Partner-related physical abuse (domestic violence) also has a significant negative impact on oral health behavior and oral health status of women (Kundu et al., 2014). In a cross-sectional survey that included clinical dental examinations of 304 women (204 (67.1%) with domestic violence), there were significant differences between women reporting and not reporting domestic violence in the use of oral hygiene aids, tooth brushing frequency, periodontal status, number of missing teeth, intraoral soft tissue injuries and fractures ($p<0.05$) (Kundu et al., 2014).

To address this knowledge gap, we study a recent cohort of mothers to examine the possible association of maternal preventive dental services utilization (dental cleaning) with preterm birth and SGA accounting for recently included survey items on psychobiological and other stress variables. Our population-based study seeks to account for psychosocial stressors in studying the association of dental cleaning with birth outcomes by studying mothers across the full range of socioeconomic status and insurance type in the population. We hypothesized that dental cleaning during or before pregnancy is associated with reduced likelihood of preterm birth and SGA after adjusting for all pertinent risk factors.

5.3 METHODS

A. Data

Data from Phase 7 of the South Carolina (SC) PRAMS survey spanning 2012-2015 were used for analysis. Survey data are collected by the South Carolina Department of Environmental Control (SCDHEC) per Centers for Disease Control and Prevention (CDC) guidelines. PRAMS, the largest population-based, perinatal cross-sectional surveillance system, monitors maternal self-reported health status, practices and experiences prior, during and following the pregnancy of mothers who delivered a live-born newborn in the 2-9 months prior to survey (Shulman et al., 2018). SC PRAMS covers a sample of resident women with live births, drawn from each year's sampling frame of all live births included in the South Carolina vital records birth certificate database. PRAMS data with linked birth certificate data for 2012-2015 and the associated sample weighting algorithm were received from the South Carolina Department of Health and Environmental Control. PRAMS oversamples low birth weight (LBW) mothers to maximize data collection for high-risk pregnancies. State sampling ratios are assigned by the CDC. SC PRAMS Phase 7 (2012-2015) sampling frame ratios were as follows: 1:1 very LBW (< 1,500 grams), 1:7 moderately LBW (1,500 – 2,499 grams) and 1:69 normal birth weight (≥ 2,500 grams) (*CDC - Methodology - Pregnancy Risk Assessment Monitoring System - Reproductive Health*, 2018). Deidentified data were provided for study per our data request. This study was approved by the South Carolina Department of Health and Environmental Control Data Oversight Committee and exempt from IRB review by the University of South Carolina Institutional Review Board.

B. Sample

The PRAMS survey's unweighted response rates during the study period were: 48% in 2012 (*n*=620); 53% in 2013 (*n*=949); 50% in 2014 (*n*=855) and 45% in 2015 (*n*=767) (SC Department of Health and Environmental Control, 2019). Figure 5.2 shows the sampling scheme, respondents, and final study-eligible subjects after exclusions. A total of 3,191 respondents from 2012-2015 were eligible for study. After excluding 321 respondents with multiple births, we excluded mothers with missing data on the birth outcome being studied. The resulting analytic samples were 2,197 and 2,152 mothers for preterm birth and SGA analyses, respectively. These samples represent an estimated total of 162,706 and 162,605 South Carolina mothers respectively, over the study period.

C. Dependent Variables

Two outcomes were studied, preterm birth (delivery before 37 weeks of gestation) and low birth weight, studied as SGA. SGA was defined as birth weight below the 10^{th} percentile at a given gestational age of males and females respectively (Alexander et al., 1996). The study sample included births by planned cesarean section.

D. Independent Variables

Receipt of dental cleaning before and/or during pregnancy was the key predictor variable of interest. Participants were asked if they had their teeth cleaned by a dentist or dental hygienist before (in the 12 months prior) or during their most recent pregnancy.

E. Covariates

Covariates were included based on a conceptual framework that extends Andersen Model of Healthcare Utilization to care outcomes. Andersen's model was populated with appropriate variables supported by the literature, as follows. *Predisposing factors* were

race (White, Black and Other), age (>35 years and <35), marital status (married, other), and education (<12 years, 12 years or greater). *Enabling factors* were annual household income ($0- $19,000, $19,001-$37,000, $37,001-$67,000, $67,001 or more), rurality (defined by the federal Office of Rural Health Policy, rural = not a designated Metropolitan Statistical Area), prenatal health insurance, and dental insurance (Amin & ElSalhy, 2014; Stein et al., 2007). *Need factors* were perceived importance of oral health, and pregnancy intent prior to pregnancy (Ivanov, 2000; Lydon-Rochelle et al., 2004). *Personal health practices* included prenatal care initiation (timely, at or before 13th week of pregnancy, versus. later), smoking, alcohol consumption during pregnancy, exercise, and prepregnancy multivitamin consumption (Al Habashneh et al., 2005; Rocha et al., 2018). *Predisposing biologic risk factors* implicated in increased risk for preterm birth or low birth weight were maternal body mass index (BMI), previous live birth, previous LBW and previous preterm birth (Amin & ElSalhy, 2014; Stein et al., 2007). *Pregnancy characteristics* were gestational age, weight gain, hypertension, diabetes, newborn sex, and presence of any one of six medical risk factors (Bodnar et al., 2010; Heude et al., 2012). Medical risk factors during pregnancy were history of diabetes, hypertension, previous preterm birth, infertility treatments/enhancers, reproductive technology assistance, or previous cesarean.

Psychological factors were physical abuse and stress during pregnancy. The PRAMS survey included questions on the occurrence of 14 stressful events during the 12 months before birth or during pregnancy. One question was excluded (question 42 c. “I moved to a new address”) because moving may be a positive or negative experience associated with a change in financial means (Stone et al., 2015). Binary responses

(yes/no) to the remaining 13 stress questions were grouped into four categories: traumatic stress, financial stress, partner-related stress and emotional stress, per published studies on pregnancy and prenatal psychological stress for logistic regression analyses (Ahluwalia et al., 2001; Association of Maternal & Child Health Programs, 2013; Stone et al., 2015). Traumatic stress was considered to exist if the mother reported one or more of the following: (a) mother experienced homelessness during the pregnancy, (b) mother or husband/partner jailed anytime during the pregnancy, or (c) close family member with a drinking or drug problem. Similarly, financial stress was coded yes if (a) husband/partner lost job, (b) mother lost job, (c) mother or partner had reduction in work hours/pay, or (d) had problems paying bills. Partner-related stress was coded yes if the mother (a) got separated or divorced from husband or partner during pregnancy, (b) had repeated arguments with husband/partner, or (c) husband/partner didn't want pregnancy. Finally, emotional stress included (a) close family member sick/ in hospital, (b) living apart from husband/partner for work reasons, or (c) death of close family member. Physical abuse was coded yes if the mother reported being pushed, hit, slapped, kicked, choked or otherwise physically hurt by their husband or partner.

F. Statistical Analyses

SAS version 9.4 was used. Data from the four survey years 2012-2015 were pooled and analyzed reporting 95% confidence intervals (CIs) for the statistical estimates. Weighted analysis using sample weights recommended for SC PRAMS data analysis were used. Sample univariate descriptive statistics (mean, standard deviation, median, interquartile range, frequency, and proportions) were calculated. Bivariate cross-tables are presented along with Rao-Scott weighted Chi-square test of significance of the

association. Univariable logistic regressions of the association of the key variable of interest, dental cleaning with the outcomes are presented. We used weighted multivariable logistic regression modeling to study associations of dental cleaning with preterm birth and birthweight using SGA. Observations with missing data on any variable in a model were excluded from analysis. For all multiple regressions, the starting point was the full model with all variables included per study conceptual framework. Because significant association of dental cleaning with the outcome was observed in univariable regressions (both for preterm birth and SGA), and prior studies have documented differential effects of healthcare utilization with pregnancy outcomes among women with risk factors (Hwang et al., 2011, 2012), we tested the interactions of dental cleaning with risk factors that are known to be associated with pre term birth and SGA. The goal was to identify the specific subgroups of mothers impacted by dental cleaning that was driving the observed univariate association with outcomes. Potential interaction effects of dental cleaning with variables that are known or expected to impact birth weight were tested: diabetes, hypertension, medical risk factors, previous preterm birth, prenatal care initiation, physical abuse, emotional stress, financial stress, traumatic stress, partner-related stress, smoking, exercise, vitamin consumption, alcohol consumption (Ahluwalia et al., 2001; Ko et al., 2014; Magro-Malosso et al., 2017; Oh et al., 2020; Patra et al., 2011). After testing each risk factor separately, a final model was evaluated that included all interaction terms with a 0.1 level of significance in separate models to finalize a model that would retain only significant variables at the 0.05 level. Final model selection was conducted by backward, stepwise, manual variable removal one at a time based on the highest p-value at each step, until covariates with $p<0.05$ were retained along with the

independent variable of interest. Crude and adjusted odds ratios (AOR) along with 95% CIs are reported.

5.4 RESULTS

A. Univariate Analyses

Table 5.1 presents the sample maternal baseline characteristics. Most mothers were below age 35 (87%), married (52%), urban (86%), White (61%), had some college education (59%), covered by Medicaid (55%) and were non-smokers (87%). Of total women, 43% were normal weight before pregnancy, and 37% were in the lowest income group (<$19,000). The majority of pregnancies were unplanned (59%), and most mothers initiated timely prenatal care (94%). The prevalence of the known risk factors was as follows: diabetes (8%), hypertension (9%), and other medical risk factors during pregnancy (23%). Proactive health behavior prevalence studied was exercise during pregnancy (36%), and consumption of weekly vitamin supplements during pregnancy (59%).

B. Dental Care and Related Experiences

Majority of women reported having dental insurance during the pregnancy (62%), and having used preventive dental services (dental cleaning), before pregnancy, 54% and during pregnancy, 44%, for a total of 59% with dental cleaning either before or during pregnancy (the key independent variable). A minority of mothers reported having a dental problem requiring a dental visit during pregnancy (23%), although only 13% utilized dental care for the problem.

C. Bivariate Analyses

Table 5.1 also shows the demographic and risk factors among mothers distributed by preterm birth and SGA status. Mothers who had dental cleaning before or during pregnancy had had lower rates of preterm birth compared to mothers that did not clean in either period (p=0.0329). For maternal birth weight variables, the highest percentages of SGA and low birth weight were found in mothers who did not get a dental cleaning before or during pregnancy compared to mothers who did not clean. (p=0.02 and <0.001, respectively). Preterm birth and SGA rates were higher among mothers who were unmarried, Black, income <$19,000, and Medicaid recipients relative to the respective comparison groups. Low birth weight infant in immediately preceding pregnancy and pregnancy weight gain less than the recommended were both associated with preterm birth and SGA. Mothers with high blood pressure, any medical risk factor, unplanned pregnancy and delayed prenatal care were significantly more likely to have preterm birth. Higher rates of SGA occurred with male newborns and among smoking mothers of all categories, in the past two years, three months before pregnancy and in the last three months of pregnancy. Among stress and abuse variables, preterm birth was associated with physical abuse (before or during pregnancy), psychological abuse, financial stress and partner-related stress during pregnancy. Diabetes, taking a prenatal vitamin and exercise during pregnancy were not associated with either birth outcome.

D. Univariable and Multiple Regression Analyses

Tables 5.2-5.5 present the analyses pertaining to preterm birth outcome - univariable logistic regression analysis, multivariable logistic regression modeling without interactions, and the final model with statistically significant covariates and

interactions. Dental cleaning was significantly associated with lower odds of preterm birth in the univariate unadjusted regression models (OR 0.698; 95% CI [0.502, 0.972]; p=0.03). Dental cleaning lost significance in the multivariable regression models (AOR 0.822; 95% CI [0.545, 1.238]; p=0.3476), which suggested that dental cleaning may impact subgroups of women differently depending on the presence or absence of other influential factors for preterm birth. The results of regression analyses, including interactions one at a time in a model, showed that interaction terms for dental cleaning with traumatic stress and smoking were significant in predicting preterm birth.

The interaction of dental cleaning with smoking was significant, and a 62% reduction in preterm birth risk was noted among non-smoking mothers but not among smoking mothers (AOR 0.377; 95% CI [0.201, 0.706]; p=0.0023). Similarly, the interaction of dental cleaning with traumatic stress during pregnancy was significant, with a risk reduction from dental cleaning noted among mothers with traumatic stress but not among those without traumatic stress (AOR 0.241; 95% CI [0.098, 0.594]; p=0.002). When both interaction terms with smoking and traumatic stress were included together in the final selected model together with other statistically significant covariates, the above results were sustained with similar magnitude of odds: mothers with traumatic stress who had dental cleaning were 68% less likely to experience preterm birth compared to no cleaning (AOR 0.312; 95% CI [0.123, 0.790]; p=0.0141). Among non-smoking mothers, those with dental cleaning had 62% lower risk than those who did not have dental cleaning. Other significant covariates were psychological abuse which showed the highest effect size (AOR 3.268; CI [1.416, 7.545]; p=0.0055) followed by medical risk factor (AOR 2.267; 95% CI [1.493, 3.442]; p=0.0001) and history of previous low birth

weight (AOR 2.238; 95% CI [1.118, 4.479]; p=0.0228). Race (higher odds for Black mothers), no previous live birth, and financial stress during pregnancy were each associated with higher odds of preterm birth than the respective comparison categories.

The results of regression analyses to study the predictors of SGA are shown in Table 5.6 which presents the results of univariable logistic regression, multivariable logistic regression without interactions, and the final selected model with all significant interactions. In the univariable regression model, dental cleaning was associated with lower odds of SGA (AOR 0.647; 95% CI [0.450, 0.930]; p=0.02). Similar to the multivariable model for pre-term birth, SGA also lost statistical significance in the multivariable regression (AOR 0.739; 95% CI [0.493, 1.110]; p=0.1449). To test differential impact of dental cleaning among subgroups of women stratified on risk factors, interactions were tested one at a time, added to the multivariable model with significant predictors of SGA. The interaction of smoking with dental cleaning was significant. Dental cleaning was not associated with an SGA prevention benefit among non-smoking mothers but showed risk reduction among women who smoked during pregnancy. Among smoking women, dental cleaning was associated with 70% lower odds of SGA (AOR 0.302; 95% CI [0.097, 0.945]; p=0.04). Other protective factors against SGA were White/Other race, married mothers, and gestational diabetes (diabetic status limited to the pregnancy period). Mothers who had previous low birth weight had higher odds of SGA. Emotional stress during pregnancy was associated with lower odds of delivering an SGA newborn in the final model (AOR 0.623; 95% CI [0.400, 0.969]; p= 0.0359). To explore this association further, additional bivariate analysis to examine the dental cleaning frequencies among mothers with and without emotional stress (excluding

those with missing data) showed that a higher proportion of emotionally stressed mothers had received dental cleaning compared to those that did not report any emotional stress.

5.5 DISCUSSION

This research contributes to the existing literature on maternal dental services utilization and birth outcomes. In South Carolina, we found that women who did not receive a dental cleaning before or during pregnancy had increased risk of preterm birth and SGA, after adjusting for a comprehensive range of biologic, behavioral and psychosocial risk factors for preterm birth. We found that statistically significant associations of dental cleaning with preterm birth and SGA in univariable regression analyses lost significance after adjustment for covariates in multiple regression analyses and regained once interaction terms were included. The results showed that dental cleaning is associated with reductions in preterm birth and SGA among subgroups of mothers. Regarding preterm birth, dental cleaning provides a protective effect among non-smoking mothers and among mothers with traumatic stress. Regarding SGA, dental cleaning showed a protective effect among smoking mothers.

Smoking is a known risk factor for low birth weight and preterm birth and is documented to have a high effect size (Adibelli & Kirca, 2020; Windham et al., 2000). Smoking is also a known risk factor for very poor dental health (Millar & Locker, 2007). Our study findings suggest that the preterm birth risk mitigation by dental cleaning is limited to non-smoking mothers. This may suggest that the adverse impact of smoking is too overwhelming to be moderated to any degree by preventive dental care. For SGA, dental cleaning mitigates the risk among women who smoked during the last three months of pregnancy. These findings are consistent with documented studies showing

that maternal smoking is associated with greater risk of low birth weight, SGA and preterm birth in mothers (Ko et al., 2014).

A new finding of this study is that dental cleaning protects against preterm birth among mothers with traumatic stress, a potential risk factor for preterm birth. Dental cleaning may mitigate the adverse birth impacts of increased cortisol levels caused by high levels of stress through minimizing inflammatory mediators triggered by periodontal disease; inflammatory mediators are known to trigger labor (Boyapati & Wang, 2007; Lima et al., 2018; Vasiliou et al., 2016). Our finding that emotional stress is associated with lower odds of SGA is counterintuitive. This could be due to missing data on traumatic stress or due to confounding of traumatic stress with other psychosocial variables in the model. Our findings showing a higher rate of dental cleaning among mothers with emotional stress and mixed findings in the literature suggest the need for additional research. (Lima et al., 2018; Nkansah-Amankra et al., 2010; Segura Marcenes & Sheiham, 1992).

Periodontal disease affects 47% or 64.7 million of Americans aged over 30 years (Eke et al., 2012). Pregnant women are more vulnerable to gingival inflammation owing to pregnancy-related physiological changes. (Chaparro et al., 2013; Markou et al., 2009) Our research contributes to the literature by addressing the prevailing uncertainty about the effectiveness of periodontal therapy in mitigating adverse birth outcomes (Iheozor-Ejiofor et al., 2017). Although several clinical trials testing the impact of periodontal treatment failed to show a mitigation effect, a common limitation of those trials is that they included only women with established periodontal disease without comparison groups of healthy mothers. Other trials commenced periodontal treatment late in

pregnancy which may have been too little or too late to impact outcomes (Agueda et al., 2008; Govindasamy et al., 2020; Iheozor-Ejiofor et al., 2017).

A major strength of this study was the availability of specific questions on oral preventive care in PRAMS which enabled determination of dental cleaning received before and during pregnancy, along with data on obstetric and newborn outcomes from birth certificate data. Relatively large annual samples of mothers pooled across multiple years, oversampling of mothers with adverse outcomes, and the comprehensive nature of PRAMS questions permitted an exploration of the impact of dental cleaning on birth outcomes after accounting for many known risk factors for adverse birth outcomes. The study provides robust evidence supporting the active pursuit of oral health promotion as a routine standard of care in women's health and wellness programs.

There are several limitations of this study. First, the cross-sectional, observational study design of PRAMS does not permit conclusions on temporal cause-effect associations among the variables. Second, PRAMS data are retrospective and subject to recall error. Although the PRAMS methodology attempts to minimize recall bias, the actual interval of 2-9 months since delivery introduces differential risk of recall error. Third, the wording of the questions on oral health status and intervention precluded determination of whether the dental/periodontal disease preceded the medical visit or dental visit or was discovered at the dental visit. Self-reported health services including dental cleaning may not be accurate, prone to reporting bias (under/over reporting). Fourth, only live births were included. Early and late term miscarriages, abortions and stillbirths were excluded. Fifth, professionally-verified mothers' dental/periodontal health status from dental or medical records was not available; therefore, respondents' reasons

for seeking dental cleaning service could not be determined. Sixth, exclusion of observations with missing data from regression analyses may be a limitation. However, few observations had missing data on any variable with the exception of household income which was not included in the final model; therefore, missing data is unlikely to impact the findings. Seventh, our study may have limited generalizability to other states due to potential differences in maternal and health system factors.

5.6 CONCLUSION

Less than 10% of South Carolina mothers who experienced preterm birth or SGA had their teeth cleaned. Further, we found that the beneficial effect of dental cleaning before or during pregnancy varied by smoking status and traumatic stress exposure during pregnancy. Our results showed that dental cleaning before or during pregnancy is associated with a lower risk of preterm birth among non-smokers and a lower risk of SGA among smokers. Dental cleaning also appeared to mitigate the adverse effect of traumatic stress during pregnancy on birth outcomes, particularly preterm birth, a key determinant of birth weight. Overall, our study supports adoption of a standard of care guideline requiring preconception oral health discussion and referral to a dentist for preventive dental treatment as a routine part of wellness care for reproductive-aged women. This research also supports collaborative referrals of women with reported stress to psycho-social services to promote better birth outcomes.

5.7 SUPPLEMENTAL INFORMATION: PRAMS SURVEY QUESTIONS USED IN THE STUDY

History of low birth weight in the preceding pregnancy: Did the baby born just before your new one weigh 5 pounds, 8 ounces (2.5 kilos) or less at birth?

No

Yes

History of preterm birth in the preceding pregnancy: Was the baby just before your new one born earlier than 3 weeks before his or her due date?

No

Yes

Proactive health/self-care behaviors: At any time during the *12 months before* you got pregnant with your new baby, did you do any of the following things? For each item, check **No** if you did not do it or **Yes** if you did it.

No Yes

a. I was dieting (changing my eating habits) to lose weight

b. I was exercising 3 or more days of the week

c. I was regularly taking prescription medicines other than birth control

d. I visited a health care worker and was checked for diabetes

e. I visited a health care worker and was checked for high blood pressure

f. I visited a health care worker and was checked for depression or anxiety

g. I talked to a health care worker about my family medical history

h. I had my teeth cleaned by a dentist or dental hygienist

Weekly multivitamin consumption: During the *month before* you got pregnant with your new baby, how many times a week did you take a multivitamin, a prenatal vitamin, or a folic acid vitamin?

I didn't take a multivitamin, prenatal vitamin, or folic acid vitamin in the *month before* I got pregnant

1 to 3 times a week

4 to 6 times a week

Every day of the week

Pregnancy Intention: When you got pregnant with your new baby, were you trying to get pregnant?

No

Yes → Go to Question 18

Timeliness of prenatal care initiation: How many weeks or months pregnant were you when you had your first visit for prenatal care? Do not count a visit that was only for a pregnancy test or only for WIC (the Special Supplemental Nutrition Program for Women, Infants, and Children).

Weeks OR Months

Medical Preconception Counseling: *Before* you got pregnant with your new baby, did a doctor, nurse, or other health care worker talk with you about any of the things listed below? *Please count only discussions*, not reading materials or videos.

For each item, check No if no one talked with you about it or Yes if someone talked with you about it.

No Yes

a. Taking vitamins with folic acid before pregnancy

b. Being a healthy weight before pregnancy

c. Getting my vaccines updated before pregnancy

d. Visiting a dentist or dental hygienist before pregnancy

e. Getting counseling for any genetic diseases that run in my family

f. Controlling any medical conditions such as diabetes and high blood pressure

g. Getting counseling or treatment for depression or anxiety

h. The safety of using prescription or over-the-counter medicines during pregnancy

i. How smoking during pregnancy can affect a baby

j. How drinking alcohol during pregnancy can affect a baby

k. How using illegal drugs during pregnancy can affect a baby

Type of health insurance for prenatal care: During your most recent pregnancy, what kind of health insurance did you have to pay for your prenatal care? Check ALL that apply.

Private health insurance from my job or the job of my husband, partner, or parents

Private health insurance purchased directly from an insurance company

Medicaid (required: state Medicaid name)

State-specific option (Other government plan or program such as SCHIP/CHIP or health reform exchange program)

State-specific option (Other government plan or program not listed above such as state MCH program, indigent program or family planning program, etc.)

State-specific option (TRICARE or other military health care)

State-specific option (IHS or tribal)

Some other kind of health insurance => Please tell us_____

I did not have any health insurance to pay for my prenatal care

Prenatal oral health knowledge and experiences: This question is about the care of your teeth *during your most recent* pregnancy. For each item, check **No** if it is not true or does not apply to you or **Yes** if it is true.

No Yes

a. I knew it was important to care for my teeth and gums during my pregnancy

b. A dental or other health care worker talked with me about how to care for my teeth and gums

c. I had my teeth cleaned by a dentist or dental hygienist

d I had insurance to cover dental care during my pregnancy

e. I needed to see a dentist for a **problem**

f. I went to a dentist or dental clinic about a **problem**

Prepregnancy Cigarette Smoking: In the *3 months before* you got pregnant, how many cigarettes did you smoke on an average day? A pack has 20 cigarettes.

41 cigarettes or more

21 to 40 cigarettes

11 to 20 cigarettes

6 to 10 cigarettes

1 to 5 cigarettes

Less than 1 cigarette

I didn't smoke then

Prenatal cigarette smoking: In the *last 3 months* of your pregnancy, how many cigarettes did you smoke on an average day? A pack has 20 cigarettes.

41 cigarettes or more

21 to 40 cigarettes

11 to 20 cigarettes

6 to 10 cigarettes

1 to 5 cigarettes

Less than 1 cigarette

I didn't smoke then

Prepregnancy alcohol consumption: During the *3 months before* you got pregnant, how many alcoholic drinks did you have in an average week?

14 drinks or more a week

7 to 13 drinks a week

4 to 6 drinks a week

1 to 3 drinks a week

Less than 1 drink a week

I didn't drink then

Prenatal alcohol consumption: During the *last 3 months* of your pregnancy, how many alcoholic drinks did you have in an average week?

14 drinks or more a week

7 to 13 drinks a week

4 to 6 drinks a week

1 to 3 drinks a week

Less than 1 drink a week

I didn't drink then

Maternal new weight gain: By the end of *your most recent* pregnancy, how much weight had you gained? Check ONE answer and fill in blank if needed.

I gained _____ pounds

I didn't gain any weight, but I lost_____ pounds

My weight didn't change during my pregnancy

I don't know

Maternal Stress Experiences before and during pregnancy: This question is about things that may have happened during the *12 months before your new baby was born*.

For each item, check **No** if it did not happen to you or **Yes** if it did. (It may help to look at the calendar when you answer these questions.)

No Yes

a. A close family member was very sick and had to go into the hospital

b. I got separated or divorced from my husband or partner

c. I moved to a new address

d. I was homeless or had to sleep outside, in a car, or in a shelter

e. My husband or partner lost his job

f. I lost my job even though I wanted to go on working

g. My husband, partner, or I had a cut in work hours or pay.

h. I was apart from my husband or partner due to military deployment

or extended work-related travel

i. I argued with my husband or partner more than usual

j. My husband or partner said he didn't want me to be pregnant

k. I had problems paying the rent, mortgage, or other bills

l. My husband, partner, or I went to jail

m. Someone very close to me had a problem with drinking or drugs

n. Someone very close to me died

Physical abuse experiences before pregnancy: During the *12 months before you got pregnant* with your new baby, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?

No

Yes

Physical abuse experiences during pregnancy: During *your most recent* pregnancy, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?

No

Yes

Prenatal weekly exercise: Thinking back to after you found out you were pregnant, how many times did you exercise or play sports per week? (Include walking briskly, jogging, aerobics, swimming, etc. for ½ hour or more.)

0 times

1 time

2 times

3 times

4 times

5 or more times

Partner-related psychological abuse during pregnancy: This question is about things that may have happened during *your most recent* pregnancy. For each thing, check **No** if it did not happen to you or **Yes** if it did.

No Yes

a. My husband or partner threatened me or made me feel unsafe in some way

b. I was frightened for my safety or my family's safety because of the anger or threats of my husband or partner

c. My husband or partner tried to control my daily activities, for example, controlling who I could talk to or where I could go

d. My husband or partner forced me to take part in touching or any sexual activity when I did not want to

Total annual household income: During the *12 months before* your new baby was born, what was your yearly total household income before taxes? Include your income, your husband's or partner's income, and any other income you may have received. *All information will be kept private* and will not affect any services you are now getting.

$0 to $15,000

$15,001 to $19,000

$19,001 to $22,000

$22,001 to $26,000

$26,001 to $29,000

$29,001 to $37,000

$37,001 to $44,000

$44,001 to $52,000

$52,001 to $56,000

$56,001 to $67,000

$67,001 to $79,000

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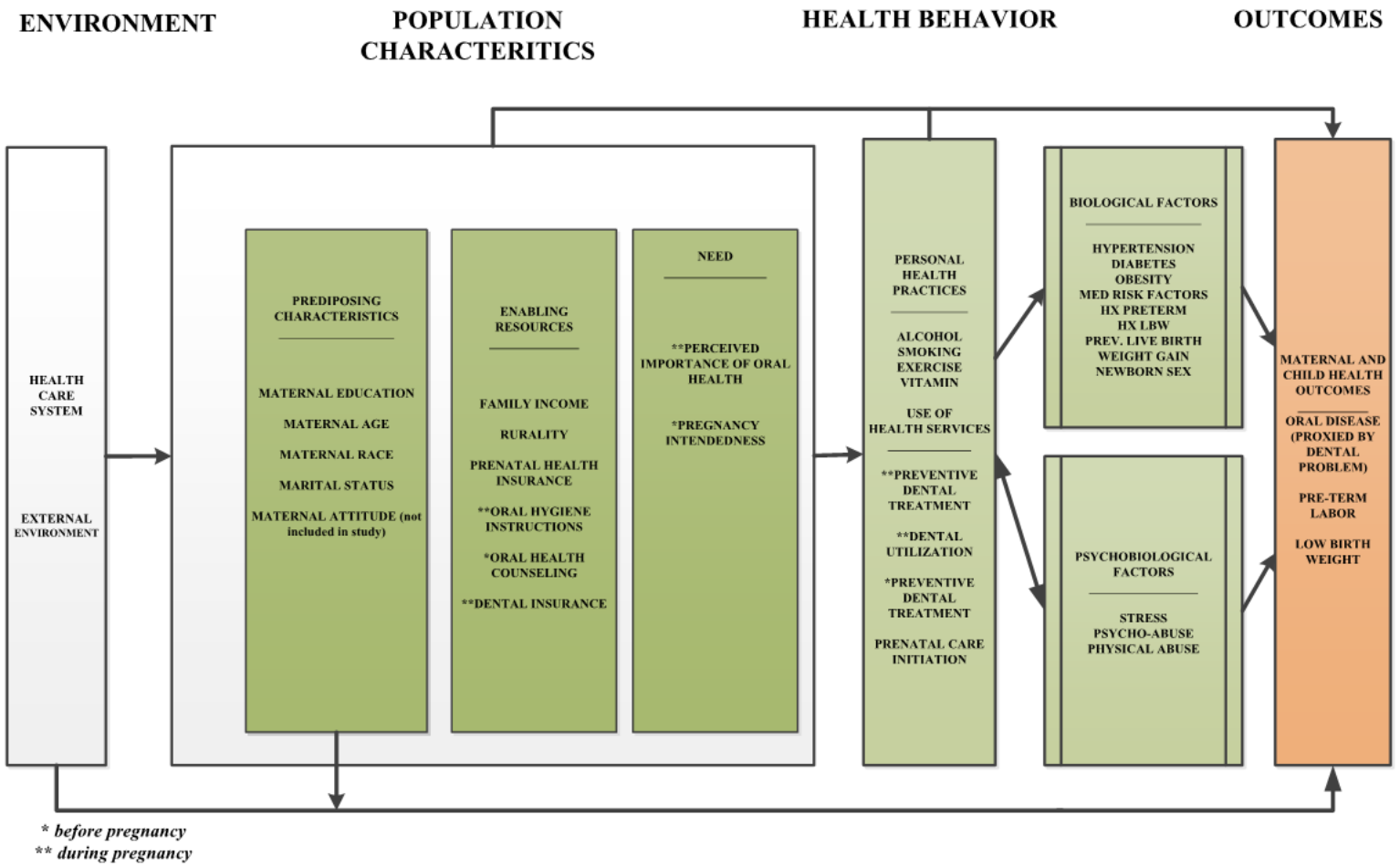

Figure 5.1. Adapted Andersen Healthcare Utilization Model.

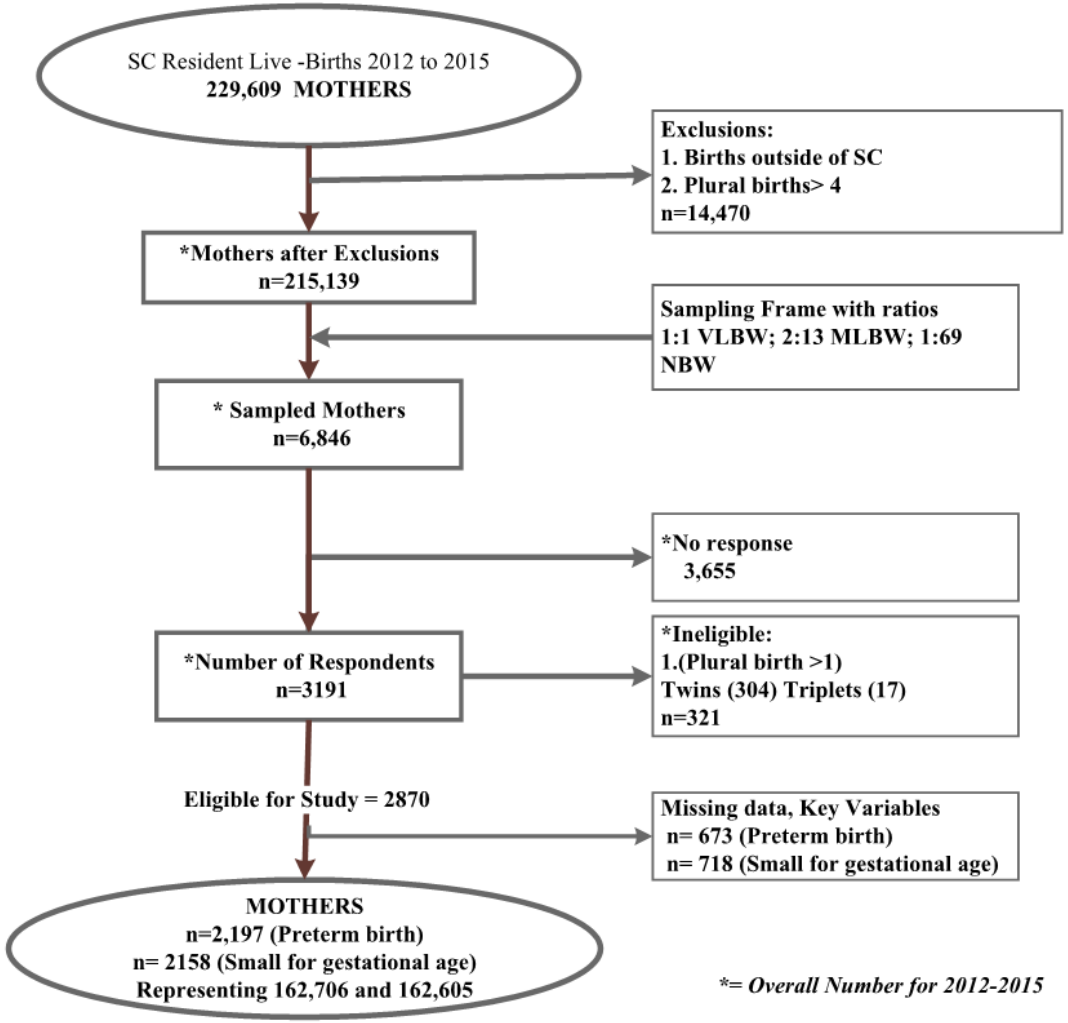

Figure 5.2. SC PRAMS Sample Flow Preterm Birth and SGA.

Table 5.1: Prevalence of Preterm Birth and Small for Gestational Age (SGA) by Maternal Characteristics.

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,870		SGA *n*=2,870	
		Yes *n*=1,627	p-value	Yes *n*=742	p-value
Predisposing Factors					
Age					
Below 35 years	2,417 (86.97)	1,336 (8.34)	0.1192	646 (11.27)	0.5619
35 years or more	453 (13.03)	291 (11.34)		96 (9.84)	
Missing	0				
Race					
White	1,504 (61.27)	728 (6.54)	**<.0001**	341 (8.45)	**0.0005**
Black	1,106 (29.55)	758 (13.21)		332 (16.16)	
Other	260 (9.18)	141 (8.92)		69 (12.37)	
Missing	0				
Education					
> 12 Years	1,766 (59.36)	963 (7.73)	0.1687	422 (9.57)	0.1031
12 Years	667 (23.82)	402 (10.80)		209 (12.15)	
Under 12 Years	424 (16.81)	252 (9.23)		109 (14.89)	
Missing	13				
Marital Status					
Married	1,443 (52.06)	722 (7.44)	**0.0439**	330 (8.34)	**0.0012**
Unmarried	1,427 (47.94)	905 (10.13)		412 (14.07)	
Missing	0				
Enabling Factors					
Household Income					

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,870		SGA *n*=2,870	
		Yes *n*=1,627	p-value	Yes *n*=742	p-value
$0 to $19,000	1,057 (37.13)	657 (11.62)	**0.0029**	330 (15.94)	**0.0046**
$19,001 to $37,000	645 (24.85)	371 (7.45)		161 (9.90)	
$37,001 to $67,000	432 (15.02	239 (6.04)		104 (10.18)	
$67,001 or More	523 (23.00)	231 (6.57)		105 (7.59)	
Missing	213				
Health Insurance					
Medicaid	1,564 (54.75)	957 (10.31)	**0.0248**	458 (13.35)	**<.0001**
Private/Military/Other	1,083 (40.14)	543 (6.59)		241 (8.42)	
Uninsured	112 (5.11)	59 (08.65)		20 (2.77)	
Missing	111				
Rurality[9]					
Urban	2,407 (85.64)	1,332 (8.38)	0.2023	612 (10.51)	0.1324
Rural	463 (14.36)	295 (10.81)		130 (14.54)	
Missing	0				
Oral Health Counseling					
Yes	261 (8.43)	156 (12.14)	0.1666	72 (11.2)	0.9697
No	2,609 (91.57)	1,471 (8.42)		670 (11.07)	
Missing	0				

Continued

[9] Federal Office of Rural Health Policy (FORHP) defined rural counties as counties that were not designated as parts of Metropolitan Areas (MAs) by the Office of Management and Budget (OMB) (U.S. Health Resources & Services Administration, 2020)

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,870		SGA *n*=2,870	
		Yes *n*=1,627	p-value	Yes *n*=742	p-value
Oral Hygiene Instruction					
Received	1,266 (47.06)	678 (7.63)	0.1056	324 (11.05)	0.8168
No receipt	1,545 (52.94)	915 (9.80)		409 (11.48)	
Missing	59				
Need Factors					
Dental Knowledge					
Yes	2,460 (87.74)	1,333 (8.01)	**0.0073**	635 (11.46)	0.3678
No	393 (12.26)	264 (14.07)		97 (9.68)	
Missing	52				
Dental Problem					
Yes	2,169 (76.88)	375 (9.04)	0.8527	177 (13.13)	0.3085
No	636 (23.12)	1219 (8.75)		553 (10.76)	
Missing	66				
Pregnancy Intention					
Trying	1,078 (40.96)	563 (7.24)	**0.0502**	254 (9.77)	0.2368
Not Trying	1,662 (59.04)	991 (10.01)		449 (11.96)	
Missing	130				
Self Health Practices					
Dental Cleaning (Before or During)					
Yes	1,546 (58.91)	819 (7.56)	**0.0329**	365 (9.43)	**0.0182**
No	1,253 (41.09)	764 (10.48)		361 (13.86)	

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,870		SGA *n*=2,870	
		Yes *n*=1,627	p-value	Yes *n*=742	p-value
Missing	71				
Problem Dental Visit					
Yes	2,460 (87.46)	190 (8.49)	0.8640	91 (12.04)	0.7666
No	336 (12.54)	1,395 (8.84)		635 (11.20)	
Missing	74				
Prenatal Care Initiation					
Timely (≤13 weeks)	2,601 (94.07)	1,465 (8.58)	0.3513	665 (10.86)	0.6327
Delayed (> 13 weeks)	176 (5.93)	100 (11.11)		52 (14.08)	
Missing	93				
Alcohol (During)					
Yes	167 (7.95)	74 (7.44)	0.6067	28 (10.47)	0.8721
No	2,703 (92.05)	1,553 (8.85)		714 (11.14)	
Missing	0				
Smoking (During)					
Yes	376 (12.77)	215 (9.80)	0.5232	137 (21.01)	**0.0001**
No	2,494 (87.23)	1,412 (8.58)		605 (9.63)	
Missing	0				
Exercise					
<3 times per week	2,023 (69.08)	1,188 (9.19)	0.2966	535 (11.04)	0.6794
3 or more times per week	771 (30.92)	391 (7.74)		194 (11.89)	
Missing	76				
Vitamin					
Yes	1,608 (58.65)	614 (7.49)	0.0897	285 (11.21)	0.8940

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,870		SGA *n*=2,870	
		Yes *n*=1,627	p-value	Yes *n*=742	p-value
No	1,134 (41.35)	940 (9.79)		421 (10.96)	
Missing	128				
Biological Factors					
Hypertension					
Yes	539 (8.58)	430 (18.32)	**<.0001**	208 (15.44)	0.1099
No	2,331 (91.43)	1197 (7.83)		534 (10.68)	
Missing	0				
Diabetes					
Yes	180 (7.24)	89 (9.74)	0.6987	48 (9.01)	0.4873
No	2,690 (92.75)	1,538 (8.65)		694 (11.25)	
Missing	0				
Prepregnancy BMI					
Underweight	244 (8.44)	139 (10.45)	0.5942	72 (9.56)	0.8246
Normal	1,112 (42.80)	563 (8.13)		283 (11.87)	
Overweight	673 (23.520	381 (8.04)		177 (10.12)	
Obese	841 (25.24)	544 (9.84)		210 (11.15)	
Missing	0				
Medical Risk Factors					
Yes	1,058 (22.47)	761 (14.86)	**<.0001**	336 (12.95)	0.2371
No	1,812 (77.53)	866 (6.96)		406 (10.54)	
Missing	0				
History of Preterm Birth					
Yes	377 (8.51)	270 (15.01)	**0.0014**	104 (13.61)	0.1731

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,870		SGA *n*=2,870	
		Yes *n*=1,627	p-value	Yes *n*=742	p-value
No	1,098 (52.47)	501 (6.82)		252 (9.54)	
No Previous Live Birth	1,314 (39.02)	808 (9.90)		365 (12.79)	
Missing	81				
History of Low Birth Weight					
Yes	378 (8.85))	266 (15.14)	**0.0009**	128 (17.60)	**0.0111**
No	1,092 (52.17)	498 (6.67)		227 (8.81)	
No Previous Live Birth	1,315 (38.98)	809 (9.91)		366 (12.79)	
Missing	85				
Newborn Sex					
Male	1,408 (48.24)	776 (8.69)	0.9552	460 (15.75)	<.0001
Female	1,462 (51.76)	851 (8.77)		282 (6.74)	
Missing	0				
Psychobiological Factors					
Physical Abuse (before/during)					
Yes	153 (4.23)	100 (17.76)	**0.0100**	38 (9.29)	0.5429
No	2,675 (95.77)	1,500 (8.40)		695 (11.14)	
Missing	42				
Psychological Abuse					
Yes	142 (4.94)	88 (20.06)	**0.0012**	38 (10.08)	0.6937
No	2,646 (95.06)	1,488 (8.25)		692 (11.37)	

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,870		SGA *n*=2,870	
		Yes *n*=1,627	p-value	Yes *n*=742	p-value
Missing	82				
Traumatic Stress					
Yes	463 (17.91)	259 (8.80)	0.9937	119 (11.89)	0.6583
No	2,366 (82.09)	1,344 (8.79)		612 (10.82)	
Missing	41				
Financial Stress					
Yes	1,101 (37.33)	653 (10.57)	**0.0398**	281 (12.49)	0.2120
No	1,728 (62.67)	950 (7.73)		450 (10.14)	
Missing	41				
Partner-Related Stress					
Yes	1,906 (69.38)	572 (11.60)	**0.0064**	238 (11.98)	0.4758
No	923 (30.63)	1,031 (7.55)		493 (10.59)	
Missing	41				
Emotional Stress					
Yes	1,050 (38.73)	582 (8.62)	0.8402	272 (9.46)	0.1578
No	1,781 (61.73)	1,022 (8.90)		460 (12.01)	
Missing	39				

Table 5.2: Association of Dental Cleaning with Preterm Birth (*n*=2,370 unweighted sample): Weighted Regression Analyses with the Interaction of Dental Cleaning And Physical Abuse.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 1 (Dental Cleaning × Physical Abuse)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning (Yes)	0.698	0.502, 0.972	**0.0333**	0.822	0.545, 1.238	0.3476	0.907	0.598, 1.376	0.6472
Maternal Age (35 years or more versus Below 35 years)	1.405	0.914, 2.160	0.1211	1.681	0.971, 2.909	0.0635	1.653	0.960, 2.846	0.0701
Maternal Race (Black versus White and Other)	2.068	1.477, 2.896	**<.0001**	1.901	1.264, 2.860	**0.0021**	1.950	1.298, 2.929	**0.0013**
Maternal Education (12 years or more versus Below 12 years)	0.926	0.605, 1.417	0.7233	-	-	-	-	-	-
Marital Status (Married versus Unmarried)	0.714	0.514, 0.990	**0.0436**	-	-	-	-	-	-
Rurality (Yes)	1.325	0.859, 2.045	0.2029	-	-	-	-	-	-
Income ($19,001 - $37,000 versus $0 - $19,000)	0.612	0.402, 0.930	**0.0216**	-	-	-	-	-	-
Income ($37,001 - $67,000 versus $0 - $19,000)	0.488	0.297, 0.802	**0.0047**	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 1 (Dental Cleaning × Physical Abuse)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Income (≥ $67,001 versus $0 - $19,000)	0.535	0.331, 0.863	**0.0101**	-	-	-	-	-	-
First PNC Visit (Delayed: >13 weeks versus Timely: 13 weeks or earlier)	1.331	0.729, 2.432	0.3522	-	-	-	-	-	-
Prenatal Insurance (Medicaid versus Uninsured)	1.214	0.568, 2.597	0.6162	-	-	-	-	-	-
Prenatal Insurance (Private Insurance/Military/Other versus Uninsured)	0.745	0.342, 1.622	0.4583	-	-	-	-	-	-
Dental Problem During Pregnancy (Yes)	1.037	0.710, 1.514	0.8515	-	-	-	-	-	-
Pregnancy Intention (Yes)	0.702	0.492, 1.001	**0.0505**	-	-	-	-	-	-
PRE-BMI (Obese versus Normal)	1.234	0.829, 1.836	0.3008	-	-	-	-	-	-
PRE-BMI (Overweight versus Normal)	0.988	0.639, 1.528	0.9572	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 1 (Dental Cleaning × Physical Abuse)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
PRE-BMI (Underweight versus Normal)	1.319	0.742, 2.346	0.3456	-	-	-	-	-	-
Medical Risk Factors (Yes)	2.334	1.673, 3.257	**<.0001**	2.217	1.467, 3.351	**0.0002**	2.180	1.433, 3.318	**0.0003**
Newborn Sex (Female versus Male)	1.009	0.729, 1.397	0.9552						
Previous Live Birth (Yes)	0.723	0.521, 1.002	0.5140	0.476	0.305, 0.745	**0.0011**	0.490	0.315, 0.761	**0.0015**
New Weight Gain (Less Than Recommended versus Recommended)	1.550	1.039, 2.311	**0.0317**	1.554	0.950, 2.542	**0.0794**	1.600	0.980, 2.612	**0.0600**
New Weight Gain (More Than Recommended versus Recommended)	0.752	0.484, 1.170	0.2059	0.804	0.470, 1.376	0.4268	0.803	0.466, 1.382	0.4284
Hypertension (Yes)	2.640	1.772, 3.932	**<.0001**	-	-	-	-	-	-
Gestational Diabetes (Gestational Diabetes versus Never Diabetic)	0.970	0.524, 1.794	0.9218	-	-	-	-	-	-
Diabetes (Pre-Existing Diabetes versus Never Diabetic)	1.562	0.722, 3.378	0.2568	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 1 (Dental Cleaning × Physical Abuse)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Previous Low Birth Weight (Yes)	2.037	1.268, 3.272	**0.0033**	2.173	1.082, 4.364	**0.0292**	2.162	1.072, 4.359	**0.0312**
Previous Preterm Birth (Yes)	1.995	1.258, 3.162	**0.0033**	-	-	-	-	-	-
Smoke (Before, Yes)	0.848	0.592, 1.214	0.3671	-	-	-	-	-	-
Smoking (During, Yes)	1.158	0.738, 1.817	0.5234	-	-	-	-	-	-
Drinking (Before, Yes)	0.971	0.706, 1.336	0.8582	-	-	-	-	-	-
Drinking (During, Yes)	0.828	0.404, 1.699	0.6037	-	-	-	-	-	-
Exercise per Week (3 ≥ Times versus < 3 Times)	0.828	0.581, 1.181	0.2974	-	-	-	-	-	-
Multivitamin Consumption (Yes)	0.746	0.532, 1.047	0.0904	-	-	-	-	-	-
Physical Abuse (Yes)	2.356	1.204, 4.609	**0.0123**	-	-	-	1.854	0.388, 8.858	0.4394
Psychological Abuse (Yes)	2.794	1.463, 5.337	**0.0019**	3.091	1.303, 7.333	**0.0105**	2.986	0.956, 9.332	**0.0599**
Traumatic Stress (Yes)	1.002	0.651, 1.541	0.9937	0.621	0.360, 1.070	0.0858	0.599	0.336, 1.069	0.0827
Financial Stress (Yes)	1.412	1.016, 1.963	**0.0402**	1.520	1.006, 2.295	**0.0465**	1.557	1.034, 2.346	**0.0342**
Partner-Related Stress (Yes)	1.607	1.141, 2.265	**0.0067**	-	-	-	-	-	-
Emotional Stress (Yes)	0.966	0.691, 1.351	0.8408	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 1 (Dental Cleaning × Physical Abuse)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning × Smoking (During)[10]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Smoking No	-	-	-	-	-	-	-	-	-
Dental Cleaning No Smoking Yes	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Smoking Yes	-	-	-	-	-	-	-	-	-
Dental Cleaning No Smoking No (Reference Group)	-	-	-	-	-	-	-	-	-
Dental Cleaning × Traumatic Stress (During)[11]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Traumatic Stress No	-	-	-	-	-	-	-	-	-

Continued

[10] Overall p-values for individual interaction and final models were 0.0933 and 0.0379, respectively.
[11] Overall p-values for individual interaction and final models were 0.0039 and 0.0026, respectively.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 1 (Dental Cleaning × Physical Abuse)		
	Odds Ratio (OR)	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**
Dental Cleaning Yes Traumatic Stress Yes	-	-	-	-	-	-	-	-	-
Dental Cleaning No Traumatic Stress No	-	-	-	-	-	-	-	-	-
Dental Cleaning No Traumatic Stress Yes (Reference Group)	-	-	-	-	-	-	-	-	-
Dental Cleaning × Physical Abuse (Before/During)[12]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Physical Abuse No	-	-	-	-	-	-	0.489	0.103, 2.317	0.3677
Dental Cleaning Yes Physical Abuse Yes	-	-	-	-	-	-	0.154	0.033, 0.718	**0.0172**
Dental Cleaning No Physical Abuse No	-	-	-	-	-	-	0.539	0.113, 2.578	0.4349

Continued

[12] Overall p-value for individual interaction is 0.0297.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 1 (Dental Cleaning × Physical Abuse)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning No Physical Abuse Yes (Reference Group)	-	-	-	-	-	-		-	-

Table 5.3: Association of Dental Cleaning with Preterm Birth (*n*=2,370 unweighted sample): Weighted Regression Analyses with the Interaction of Dental Cleaning And Traumatic Stress.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 2 (Dental Cleaning × Traumatic Stress)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning (Yes)	0.698	0.502, 0.972	**0.0333**	0.822	0.545, 1.238	0.3476	1.041	0.664, 1.632	0.8602
Maternal Age (35 years or more versus Below 35 years)	1.405	0.914, 2.160	0.1211	1.681	0.971, 2.909	0.0635	1.638	0.947, 2.834	0.0776

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 2 (Dental Cleaning × Traumatic Stress)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Maternal Race (Black versus White and Other)	2.068	1.477, 2.896	**<.0001**	1.901	1.264, 2.860	**0.0021**	1.941	1.287, 2.925	**0.0016**
Maternal Education (12 years or more versus Below 12 years)	0.926	0.605, 1.417	0.7233	-	-	-	-	-	-
Marital Status (Married versus Unmarried)	0.714	0.514, 0.990	**0.0436**	-	-	-	-	-	-
Rurality (Yes)	1.325	0.859, 2.045	0.2029	-	-	-	-	-	-
Income ($19,001 - $37,000 versus $0 - $19,000)	0.612	0.402, 0.930	**0.0216**	-	-	-	-	-	-
Income ($37,001 - $67,000 versus $0 - $19,000)	0.488	0.297, 0.802	**0.0047**	-	-	-	-	-	-
Income (≥ $67,001 versus $0 - $19,000)	0.535	0.331, 0.863	**0.0101**	-	-	-	-	-	-
First PNC Visit (Delayed: >13 weeks versus Timely: 13 weeks or earlier)	1.331	0.729, 2.432	0.3522	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 2 (Dental Cleaning × Traumatic Stress)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Prenatal Insurance (Medicaid versus Uninsured)	1.214	0.568, 2.597	0.6162	-	-	-	-	-	-
Prenatal Insurance (Private Insurance/Military/Other versus Uninsured)	0.745	0.342, 1.622	0.4583	-	-	-	-	-	-
Dental Problem During Pregnancy (Yes)	1.037	0.710, 1.514	0.8515	-	-	-	-	-	-
Pregnancy Intention (Yes)	0.702	0.492, 1.001	**0.0505**	-	-	-	-	-	-
PRE-BMI (Obese versus Normal)	1.234	0.829, 1.836	0.3008	-	-	-	-	-	-
PRE-BMI (Overweight versus Normal)	0.988	0.639, 1.528	0.9572	-	-	-	-	-	-
PRE-BMI (Underweight versus Normal)	1.319	0.742, 2.346	0.3456	-	-	-	-	-	-
Medical Risk Factors (Yes)	2.334	1.673, 3.257	**<.0001**	2.217	1.467, 3.351	**0.0002**	2.234	1.472, 3.390	**0.0002**
Newborn Sex (Female versus Male)	1.009	0.729, 1.397	0.9552						

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 2 (Dental Cleaning × Traumatic Stress)		
	Odds Ratio (OR)	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**
Previous Live Birth (Yes)	0.723	0.521, 1.002	0.5140	0.476	0.305, 0.745	**0.0011**	0.463	0.298, 0.718	**0.0006**
New Weight Gain (Less Than Recommended versus Recommended)	1.550	1.039, 2.311	**0.0317**	1.554	0.950, 2.542	**0.0794**	1.581	0.967, 2.586	0.0681
New Weight Gain (More Than Recommended versus Recommended)	0.752	0.484, 1.170	0.2059	0.804	0.470, 1.376	0.4268	0.804	0.469, 1.378	0.4271
Hypertension (Yes)	2.640	1.772, 3.932	**<.0001**	-	-	-	-	-	-
Gestational Diabetes (Gestational Diabetes versus Never Diabetic)	0.970	0.524, 1.794	0.9218	-	-	-	-	-	-
Diabetes (Pre-Existing Diabetes versus Never Diabetic)	1.562	0.722, 3.378	0.2568	-	-	-	-	-	-
Previous Low Birth Weight (Yes)	2.037	1.268, 3.272	**0.0033**	2.173	1.082, 4.364	**0.0292**	2.257	1.120, 4.550	**0.0229**
Previous Preterm Birth (Yes)	1.995	1.258, 3.162	**0.0033**	-	-	-	-	-	-
Smoke (Before, Yes)	0.848	0.592, 1.214	0.3671	-	-	-	-	-	-
Smoking (During, Yes)	1.158	0.738, 1.817	0.5234	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 2 (Dental Cleaning × Traumatic Stress)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Drinking (Before, Yes)	0.971	0.706, 1.336	0.8582	-	-	-	-	-	-
Drinking (During, Yes)	0.828	0.404, 1.699	0.6037	-	-	-	-	-	-
Exercise per Week (3 ≥ Times versus < 3 Times)	0.828	0.581, 1.181	0.2974	-	-	-	-	-	-
Multivitamin Consumption (Yes)	0.746	0.532, 1.047	0.0904	-	-	-	-	-	-
Physical Abuse (Yes)	2.356	1.204, 4.609	**0.0123**	-	-	-	-	-	-
Psychological Abuse (Yes)	2.794	1.463, 5.337	**0.0019**	3.091	1.303, 7.333	**0.0105**	3.038	1,292, 7.907	**0.0108**
Traumatic Stress (Yes)	1.002	0.651, 1.541	0.9937	0.621	0.360, 1.070	0.0858	1.189	0.565, 2.501	0.6481
Financial Stress (Yes)	1.412	1.016, 1.963	**0.0402**	1.520	1.006, 2.295	**0.0465**	1.562	1.034, 2.360	0.6481
Partner-Related Stress (Yes)	1.607	1.141, 2.265	**0.0067**	-	-	-	-	-	-
Emotional Stress (Yes)	0.966	0.691, 1.351	0.8408	-	-	-	-	-	-
Dental Cleaning × Smoking (During)[13]	-	-	-	-	-	-		-	-

Continued

[13] Overall p-values for individual interaction and final models were 0.0933 and 0.0379, respectively.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 2 (Dental Cleaning × Traumatic Stress)		
	Odds Ratio (OR)	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**
Dental Cleaning Yes Smoking No	-	-	-	-	-	-		-	-
Dental Cleaning No Smoking Yes	-	-	-	-	-	-		-	-
Dental Cleaning Yes Smoking Yes	-	-	-	-	-	-		-	-
Dental Cleaning No Smoking No (Reference Group)	-	-	-	-	-	-		-	-
Dental Cleaning × Traumatic Stress (During)[14]	-	-	-	-	-	-		-	-
Dental Cleaning Yes Traumatic Stress No	-	-	-	-	-	-	0.876	0.417, 1.839	0.7256
Dental Cleaning Yes Traumatic Stress Yes	-	-	-	-	-	-	0.241	0.098, 0.594	**0.0020**

Continued

[14] Overall p-values for individual interaction and final models were 0.0039 and 0.0026, respectively.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 2 (Dental Cleaning × Traumatic Stress)		
	Odds Ratio (OR)	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**
Dental Cleaning No Traumatic Stress No	-	-	-	-	-	-	0.841	0.400, 1.769	0.6481
Dental Cleaning No Traumatic Stress Yes (Reference Group)	-	-	-	-	-	-		-	-
Dental Cleaning × Physical Abuse (Before/During)[15]	-	-	-	-	-	-		-	-
Dental Cleaning Yes Physical Abuse No	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Physical Abuse Yes	-	-	-	-	-	-	-	-	-
Dental Cleaning No Physical Abuse No	-	-	-	-	-	-	-	-	-
Dental Cleaning No Physical Abuse Yes (Reference Group)	-	-	-	-	-	-	-	-	-

[15] Overall p-value for individual interaction is 0.0297.

Table 5.4: Association of Dental Cleaning with Preterm Birth (*n*=2,370 unweighted sample): Weighted Regression Analyses with the Interaction of Dental Cleaning And Smoking.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 3 (Dental Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning (Yes)	0.698	0.502, 0.972	**0.0333**	0.822	0.545, 1.238	0.3476	0.717	0.459, 1.120	0.144
Maternal Age (35 years or more versus Below 35 years)	1.405	0.914, 2.160	0.1211	1.681	0.971, 2.909	0.0635	1.722	0.976, 3.040	0.0606
Maternal Race (Black versus White and Other)	2.068	1.477, 2.896	**<.0001**	1.901	1.264, 2.860	**0.0021**	1.892	1.248, 2.869	**0.0027**
Maternal Education (12 years or more versus Below 12 years)	0.926	0.605, 1.417	0.7233	-	-	-	-	-	-
Marital Status (Married versus Unmarried)	0.714	0.514, 0.990	**0.0436**	-	-	-	-	-	-
Rurality (Yes)	1.325	0.859, 2.045	0.2029	-	-	-	-	-	-
Income ($19,001 - $37,000 versus $0 - $19,000)	0.612	0.402, 0.930	**0.0216**	-	-	-	-	-	-
Income ($37,001 - $67,000 versus $0 - $19,000)	0.488	0.297, 0.802	**0.0047**	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 3 (Dental Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Income (≥ $67,001 versus $0 - $19,000)	0.535	0.331, 0.863	**0.0101**	-	-	-	-	-	-
First PNC Visit (Delayed: >13 weeks versus Timely: 13 weeks or earlier)	1.331	0.729, 2.432	0.3522	-	-	-	-	-	-
Prenatal Insurance (Medicaid versus Uninsured)	1.214	0.568, 2.597	0.6162	-	-	-	-	-	-
Prenatal Insurance (Private Insurance/Military/Other versus Uninsured)	0.745	0.342, 1.622	0.4583	-	-	-	-	-	-
Dental Problem During Pregnancy (Yes)	1.037	0.710, 1.514	0.8515	-	-	-	-	-	-
Pregnancy Intention (Yes)	0.702	0.492, 1.001	**0.0505**	-	-	-	-	-	-
PRE-BMI (Obese versus Normal)	1.234	0.829, 1.836	0.3008	-	-	-	-	-	-
PRE-BMI (Overweight versus Normal)	0.988	0.639, 1.528	0.9572	-	-	-	-	-	-
PRE-BMI (Underweight versus Normal)	1.319	0.742, 2.346	0.3456	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 3 (Dental Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Medical Risk Factors (Yes)	2.334	1.673, 3.257	**<.0001**	2.217	1.467, 3.351	**0.0002**	2.844	1.770, 4.571	**<.0001**
Newborn Sex (Female versus Male)	1.009	0.729, 1.397	0.9552						
Previous Live Birth (Yes)	0.723	0.521, 1.002	0.5140	0.476	0.305, 0.745	**0.0011**	0.488	0.312, 0.766	**0.0018**
New Weight Gain (Less Than Recommended versus Recommended)	1.550	1.039, 2.311	**0.0317**	1.554	0.950, 2.542	**0.0794**	1.502	0.903, 2.500	0.1171
New Weight Gain (More Than Recommended versus Recommended)	0.752	0.484, 1.170	0.2059	0.804	0.470, 1.376	0.4268	0.804	0.467, 1.384	0.4304
Hypertension (Yes)	2.640	1.772, 3.932	**<.0001**	-	-	-	-	-	-
Gestational Diabetes (Gestational Diabetes versus Never Diabetic)	0.970	0.524, 1.794	0.9218	-	-	-	0.431	0.199, 0.933	**0.0328**
Diabetes (Pre-Existing Diabetes versus Never Diabetic)	1.562	0.722, 3.378	0.2568	-	-	-	0.882	0.343, 2.268	0.7942
Previous Low Birth Weight (Yes)	2.037	1.268, 3.272	**0.0033**	2.173	1.082, 4.364	**0.0292**	2.136	1.044, 4.370	**0.0376**
Previous Preterm Birth (Yes)	1.995	1.258, 3.162	**0.0033**	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 3 (Dental Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Smoke (Before, Yes)	0.848	0.592, 1.214	0.3671	-	-	-	-	-	-
Smoking (During, Yes)	1.158	0.738, 1.817	0.5234	-	-	-	0.583	0.285, 1.195	0.1405
Drinking (Before, Yes)	0.971	0.706, 1.336	0.8582	-	-	-	-	-	-
Drinking (During, Yes)	0.828	0.404, 1.699	0.6037	-	-	-	-	-	-
Exercise per Week (3 ≥ Times versus < 3 Times)	0.828	0.581, 1.181	0.2974	-	-	-	-	-	-
Multivitamin Consumption (Yes)	0.746	0.532, 1.047	0.0904	-	-	-	-	-	-
Physical Abuse (Yes)	2.356	1.204, 4.609	**0.0123**	-	-	-	3.293	1.399, 7.750	**0.0064**
Psychological Abuse (Yes)	2.794	1.463, 5.337	**0.0019**	3.091	1.303, 7.333	**0.0105**	3.293	1.399, 7.750	**0.0064**
Traumatic Stress (Yes)	1.002	0.651, 1.541	0.9937	0.621	0.360, 1.070	0.0858	0.570	0.311, 1.044	0.0687
Financial Stress (Yes)	1.412	1.016, 1.963	**0.0402**	1.520	1.006, 2.295	**0.0465**	1.511	0.996, 2.292	**0.0524**
Partner-Related Stress (Yes)	1.607	1.141, 2.265	**0.0067**	-	-	-	-	-	-
Emotional Stress (Yes)	0.966	0.691, 1.351	0.8408	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 3 (Dental Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning × Smoking (During)[16]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Smoking No	-	-	-	-	-	-	0.717	0.459, 1.120	0.144
Dental Cleaning No Smoking Yes	-	-	-	-	-	-	0.583	0.285, 1.195	0.1405
Dental Cleaning Yes Smoking Yes	-	-	-	-	-	-	1.232	0.430, 3.536	0.6974
Dental Cleaning No Smoking No (Reference Group)	-	-	-	-	-	-	-	-	-
Dental Cleaning × Traumatic Stress (During)[17]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Traumatic Stress No	-	-	-	-	-	-	-	-	-

Continued

[16] Overall p-values for individual interaction and final models were 0.0933 and 0.0379, respectively.
[17] Overall p-values for individual interaction and final models were 0.0039 and 0.0026, respectively.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 3 (Dental Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning Yes Traumatic Stress Yes	-	-	-	-	-	-	-	-	-
Dental Cleaning No Traumatic Stress No	-	-	-	-	-	-	-	-	-
Dental Cleaning No Traumatic Stress Yes (Reference Group)	-	-	-	-	-	-	-	-	-
Dental Cleaning × Physical Abuse (Before/During)[18]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Physical Abuse No	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Physical Abuse Yes	-	-	-	-	-	-	-	-	-
Dental Cleaning No Physical Abuse No	-	-	-	-	-	-	-	-	-

Continued

[18] Overall p-value for individual interaction is 0.0297.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Adjusted Selected Model with Interaction 3 (Dental Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning No Physical Abuse Yes (Reference Group)	-	-	-	-	-	-	-	-	-

Table 5.5: Association of Dental Cleaning with Preterm Birth (*n*=2,370 unweighted sample): Weighted Regression Analyses with the Interaction of Dental Cleaning And All Significant Interaction Terms.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Final Selected Model with Significant Interaction Terms		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning (Yes)	0.698	0.502, 0.972	**0.0333**	0.822	0.545, 1.238	0.3476	0.907	0.567, 1.451	0.683
Maternal Age (35 years or more versus Below 35 years)	1.405	0.914, 2.160	0.1211	1.681	0.971, 2.909	0.0635	1.659	0.963, 2.856	0.0679
Maternal Race (Black versus White and Other)	2.068	1.477, 2.896	**<.0001**	1.901	1.264, 2.860	**0.0021**	1.929	1.282, 2.904	**0.0016**

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Final Selected Model with Significant Interaction Terms		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Maternal Education (12 years or more versus Below 12 years)	0.926	0.605, 1.417	0.7233	-	-	-	-	-	-
Marital Status (Married versus Unmarried)	0.714	0.514, 0.990	**0.0436**	-	-	-	-	-	-
Rurality (Yes)	1.325	0.859, 2.045	0.2029	-	-	-	-	-	-
Income ($19,001 - $37,000 versus $0 - $19,000)	0.612	0.402, 0.930	**0.0216**	-	-	-	-	-	-
Income ($37,001 - $67,000 versus $0 - $19,000)	0.488	0.297, 0.802	**0.0047**	-	-	-	-	-	-
Income (≥ $67,001 versus $0 - $19,000)	0.535	0.331, 0.863	**0.0101**	-	-	-	-	-	-
First PNC Visit (Delayed: >13 weeks versus Timely: 13 weeks or earlier)	1.331	0.729, 2.432	0.3522	-	-	-	-	-	-
Prenatal Insurance (Medicaid versus Uninsured)	1.214	0.568, 2.597	0.6162	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Final Selected Model with Significant Interaction Terms		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Prenatal Insurance (Private Insurance/Military/Other versus Uninsured)	0.745	0.342, 1.622	0.4583	-	-	-	-	-	-
Dental Problem During Pregnancy (Yes)	1.037	0.710, 1.514	0.8515	-	-	-	-	-	-
Pregnancy Intention (Yes)	0.702	0.492, 1.001	**0.0505**	-	-	-	-	-	-
PRE-BMI (Obese versus Normal)	1.234	0.829, 1.836	0.3008	-	-	-	-	-	-
PRE-BMI (Overweight versus Normal)	0.988	0.639, 1.528	0.9572	-	-	-	-	-	-
PRE-BMI (Underweight versus Normal)	1.319	0.742, 2.346	0.3456	-	-	-	-	-	-
Medical Risk Factors (Yes)	2.334	1.673, 3.257	**<.0001**	2.217	1.467, 3.351	**0.0002**	2.267	1.493,3.442	**0.0001**
Newborn Sex (Female versus Male)	1.009	0.729, 1.397	0.9552						
Previous Live Birth (Yes)	0.723	0.521, 1.002	0.5140	0.476	0.305, 0.745	**0.0011**	0.464	0.300, 0.717	**0.0006**
New Weight Gain (Less Than Recommended versus Recommended)	1.550	1.039, 2.311	**0.0317**	1.554	0.950, 2.542	**0.0794**	1.517	0.916, 2.515	0.1057

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Final Selected Model with Significant Interaction Terms		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
New Weight Gain (More Than Recommended versus Recommended)	0.752	0.484, 1.170	0.2059	0.804	0.470, 1.376	0.4268	0.803	0.470, 1370	0.4208
Hypertension (Yes)	2.640	1.772, 3.932	**<.0001**	-	-	-	-	-	-
Gestational Diabetes (Gestational Diabetes versus Never Diabetic)	0.970	0.524, 1.794	0.9218	-	-	-	-	-	-
Diabetes (Pre-Existing Diabetes versus Never Diabetic)	1.562	0.722, 3.378	0.2568	-	-	-	-	-	-
Previous Low Birth Weight (Yes)	2.037	1.268, 3.272	**0.0033**	2.173	1.082, 4.364	**0.0292**	2.238	1.118, 4.479	**0.0228**
Previous Preterm Birth (Yes)	1.995	1.258, 3.162	**0.0033**	-	-	-	-	-	-
Smoke (Before, Yes)	0.848	0.592, 1.214	0.3671	-	-	-	-	-	-
Smoking (During, Yes)	1.158	0.738, 1.817	0.5234	-	-	-	0.613	0.306, 1.228	0.1675
Drinking (Before, Yes)	0.971	0.706, 1.336	0.8582	-	-	-	-	-	-
Drinking (During, Yes)	0.828	0.404, 1.699	0.6037	-	-	-	-	-	-
Exercise per Week (3 ≥ Times versus < 3 Times)	0.828	0.581, 1.181	0.2974	-	-	-	-	-	-
Multivitamin Consumption (Yes)	0.746	0.532, 1.047	0.0904	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Final Selected Model with Significant Interaction Terms		
	Odds Ratio (OR)	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**
Physical Abuse (Yes)	2.356	1.204, 4.609	**0.0123**	-	-	-	-	-	-
Psychological Abuse (Yes)	2.794	1.463, 5.337	**0.0019**	3.091	1.303, 7.333	**0.0105**	3.268	1.416, 7.545	**0.0055**
Traumatic Stress (Yes)	1.002	0.651, 1.541	0.9937	0.621	0.360, 1.070	0.0858	1.189	0.564, 2.504	0.6496
Financial Stress (Yes)	1.412	1.016, 1.963	**0.0402**	1.520	1.006, 2.295	**0.0465**	1.575	1.048, 2.365	**0.0287**
Partner-Related Stress (Yes)	1.607	1.141, 2.265	**0.0067**	-	-	-	-	-	-
Emotional Stress (Yes)	0.966	0.691, 1.351	0.8408	-	-	-	-	-	-
Dental Cleaning × Smoking (During)[19]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Smoking No	-	-	-	-	-	-	0.377	0.201, 0.706	**0.0023**
Dental Cleaning No Smoking Yes	-	-	-	-	-	-	0.613	0.306, 1.228	0.1675
Dental Cleaning Yes Smoking Yes	-	-	-	-	-	-	0.919	0.357, 2.365	0.8601
Dental Cleaning No Smoking No (Reference Group)	-	-	-	-	-	-	-	-	-

Continued

[19] Overall p-values for individual interaction and final models were 0.0933 and 0.0379, respectively.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Final Selected Model with Significant Interaction Terms		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning × Traumatic Stress (During)[20]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Traumatic Stress No	-	-	-	-	-	-	1.521	0.613, 3.777	0.3660
Dental Cleaning Yes Traumatic Stress Yes	-	-	-	-	-	-	0.312	0.123, 0.790	**0.0141**
Dental Cleaning No Traumatic Stress No	-	-	-	-	-	-	0.841	0.399, 1.773	0.6496
Dental Cleaning No Traumatic Stress Yes (Reference Group)	-	-	-	-	-	-	-	-	-
Dental Cleaning × Physical Abuse (Before/During)[21]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Physical Abuse No	-	-	-	-	-	-	-	-	-

Continued

[20] Overall p-values for individual interaction and final models were 0.0039 and 0.0026, respectively.
[21] Overall p-value for individual interaction is 0.0297.

Variable	Unadjusted (Univariable) Regression Predicting PTB			Adjusted Selected PTB Model without Interactions			Final Selected Model with Significant Interaction Terms		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning Yes Physical Abuse Yes	-	-	-	-	-	-	-	-	-
Dental Cleaning No Physical Abuse No	-	-	-	-	-	-	-	-	-
Dental Cleaning No Physical Abuse Yes (Reference Group)	-	-	-	-	-	-	-	-	-

Table 5.6: Weighted Regression Analyses Showing the Association of Dental Cleaning with Small for Gestational Age (SGA) (*n*=2,370 unweighted sample).

Variable	Unadjusted (Univariate) Regression Predicting SGA			Adjusted SGA Model Without Interaction			Adjusted Selected Model with Interaction (Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Dental Cleaning (Yes)	0.647	0.450, 0.930	**0.0188**	0.739	0.493, 1.110	0.1449	0.915	0.581, 1.441	0.7016
Maternal Age (35 years or more versus Below 35 years)	0.859	0.514, 1.436	0.5624	1.083	0.599, 1.958	0.7928	1.038	0570, 1.890	0.9035
Maternal Race (Black versus White and Other)	1.958	1.353, 2.835	**0.0004**	1.739	1.028, 2.941	**0.0390**	1.634	0.950, 2.810	**0.0760**
Maternal Education (12 years or more versus Below 12 years)	0.657	0.410, 1.054	0.0813	0.610	0.337, 1.101	0.1010	-	-	-
Marital Status (Married versus Unmarried)	0.555	0.388, 0.794	**0.0013**	0.594	0.358, 0.986	**0.0439**	0.536	0.315, 0.910	**0.0209**
Rurality (Yes)	1.449	0.891, 2.355	0.1345						

Continued

Variable	Unadjusted (Univariate) Regression Predicting SGA			Adjusted SGA Model Without Interaction			Adjusted Selected Model with Interaction (Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Income ($19,001 - $37,000 versus $0 - $19,000)	0.579	0.353, 0.951	**0.0310**	-	-	-	-	-	-
Income ($37,001 - $67,000 versus $0 - $19,000)	0.597	0.350, 1.018	0.0580	-	-	-	-	-	-
Income (≥ $67,001 versus $0 - $19,000)	0.433	0.257, 0.731	**0.0017**	-	-	-	-	-	-
First PNC Visit (Delayed: After 13 weeks versus Timely: 13 weeks or earlier)	1.346	0.709, 2.533	0.3635	-	-	-	-	-	-
Prenatal Insurance (Medicaid versus Uninsured)	5.400	2.774, 10.515	**<.0001**	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariate) Regression Predicting SGA			Adjusted SGA Model Without Interaction			Adjusted Selected Model with Interaction (Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Prenatal Insurance (Private Insurance/Military/Other versus Uninsured)	3.223	1.617, 6.425	**0.0009**	-	-	-	-	-	-
Dental Problem During Pregnancy (Yes)	1.254	0.810, 1.940	0.3097	-	-	-	-	-	-
Pregnancy Intention (Yes)	0.797	0.547, 1.162	0.2375	-	-	-	-	-	-
PRE-BMI (Obese versus Normal)	0.932	0.590, 1.472	0.7621	-	-	-	-	-	-
PRE-BMI (Overweight versus Normal)	0.836	0.525, 1.333	0.4520	-	-	-	-	-	-
PRE-BMI (Underweight versus Normal)	0.785	0.426, 1.447	0.4379	-	-	-	-	-	-
Medical Risk Factors (Yes)	1.263	0.857, 1.860	0.2376	-	-	-	-	-	-

Continued

Variable	Unadjusted (Univariate) Regression Predicting SGA			Adjusted SGA Model Without Interaction			Adjusted Selected Model with Interaction (Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Previous Live Birth (Yes)	0.774	0.541, 1.109	0.1627	-	-	-	-	-	-
Hypertension (Yes)	1.528	0.906, 2.578	0.1121	-	-	-	-	-	-
Gestational Diabetes (Gestational Diabetes versus Never Diabetic)	0.612	0.320, 1.172	0.1385	0.425	0.200, 0.907	**0.0269**	0.414	0.195, 0.880	**0.0220**
Diabetes (Pre-Existing Diabetes versus Never Diabetic)	0.548	0.196, 1.528	0.2502	0.486	0.129, 1.829	0.2856	0.535	0.143, 2.006	0.3536
Previous Low Birth Weight (Yes)	1.817	1.065, 3.102	**0.0285**	2.057	1.002, 4.225	**0.0494**	2.060	1.002, 4.234	**0.0493**
Previous Preterm Birth (Yes)	1.285	0.711, 2.324	0.4065	-	-	-	-	-	-
Smoking (Before, Yes)	1.857	1.256, 2.746	**0.0019**	1.782	1.164, 2.728	**0.0079**	-	-	-
Smoking (During, Yes)	2.496	1.546, 4.209	**0.0002**	-	-	-	3.108	1.542, 6.262	**0.0015**

Continued

Variable	Unadjusted (Univariate) Regression Predicting SGA			Adjusted SGA Model Without Interaction			Adjusted Selected Model with Interaction (Cleaning × Smoking)		
	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Drinking (Before, Yes)	0.912	0.637, 1.304	0.6123	-	-	-	-	-	-
Drinking (During, Yes)	0.933	0.402, 2.165	0.8721	-	-	-	-	-	-
Exercise per Week (3 ≥ Times versus < 3 Times)	1.087	0.732, 1.615	0.6798	-	-	-	-	-	-
Multivitamin Consumption (Yes)	1.026	0.708, 1.486	0.8939	1.659	1.063, 2.590	**0.0260**	1.538	0.984, 2.405	**0.0590**
Physical Abuse (Yes)	0.817	0.426, 1.568	0.5443	-	-	-	-	-	-
Psychological Abuse (Yes)	0.874	0.446, 1.712	0.6943	-	-	-	-	-	-
Traumatic Stress (Yes)	1.111	0.696, 1.774	0.6585	-	-	-	-	-	-
Financial Stress (Yes)	1.265	0.874, 1.831	0.2130	-	-	-	-	-	-
Partner-Related Stress (Yes)	1.149	0.784, 1.683	0.4759	-	-	-	-	-	-
Emotional Stress (Yes)	0.765	0.527, 1.111	0.1596	0.592	0.380, 0.922	**0.0205**	0.623	0.400, 0.969	**0.0359**

Continued

Variable	Unadjusted (Univariate) Regression Predicting SGA			Adjusted SGA Model Without Interaction			Adjusted Selected Model with Interaction (Cleaning × Smoking)		
	Odds Ratio (OR)	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**	**Odds Ratio (OR)**	**95% Confidence Interval (CI)**	**p-value**
Dental Cleaning × Smoking (During)[22]	-	-	-	-	-	-	-	-	-
Dental Cleaning Yes Smoking No	-	-	-	-	-	-	0.294	0.150, 0.579	**0.0004**
Dental Cleaning No Smoking No	-	-	-	-	-	-	0.322	0.160, 0.648	**0.0015**
Dental Cleaning Yes Smoking Yes	-	-	-	-	-	-	0.302	0.097, 0.945	**0.0396**
Dental Cleaning No Smoking Yes (Reference)	-	-	-	-	-	-	-	-	-
Note: Odds ratios are blank for variables that were not included in the respective models. Observations with missing data on any variable in a model were excluded from the respective models.									

[22]Overall p-value is 0.0792.

CHAPTER 6

CONCLUSION

Dental services for the pregnant patients potentially affect the lives of two individuals: the mother and her unborn child (Naavaal et al., 2019). Physiologic changes taking place in pregnancy make pregnant women more vulnerable to inflammatory processes throughout their bodies, including the oral cavity. We found that most South Carolina resident mothers reported dental insurance uptake during pregnancy (62%) yet underutilization persists. Preventive services utilization (dental cleaning) results showed that 54% cleaned before pregnancy, 44% during pregnancy, and 59% before or during pregnancy. Of the 23% who reported a dental problem, 13% actually sought treatment. This study explored the association of patient education with dental cleaning to understand the impact that prepregnancy counseling may have on maternal oral health services usage. We also examined the association between dental cleaning before or during pregnancy and adverse birth outcomes: preterm birth and SGA.

Preconception oral counseling, a previously undocumented intervention, is associated with significantly higher odds of dental cleaning during pregnancy, after adjusting for maternal socio-demographic and other factors. Likewise, oral health knowledge of the importance of dental care during pregnancy was also a great influencer of institutional delivery of dental cleaning before or during pregnancy. Our findings promote the implementation of preconception oral health counseling by maternity care providers during a woman's wellness visit. Patient knowledge on the importance of oral

health care and possible risks of delaying oral care should be given to all patients of childbearing age along with referrals for dental treatment before and during pregnancy.

Congruent with previous research, dental insurance was a strong predictor and independent risk factor for receipt of dental cleaning, even after adjusting for annual income and financial stress. There was no significant interaction found between dental insurance and other financial factors: annual income and financial stress. Thus, dental insurance remained independently associated with dental care use among pregnant women among other financial influences affecting utilization.

Dental cleaning is significantly associated with lower odds of preterm birth, but the benefit varied by smoking status and traumatic stress experiences during pregnancy. Nonsmokers who had a dental cleaning before or during pregnancy were 62% less likely to experience preterm birth compared to nonsmokers who did not clean in either period. Dental cleaning was unable to mitigate the damage caused by smoking during pregnancy and did not help smokers to avoid early birth. Among mothers with traumatic stress, mothers who cleaned their teeth were 68% less likely to experience preterm birth, i.e. those who did not get dental cleaning had twice the odds of preterm birth comparatively.

Dental cleaning before or during pregnancy was also associated with lower odds of having a SGA newborn. The possible attenuation of newborn SGA by dental cleaning varied by smoking status. Mothers who smoked during pregnancy but cleaned their teeth had a 70% lower likelihood of having a SGA newborn. The effect of dental cleaning diminished in nonsmokers. Nonsmoking mothers who completed dental cleaning were 9% less likely to have a SGA newborn compared to nonsmokers who did not clean.

The findings of this study remain relevant in oral health intervention efforts to improve dental utilization and thereby obstetric outcomes. Collaboration between dental and medical providers delivers needed continuity of care for mothers and their unborn children. Future policy changes in maternity care guidelines should include oral health education, referral and preventive oral health services recommendations. Oral health counseling in conjunction with smoking cessation and stress reduction education may improve maternal health as well as birth outcomes going forward.

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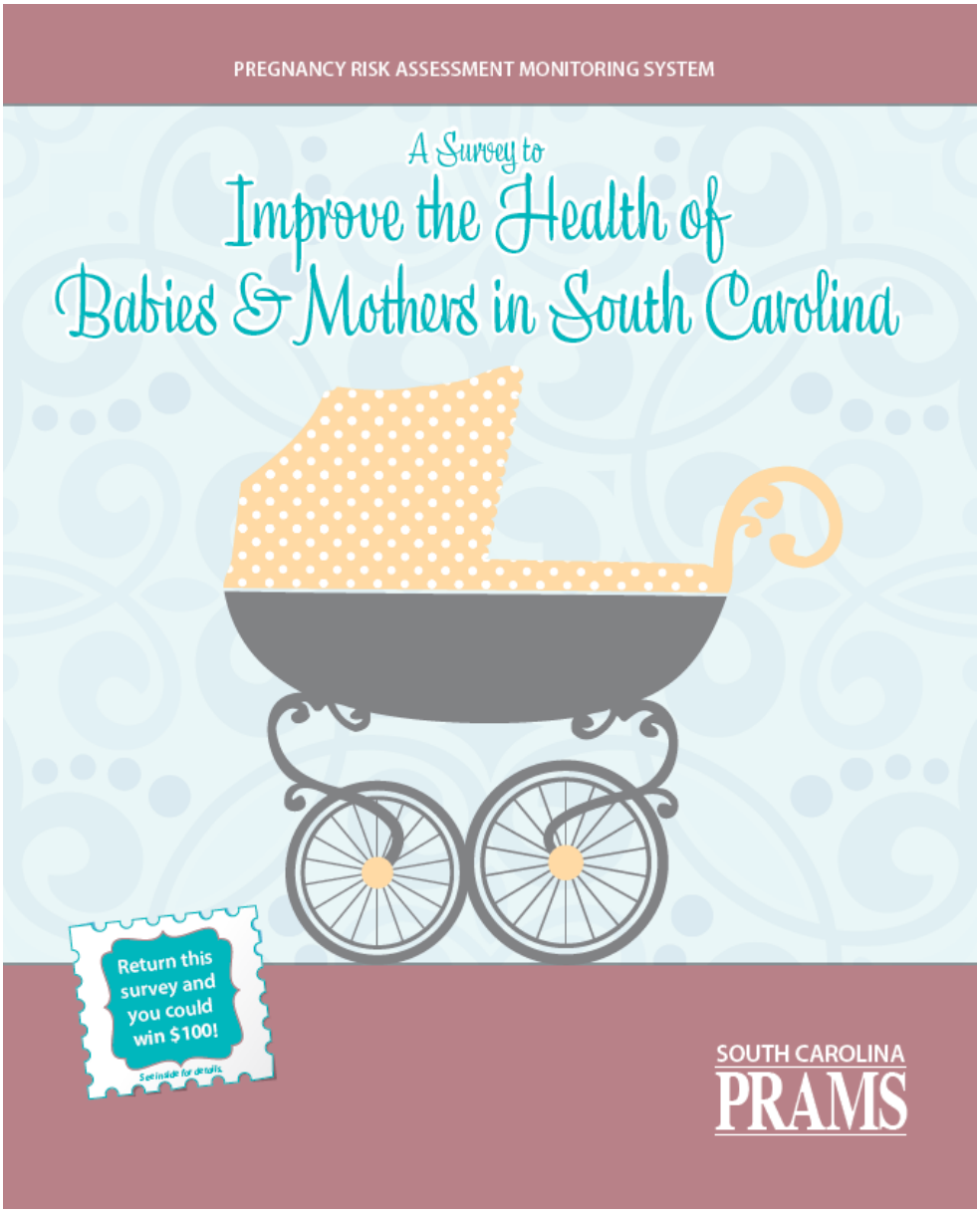
APPENDIX A

SOUTH CAROLINA PREGNANCY RISK ASSESSMENT

MONITORING SYSTEM PHASE 7 SURVEY



Questions Commonly Asked About PRAMS

What is PRAMS?

PRAMS (*P*regnancy *R*isk *A*ssessment *M*onitoring *S*ystem) is a joint research project between the South Carolina Department of Health and the Centers for Disease Control and Prevention (CDC). Our purpose is to find out why some babies are born healthy and others are not. To do this, our questionnaire asks new mothers questions about their behaviors and experiences around the time of their pregnancy. Each year in South Carolina there are hundreds of babies born with serious health problems. Many of these babies die. We need your help to find out why. No matter how your pregnancy went, your answers will help us learn more about ways to improve the chances for future mothers and babies in South Carolina.

Will my answers be kept private?

Yes—all answers are kept completely private to the extent permitted by law. All answers given on the questionnaires will be grouped together to give us information on South Carolina mothers of new babies. In reports from this survey, no woman will be identified by name.

Is it really important that I answer these questions?

Yes! Because of the small number of mothers picked, it is important to have everyone's answers. Every pregnancy is different. To get a better overall picture of the health of mothers and babies in South Carolina, we need each mother selected to answer the questions. From the information you give us, we may be able to improve health care for women and children in South Carolina. We need to know what went *right* as well as what went wrong during your pregnancy. Your help is really important to the success of our program.

Some of the questions do not seem related to health care why are they asked?

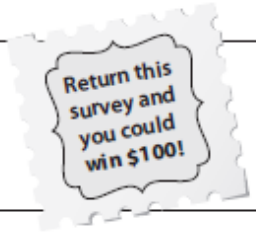
Many things in a mother's life and pregnancy may affect her pregnancy. These questions try to get the best picture of the new mother's health care and things that happened to her during pregnancy.

How was I chosen to participate in PRAMS?

Your name was picked by chance, like in a lottery, from the state birth certificate registry. You are one of a small number of women who were chosen to help us in this study.

What if I want to ask more questions about PRAMS?

Please call us at our toll-free number, 1-800-286-6968, and we will be happy to answer any other questions that you may have about PRAMS. If you prefer to complete the questionnaire over the telephone, please call us on the same number.



It is not necessary to fill out your personal info on the survey to be entered into the drawing for $100. The drawing will be based on your identification number found on the back of the survey.

Please check the box next to your answer or follow the directions included with the question. You may be asked to skip some questions that do not apply to you.

BEFORE PREGNANCY

The first questions are about *you*.

1. How tall are *you* without shoes?

____ Feet ____ Inches

OR ____ Centimeters

2. *Just before* you got pregnant with your *new* baby, how much did you weigh?

____ Pounds OR ____ Kilos

3. What is *your* date of birth?

____ / ____ / _____

Month Day Year

4. *Before* you got pregnant with your new baby, did you ever have any other babies who were born alive?

❑ No → **Go to Question 7**

❑ Yes

5. Did the baby born *just before* your new one weigh 5 pounds, 8 ounces (2.5 kilos) or *less* at birth?

❑ No

❑ Yes

6. Was the baby *just before* your new one born *earlier* than 3 weeks before his or her due date?

❑ No

❑ Yes

The next questions are about the time *before* you got pregnant with your *new* baby.

7. At any time during the *12 months before* you got pregnant with your new baby, did you do any of the following things? For each item, check **No** if you did not do it or **Yes** if you did it.

	No	Yes
a. I was dieting (changing my eating habits) to lose weight	❑	❑
b. I was exercising 3 or more days of the week	❑	❑
c. I was regularly taking prescription medicines other than birth control	❑	❑
d. I visited a health care worker and was checked for diabetes	❑	❑
e. I visited a health care worker and was checked for high blood pressure	❑	❑
f. I visited a health care worker and was checked for depression or anxiety	❑	❑
g. I talked to a health care worker about my family medical history	❑	❑
h. I had my teeth cleaned by a dentist or dental hygienist	❑	❑

8. During the *month before* you got pregnant with your new baby, what kind of *health insurance* did you have?

Check ALL that apply

- ❑ Private health insurance from my job or the job of my husband, partner, or parents
- ❑ Private health insurance purchased directly from an insurance company
- ❑ Medicaid or Optional Care for Women and Infants (OCWI)
- ❑ TRICARE or other military health care
- ❑ Some other kind of health insurance → Please tell us:

  _____

- ❑ I did not have any health insurance during the *month before* I got pregnant

9. During the *month before* you got pregnant with your new baby, how many times a week did you take a multivitamin, a prenatal vitamin, or a folic acid vitamin?

- ❑ I didn't take a multivitamin, prenatal vitamin, or folic acid vitamin in the *month before* I got pregnant
- ❑ 1 to 3 times a week
- ❑ 4 to 6 times a week
- ❑ Every day of the week

10. *Before* you got pregnant with your new baby, did a doctor, nurse, or other health care worker talk to you about how to improve your health before pregnancy?

- ❑ No → **Go to Question 12**
- ❑ Yes

Go to Question 11

11. *Before* you got pregnant with your new baby, did a doctor, nurse, or other health care worker talk with you about any of the things listed below? *Please count only discussions*, not reading materials or videos. For each item, check **No** if no one talked with you about it or **Yes** if someone talked with you about it.

	No	Yes
a. Taking vitamins with folic acid before pregnancy	❑	❑
b. Being a healthy weight before pregnancy	❑	❑
c. Getting my vaccines updated before pregnancy	❑	❑
d. Visiting a dentist or dental hygienist before pregnancy	❑	❑
e. Getting counseling for any genetic diseases that run in my family	❑	❑
f. Controlling any medical conditions such as diabetes and high blood pressure	❑	❑
g. Getting counseling or treatment for depression or anxiety	❑	❑
h. The safety of using prescription or over-the-counter medicines during pregnancy	❑	❑
i. How smoking during pregnancy can affect a baby	❑	❑
j. How drinking alcohol during pregnancy can affect a baby	❑	❑
k. How using illegal drugs during pregnancy can affect a baby	❑	❑

12. *Before* you got pregnant with your new baby, did a doctor, nurse, or other health care worker tell you that you had any of the following health conditions? For each one, check **No** if you did not have the condition or **Yes** if you did.

	No	Yes
a. Type 1 or Type 2 diabetes (NOT the same as gestational diabetes or diabetes that starts during pregnancy)	❑	❑
b. High blood pressure or hypertension	❑	❑
c. Depression	❑	❑

The next questions are about the time when you got pregnant with your new baby.

13. Thinking back to *just before* you got pregnant with your new baby, how did you feel about becoming pregnant?

Check ONE answer

- ❑ I wanted to be pregnant later
- ❑ I wanted to be pregnant sooner
- ❑ I wanted to be pregnant then
- ❑ I didn't want to be pregnant then or at any time in the future
- ❑ I wasn't sure what I wanted

→ **Go to Question 15**

14. How much longer did you want to wait to become pregnant?

- ❑ Less than 1 year
- ❑ 1 year to less than 2 years
- ❑ 2 years to less than 3 years
- ❑ 3 years to 5 years
- ❑ More than 5 years

15. When you got pregnant with your new baby, were you trying to get pregnant?

- ❑ No
- ❑ Yes → **Go to Question 18**

16. When you got pregnant with your new baby, were you or your husband or partner doing anything to keep from getting pregnant? Some things people do to keep from getting pregnant include using birth control pills, condoms, withdrawal, or natural family planning.

- ❑ No
- ❑ Yes → **Go to Question 18**

17. What were your reasons or your husband's or partner's reasons for not doing anything to keep from getting pregnant?

Check ALL that apply

- ❑ I didn't mind if I got pregnant
- ❑ I thought I could not get pregnant at that time
- ❑ I had side effects from the birth control method I was using
- ❑ I had problems getting birth control when I needed it
- ❑ I thought my husband or partner or I was sterile (could not get pregnant at all)
- ❑ My husband or partner didn't want to use anything
- ❑ I forgot to use a birth control method
- ❑ Other → Please tell us:

DURING PREGNANCY

The next questions are about the prenatal care you received during your most recent pregnancy. Prenatal care includes visits to a doctor, nurse, or other health care worker before your baby was born to get checkups and advice about pregnancy. (It may help to look at the calendar when you answer these questions.)

18. How many weeks *or* months pregnant were you when you had your first visit for prenatal care? Do not count a visit that was only for a pregnancy test or only for WIC (the Special Supplemental Nutrition Program for Women, Infants, and Children).

____ Weeks **OR** ____ Months

❑ I didn't go for prenatal care → **Go to Question 20**

19. Did you get prenatal care as early in your pregnancy as you wanted?

❑ No
❑ Yes → **Go to Question 21**

Go to Question 20

20. Did any of these things keep you from getting prenatal care when you wanted it? For each item, check **No** if it did not keep you from getting prenatal care or **Yes** if it did.

	No	Yes
a. I couldn't get an appointment when I wanted one	❑	❑
b. I didn't have enough money or insurance to pay for my visits	❑	❑
c. I didn't have any transportation to get to the clinic or doctor's office	❑	❑
d. The doctor or my health plan would not start care as early as I wanted	❑	❑
e. I had too many other things going on	❑	❑
f. I couldn't take time off from work or school	❑	❑
g. I didn't have my Medicaid or Optional Care for Women and Infants (OCWI) card	❑	❑
h. I didn't have anyone to take care of my children	❑	❑
i. I didn't know that I was pregnant	❑	❑
j. I didn't want anyone else to know I was pregnant	❑	❑
k. I didn't want prenatal care	❑	❑

If you did not get prenatal care, go to Question 23.

21. During *your most recent* pregnancy, what kind of *health insurance* did you have to pay for your *prenatal care*?

Check ALL that apply

- ❑ Private health insurance from my job or the job of my husband, partner, or parents
- ❑ Private health insurance purchased directly from an insurance company
- ❑ Medicaid or Optional Care for Women and Infants (OCWI)
- ❑ TRICARE or other military health care
- ❑ Some other kind of health insurance → Please tell us:

_____

- ❑ I did not have any health insurance to pay for my *prenatal care*

22. *During any of your prenatal care visits*, did a doctor, nurse, or other health care worker talk with you about any of the things listed below? *Please count only discussions,* not reading materials or videos. For each item, check **No** if no one talked with you about it or **Yes** if someone did.

	No	Yes
a. How much weight I should gain during my pregnancy	❑	❑
b. How smoking during pregnancy could affect my baby	❑	❑
c. Breastfeeding my baby	❑	❑
d. How drinking alcohol during pregnancy could affect my baby	❑	❑
e. Using a seat belt during my pregnancy	❑	❑
f. Medicines that are safe to take during my pregnancy	❑	❑
g. How using illegal drugs could affect my baby	❑	❑
h. Doing tests to screen for birth defects or diseases that run in my family	❑	❑
i. The signs and symptoms of preterm labor (labor more than 3 weeks before the baby is due)	❑	❑
j. Getting tested for HIV (the virus that causes AIDS)	❑	❑
k. What to do if I feel depressed during my pregnancy or after my baby is born	❑	❑
l. Physical abuse to women by their husbands or partners	❑	❑

23. At any time during *your most recent* pregnancy or delivery, did you have a test for HIV (the virus that causes AIDS)?

- ❑ No
- ❑ Yes → **Go to Page 6, Question 25**
- ❑ I don't know

Go to Page 6, Question 24

24. Were you *offered* an HIV test during *your most recent* pregnancy or delivery?

- ❑ No
- ❑ Yes

25. During the 12 months *before the delivery* of your new baby, did a doctor, nurse, or other health care worker *offer* you a flu shot or *tell* you to get one?

- ❑ No
- ❑ Yes

26. During the 12 months *before the delivery* of your new baby, did you *get* a flu shot?

Check ONE answer

- ❑ No → **Go to Question 28**
- ❑ Yes, before my pregnancy
- ❑ Yes, during my pregnancy

27. During what month and year did you get the flu shot?

____ / 20____

Month Year

- ❑ I don't remember

28. This question is about the care of your teeth *during your most recent* pregnancy. For each item, check **No** if it is not true or does not apply to you or **Yes** if it is true.

	No	Yes
a. I knew it was important to care for my teeth and gums during my pregnancy	❑	❑
b. A dental or other health care worker talked with me about how to care for my teeth and gums	❑	❑
c. I had my teeth cleaned by a dentist or dental hygienist	❑	❑
d. I had insurance to cover dental care during my pregnancy	❑	❑
e. I needed to see a dentist for **a problem**	❑	❑
f. I went to a dentist or dental clinic about a **problem**	❑	❑

29. During *your most recent* pregnancy, did you take a class or classes to prepare for childbirth and learn what to expect during labor and delivery?

- ❑ No
- ❑ Yes

30. During *your most recent* pregnancy, did a home visitor come to your home to help you prepare for your new baby? A home visitor is a nurse, a health care worker, a social worker, or other person who works for a program that helps pregnant women.

- ❑ No
- ❑ Yes

31. During *your most recent* pregnancy, were you on WIC (the Special Supplemental Nutrition Program for Women, Infants, and Children)?

- ❑ No
- ❑ Yes

32. During *your most recent* pregnancy, were you told by a doctor, nurse, or other health care worker that you had gestational diabetes (diabetes that started during *this* pregnancy)?

- ❑ No → **Go to Question 34**
- ❑ Yes

33. During *your most recent* pregnancy, when you were told that you had gestational diabetes, did a doctor, nurse, or other health care worker do any of the things listed below? For each item, check **No** if it was not done or **Yes** if it was done.

	No	Yes
a. Refer you to a nutritionist	❑	❑
b. Talk to you about the importance of exercise	❑	❑
c. Talk to you about getting to and staying at a healthy weight after delivery	❑	❑
d. Suggest that you breastfeed your new baby	❑	❑
e. Talk to you about your risk for Type 2 diabetes	❑	❑

34. During *your most recent* pregnancy, did a doctor, nurse, or other health care worker try to keep your new baby from being born too early by giving you a series of weekly shots of a medicine called Progesterone, Makena®, or 17P (17 alpha-hydroxyprogesterone)?

- ❑ No
- ❑ Yes
- ❑ I don't know

The next questions are about smoking cigarettes around the time of pregnancy (before, during, and after).

35. Have you smoked any cigarettes in the *past 2 years*?

- ❑ No → **Go to Page 8, Question 39**
- ❑ Yes

36. In the *3 months before* you got pregnant, how many cigarettes did you smoke on an average day? A pack has 20 cigarettes.

- ❑ 41 cigarettes or more
- ❑ 21 to 40 cigarettes
- ❑ 11 to 20 cigarettes
- ❑ 6 to 10 cigarettes
- ❑ 1 to 5 cigarettes
- ❑ Less than 1 cigarette
- ❑ I didn't smoke then

37. In the *last 3 months* of your pregnancy, how many cigarettes did you smoke on an average day? A pack has 20 cigarettes.

- ❑ 41 cigarettes or more
- ❑ 21 to 40 cigarettes
- ❑ 11 to 20 cigarettes
- ❑ 6 to 10 cigarettes
- ❑ 1 to 5 cigarettes
- ❑ Less than 1 cigarette
- ❑ I didn't smoke then

38. How many cigarettes do you smoke on an average day *now*? A pack has 20 cigarettes.

- ❑ 41 cigarettes or more
- ❑ 21 to 40 cigarettes
- ❑ 11 to 20 cigarettes
- ❑ 6 to 10 cigarettes
- ❑ 1 to 5 cigarettes
- ❑ Less than 1 cigarette
- ❑ I don't smoke now

The next questions are about drinking alcohol around the time of pregnancy (before and during).

39. Have you had any alcoholic drinks in the *past 2 years*? A drink is 1 glass of wine, wine cooler, can or bottle of beer, shot of liquor, or mixed drink.

- ❑ No → **Go to Question 42**
- ❑ Yes

40. During the *3 months before* you got pregnant, how many alcoholic drinks did you have in an average week?

- ❑ 14 drinks or more a week
- ❑ 7 to 13 drinks a week
- ❑ 4 to 6 drinks a week
- ❑ 1 to 3 drinks a week
- ❑ Less than 1 drink a week
- ❑ I didn't drink then

41. During the *last 3 months* of your pregnancy, how many alcoholic drinks did you have in an average week?

- ❑ 14 drinks or more a week
- ❑ 7 to 13 drinks a week
- ❑ 4 to 6 drinks a week
- ❑ 1 to 3 drinks a week
- ❑ Less than 1 drink a week
- ❑ I didn't drink then

Pregnancy can be a difficult time for some women. The next questions are about things that may have happened *before* and *during* your most recent pregnancy.

42. This question is about things that may have happened during the *12 months before your new baby was born*. For each item, check **No** if it did not happen to you or **Yes** if it did. (It may help to look at the calendar when you answer these questions.)

	No	Yes
a. A close family member was very sick and had to go into the hospital	❑	❑
b. I got separated or divorced from my husband or partner	❑	❑
c. I moved to a new address	❑	❑
d. I was homeless or had to sleep outside, in a car, or in a shelter	❑	❑
e. My husband or partner lost his job	❑	❑
f. I lost my job even though I wanted to go on working	❑	❑
g. My husband, partner, or I had a cut in work hours or pay	❑	❑
h. I was apart from my husband or partner due to military deployment or extended work-related travel	❑	❑
i. I argued with my husband or partner more than usual	❑	❑
j. My husband or partner said he didn't want me to be pregnant	❑	❑
k. I had problems paying the rent, mortgage, or other bills	❑	❑
l. My husband, partner, or I went to jail	❑	❑
m. Someone very close to me had a problem with drinking or drugs	❑	❑
n. Someone very close to me died	❑	❑

43. During the *12 months before you got pregnant* with your new baby, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?

- ❑ No
- ❑ Yes

44. During *your most recent* pregnancy, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?

- ❑ No
- ❑ Yes

The next questions are about your labor and delivery.

45. When was your new baby born?

___ / ___ / 20__

Month Day Year

46. Did you plan or schedule a cesarean delivery (c-section) at least one week before your new baby was born?

- ❑ No
- ❑ Yes

47. How was your new baby delivered?

- ❑ Vaginally → **Go to Question 49**
- ❑ Cesarean delivery (c-section)

Go to Question 48

48. What was the reason that your new baby was born by cesarean delivery (c-section)?

Check ALL that apply

- ❑ I had a previous cesarean delivery (c-section)
- ❑ My baby was in the wrong position (such as breech)
- ❑ I was past my due date
- ❑ My health care provider worried that my baby was too big
- ❑ I had a medical condition that made labor dangerous for me (such as heart condition, physical disability)
- ❑ I had a complication in my pregnancy (such as preeclampsia, placental problems, infection, preterm labor)
- ❑ My health care provider tried to induce my labor, but it didn't work
- ❑ Labor was taking too long
- ❑ The fetal monitor showed that my baby was having problems before or during labor (fetal distress)
- ❑ I wanted to schedule my delivery
- ❑ I didn't want to have my baby vaginally
- ❑ Other → Please tell us:

_____

49. By the end of *your most recent* pregnancy, how much weight had you gained?

Check ONE answer and fill in blank if needed

- ❑ I gained ____ pounds
- ❑ I didn't gain any weight, but I lost ____ pounds
- ❑ My weight didn't change during my pregnancy
- ❑ I don't know

AFTER PREGNANCY

The next questions are about the time since your new baby was born.

50. After your baby was delivered, was he or she put in an intensive care unit (NICU)?

- ❑ No
- ❑ Yes
- ❑ I don't know

51. After your baby was delivered, how long did he or she stay in the hospital?

- ❑ Less than 24 hours (less than 1 day)
- ❑ 24 to 48 hours (1 to 2 days)
- ❑ 3 to 5 days
- ❑ 6 to 14 days
- ❑ More than 14 days
- ❑ My baby was not born in a hospital
- ❑ My baby is still in the hospital → **Go to Question 54**

52. Is your baby alive now?

- ❑ No → *We are very sorry for your loss.* **Go to Question 61**
- ❑ Yes

53. Is your baby living with you now?

- ❑ No → **Go to Question 60**
- ❑ Yes

54. Did you ever breastfeed or pump breast milk to feed your new baby, even for a short period of time?

- ❑ No
- ❑ Yes → **Go to Question 56**

Go to Question 55

55. What were your reasons for not breastfeeding your new baby?

Check ALL that apply

- ❑ I was sick or on medicine
- ❑ I had other children to take care of
- ❑ I had too many household duties
- ❑ I didn't like breastfeeding
- ❑ I tried but it was too hard
- ❑ I didn't want to
- ❑ I went back to work or school
- ❑ Other → Please tell us:

_____

If you did not breastfeed your new baby, go to Question 59.

56. Are you currently breastfeeding or feeding pumped milk to your new baby?

- ❑ No
- ❑ Yes → **Go to Question 58**

57. How many weeks or months did you breastfeed or pump milk to feed your baby?

____ Weeks **OR** ____ Months

- ❑ Less than 1 week

If your baby was not born in a hospital, go to Question 59.

58. This question asks about things that may have happened at the hospital where your new baby was born. For each item, check No if it did not happen or Yes if it did happen.

	No	Yes
a. Hospital staff gave me information about breastfeeding	❑	❑
b. My baby stayed in the same room with me at the hospital	❑	❑
c. Hospital staff helped me learn how to breastfeed	❑	❑
d. I breastfed in the first hour after my baby was born	❑	❑
e. I breastfed my baby in the hospital	❑	❑
f. My baby was fed only breast milk at the hospital	❑	❑
g. Hospital staff told me to breastfeed whenever my baby wanted	❑	❑
h. The hospital gave me a breast pump to use	❑	❑
i. The hospital gave me a gift pack with formula	❑	❑
j. The hospital gave me a telephone number to call for help with breastfeeding	❑	❑
k. Hospital staff gave my baby a pacifier	❑	❑

If your baby is still in the hospital, go to Question 60.

59. In which *one* position do you *most often* lay your baby down to sleep now?

Check ONE answer

- ❑ On his or her side
- ❑ On his or her back
- ❑ On his or her stomach

60. *Since your new baby was born,* has a home visitor come to your home to help you learn how to take care of yourself or your new baby? A home visitor is a nurse, a health care worker, a social worker, or other person who works for a program that helps mothers of newborns.

- ❑ No
- ❑ Yes

61. Are you or your husband or partner doing anything *now* to keep from getting pregnant? Some things people do to keep from getting pregnant include using birth control pills, condoms, withdrawal, or natural family planning.

- ❑ No
- ❑ Yes → **Go to Page 12, Question 63**

62. What are your reasons or your husband's or partner's reasons for not doing anything to keep from getting pregnant *now*?

Check ALL that apply

- ❑ I am not having sex
- ❑ I want to get pregnant
- ❑ I don't want to use birth control
- ❑ I am worried about side effects from birth control
- ❑ My husband or partner doesn't want to use anything
- ❑ I have problems getting birth control when I need it
- ❑ I had my tubes tied or blocked
- ❑ My husband or partner had a vasectomy
- ❑ I am pregnant now
- ❑ Other → Please tell us:

If you or your husband or partner is not doing anything to keep from getting pregnant *now*, go to Question 64.

63. What kind of birth control are you or your husband or partner using *now* to keep from getting pregnant?

Check ALL that apply

- ❑ Tubes tied or blocked (female sterilization, Essure®, Adiana®)
- ❑ Vasectomy (male sterilization)
- ❑ Birth control pill
- ❑ Condoms
- ❑ Injection (Depo-Provera®)
- ❑ Contraceptive implant (Implanon®)
- ❑ Contraceptive patch (OrthoEvra®) or vaginal ring (NuvaRing®)
- ❑ IUD (including Mirena® or ParaGard®)
- ❑ Natural family planning (including rhythm method)
- ❑ Withdrawal (pulling out)
- ❑ Not having sex (abstinence)
- ❑ Other → Please tell us:

_____

64. *After your new baby was born*, did a doctor, nurse, or other health care worker talk with you about using birth control?

- ❑ No
- ❑ Yes

65. *Since your new baby was born*, have you had a postpartum checkup for yourself? A postpartum checkup is the regular checkup a woman has about 4-6 weeks after she gives birth.

- ❑ No
- ❑ Yes

66. *Since your new baby was born*, how often have you felt down, depressed, or hopeless?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Rarely
- ❑ Never

67. *Since your new baby was born*, how often have you had little interest or little pleasure in doing things?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Rarely
- ❑ Never

68. What kind of *health insurance* do you have *now*?

Check ALL that apply

- ❑ Private health insurance from my job or the job of my husband, partner, or parents
- ❑ Private health insurance purchased directly from an insurance company
- ❑ Medicaid or Optional Care for Women and Infants (OCWI)
- ❑ TRICARE or other military health care
- ❑ Some other kind of health insurance → Please tell us:

_____

- ❑ I do not have health insurance *now*

OTHER EXPERIENCES

The next questions are on a variety of topics.

69. How old were you when you got pregnant with your *first* baby?

____ Years old

70. ***Before*** **you got pregnant with your new baby, had you ever heard or read about emergency birth control (the "morning-after pill")?** This combination of pills is used to prevent pregnancy up to 5 days after unprotected sex.

- ☐ No
- ☐ Yes

71. ***Before*** **you got pregnant with your new baby, did your husband or partner ever try to keep you from using your birth control so that you would get pregnant when you didn't want to?** For example, did he hide your birth control, throw it away or do anything else to keep you from using it?

- ☐ No
- ☐ Yes

72. Thinking back to <u>3 months before</u> you found out you were pregnant, how many times did you exercise or play sports per week? (Include walking briskly, jogging, aerobics, swimming, etc. for ½ hour or more.)

- ☐ 0 times
- ☐ 1 time
- ☐ 2 times
- ☐ 3 times
- ☐ 4 times
- ☐ 5 or more times

73. Thinking back to <u>after</u> you found out you were pregnant, how many times did you exercise or play sports per week? (Include walking briskly, jogging, aerobics, swimming, etc. for ½ hour or more.)

- ☐ 0 times → **Go to Question 76**
- ☐ 1 time
- ☐ 2 times
- ☐ 3 times
- ☐ 4 times
- ☐ 5 or more times

Go to Question 74

74. During how many months of this pregnancy did you exercise or play sports at least 3 times a week?

____ Months

75. What kind of exercise or sport did you do <u>most often</u> during your pregnancy?

Check ONE answer

- ☐ Brisk walking
- ☐ Hiking
- ☐ Jogging or running
- ☐ Aerobics or aerobic dancing
- ☐ Other dancing
- ☐ Calisthenics or general exercise
- ☐ Biking
- ☐ Swimming or water exercise
- ☐ Yoga or pilates
- ☐ Other → Please tell us:

_____

76. At any time during *your most recent* pregnancy or after delivery, did a doctor, nurse, or other health care worker talk with you about "baby blues" or postpartum depression?

- ☐ No
- ☐ Yes

77. This question is about things that may have happened during *your most recent* pregnancy. For each thing, check **No** if it did not happen to you or **Yes** if it did.

	No	Yes
a. My husband or partner threatened me or made me feel unsafe in some way	❑	❑
b. I was frightened for my safety or my family's safety because of the anger or threats of my husband or partner	❑	❑
c. My husband or partner tried to control my daily activities, for example, controlling who I could talk to or where I could go	❑	❑
d. My husband or partner forced me to take part in touching or any sexual activity when I did not want to	❑	❑

If your baby is not alive, is not living with you, or is still in the hospital, go to Question 79.

78. How often do you, other adults, or any other children sleep with your new baby in the same bed, couch, or chair?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Rarely
- ❑ Never

79. *Since your new baby was born*, have you been tested for diabetes or high blood sugar?

- ❑ No → **Go to Question 81**
- ❑ Yes

80. *Since your new baby was born*, did a doctor, nurse, or other health care worker tell you that you had diabetes?

- ❑ No
- ❑ Yes

The last questions are about the time during the *12 months before* your new baby was born.

81. During the *12 months before* your new baby was born, what was your yearly total household income before taxes? Include your income, your husband's or partner's income, and any other income you may have received. *All information will be kept private* and will not affect any services you are now getting.

- ❑ $0 to $15,000
- ❑ $15,001 to $19,000
- ❑ $19,001 to $22,000
- ❑ $22,001 to $26,000
- ❑ $26,001 to $29,000
- ❑ $29,001 to $37,000
- ❑ $37,001 to $44,000
- ❑ $44,001 to $52,000
- ❑ $52,001 to $56,000
- ❑ $56,001 to $67,000
- ❑ $67,001 to $79,000
- ❑ $79,001 or more

82. During the *12 months before* your new baby was born, how many people, *including yourself*, depended on this income?

____ People

83. What is today's date?

____ / ____ / 20____

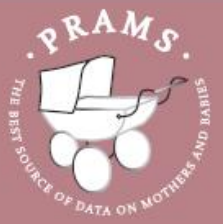
Month Day Year

Please use this space for any additional comments you would like to make about your experiences around the time of your pregnancy or the health of mothers and babies in South Carolina.

Thanks for answering our questions!

Your answers will help us work to make South Carolina mothers and babies healthier.

If you have any questions, please call:
The PRAMS Staff
1-800-286-6968



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Office of Public Health Statistics and Information Services
2600 Bull Street Columbia, S.C. 29201

CR-001332 April 2012

APPENDIX B

SOCIODEMOGRAPHIC CHARACTERISTICS AND DENTAL EXPERIENCES CLASSIFIED BY DENTAL PROBLEM DURING PREGNANCY

Table B.1: Sociodemographic Characteristics and Dental Experiences Classified by Dental Problem During Pregnancy.

CHARACTERISTICS	TOTAL SAMPLE UNWEIGHTED FREQUENCY (WEIGHTED %)	DENTAL PROBLEM UNWEIGHTED FREQUENCY (WEIGHTED FREQUENCY)	P-VALUE
PREDISPOSING FACTORS			
TOTAL		Yes (*n*=1,546)	
AGE			
Below 35 years	2,417 (86.97)	532 (20.19)	0.9301
35 years or more	453 (13.03)	104 (2.93)	
RACE			
White	1,504 (61.27)	298 (13.32)	0.1512
Black	1,106 (29.55)	292 (8.00)	
Other	260 (9.18)	46 (1.80)	
EDUCATION			
> 12 years	1,766 (59.36)	349 (11.16)	**0.0013**
12 years	667 (23.82)	170 (6.94)	
Under 12 years	424 (16.81)	113 (5.02)	
MARITAL STATUS			
Married	1,443 (52.1)	258 (9.61)	**0.0004**
Unmarried	1,427 (47.9)	378 (13.51)	
ENABLING/ DISABLING FACTORS			
HOUSEHOLD INCOME (ANNUAL)			
$0 to $19,000	1,057 (37.13)	325 (12.40)	**<.0001**
$19,001 to $37,000	645 (24.85)	149 (5.54)	
$37,001 to $67,000	432 (15.02)	57 (2.60)	

Continued

CHARACTERISTICS	TOTAL SAMPLE UNWEIGHTED FREQUENCY (WEIGHTED %)	DENTAL PROBLEM UNWEIGHTED FREQUENCY (WEIGHTED FREQUENCY)	P-VALUE
$67,001 or more	523 (23.00)	68 (2.38)	
HEALTH INSURANCE			
Medicaid	1,564 (54.75)	454 (16.93)	<.0001
Private/military/other	1,083 (40.14)	139 (5.07)	
Uninsured	112 (5.11)	23 (1.21)	
DENTAL INSURANCE			
Insured	1,090 (38.30)	293 (11.90)	0.0012
Uninsured	1,688 (61.69)	333 (11.15)	
RURALITY			
Urban	2,407 (85.64)	524 (19.19)	0.2481
Rural	463 (14.36)	112 (3.93)	
PRECONCEPTION ORAL COUNSELING			
Counseled	261 (8.43)	67 (2.04)	0.5613
Not counseled	2,609 (91.57)	569 (21.08)	
DENTAL KNOWLEDGE			
Yes	2,425 (87.74)	544 (20.41)	0.6250
No	393 (12.26)	89 (2.61)	
ORAL HYGIENE INSTRUCTIONS			
Received	1,266 (47.06)	281 (11.44)	0.3509
No receipt	1,545 (52.94)	351 (11.62)	
PHYSICAL ABUSE (Before)			
Yes	130 (4.42)	41 (0.91)	0.6408
No	2,695 (96.58)	589 (22.17)	
PHYSICAL ABUSE (During)			
Yes	112 (2.85)	37 (0.91)	0.2854
No	2,714 (97.15)	593 (22.17)	
PSYCHOLOGICAL ABUSE			
Yes	142 (4.94)	48 (1.48)	0.3061
No	2,646 (95.06)	577 (21.80)	
TRAUMATIC STRESS			
Yes	463 (17.91)	156 (7.37)	**<.0001**
No	2,366 (82.09)	475 (15.65)	
FINANCIAL STRESS			
Yes	1,101 (37.33)	329 (11.05)	**0.0004**
No	1,728 (62.67)	302 (11.98)	
PARTNER-RELATED STRESS			
Yes	923 (30.63)	297 (10.13)	**<.0001**
No	1,906 (69.37)	333 (12.90)	

Continued

CHARACTERISTICS	TOTAL SAMPLE UNWEIGHTED FREQUENCY (WEIGHTED %)	DENTAL PROBLEM UNWEIGHTED FREQUENCY (WEIGHTED FREQUENCY)	P-VALUE
EMOTIONAL STRESS			
Yes	1,050 (38.73)	271 (10.45)	**0.0393**
No	1,781 (61.27)	360 (12.57)	
NEED FACTORS			
DENTAL CLEANING (Before)			
Yes	1,433 (53.51)	262 (9.85)	0.5613
No	1,418 (46.89)	371 (13.21)	
DENTAL KNOWLEDGE			
Knowledge	2,425 (87.74)	544 (20.41)	0.6250
No knowledge	393 (12.26)	89 (2.61)	
PREGNANCY INTENT			
Trying	1,078 (40.96)	205 (7.80)	**0.0129**
Not trying	1,662 (59.04)	401 (15.57)	
HYPERTENSION			
Yes	539 (8.58)	132 (3.25)	**0.0012**
No	2,331 (91.42)	504 (19.87)	
DIABETES			
Yes	180 (7.24)	45 (2.00)	0.3789
No	2,690 (92.76)	591 (21.11)	
OBESITY			
Underweight	244 (8.44)	54 (2.04)	0.3366
Normal	1,112 (42.80)	231 (8.67)	
Overweight	673 (23.51)	135 (5.70)	
Obese	841 (25.24)	216 (6.72)	
MEDICAL RISK FACTORS			
Yes	1,058 (22.47)	263 (7.46)	**0.0001**
No	1,812 (77.53)	373 (15.67)	
HISTORY PTB			
Yes	377 (8.51)	116 (2.64)	0.1013
No	1,098 (52.47)	267 (12.12)	
No previous live birth	1,314 (39.02)	230 (7.93)	
HISTORY LBW			
Yes	378 (8.85)	118 (3.27)	**0.0045**
No	1,092 (52.17)	264 (11.47)	
No previous live birth	1315 (38.98)	231 (7.92)	
PERSONAL HEALTH PRACTICES			
ALCOHOL (During)			
Yes	167 (7.95)	33 (1.88)	**0.0002**

Continued

CHARACTERISTICS	TOTAL SAMPLE UNWEIGHTED FREQUENCY (WEIGHTED %)	DENTAL PROBLEM UNWEIGHTED FREQUENCY (WEIGHTED FREQUENCY)	P-VALUE
No	2,703 (92.05)	603 (21.24)	
SMOKING (2yrs.)			
Yes	376 (12.77)	273 (10.85)	**<.0001**
No	2,494 (87.23)	355 (12.30)	
EXERCISE			
0-3 times per week	2,023 (69.08)	455 (16.54)	0.5026
3-7 times per week	771 (30.91)	171 (6.68)	
MULTIVITAMIN			
Yes	1,134 (41.35)	215 (8.33)	0.0618
No	1,608 (58.65)	393 (14.91)	

APPENDIX C

ASSOCIATION BETWEEN DENTAL CLEANING BEFORE PREGNANCY AND DENTAL PROBLEM DURING PREGNANCY

Table C.1: Association Between Dental Cleaning Before Pregnancy and Dental Problem During Pregnancy.

CHARACTERISTICS	ADJUSTED ODDS RATIO (AOR) [95% CONFIDENCE INTERVAL (CI)]	P-VALUE
AGE		
35 years or more	1.152 [0.651, 2.037]	0.6269
Below 35 years	*	*
RACE		
Non-white	1.265 [0.832, 1.924]	0.2711
White	*	*
INCOME		
$0 to $19,000	*	*
$19,001 to $37,000	0.657 [0.418, 1.033]	0.0688
$37,001 to $67,000	0.667 [0.385, 1.156]	0.1490
$67,000 or more	**0.347 [0.192, 0.627]**	**0.0005**
DENTAL CLEANING (BEFORE)		
Yes	0.863 [0.598, 1.247]	0.4329
No	*	*
DENTAL KNOWLEDGE		
Yes	**1.816 [1.010, 3.267]**	**0.0463**
No	*	*
HYPERTENSION		
Yes	**2.709 [1.629, 4.507]**	**0.0001**
No	*	*
SMOKING (BEFORE)		
Yes	**2.468 [1.658, 3.672]**	**<.0001**
No	*	*
TRAUMATIC STRESS (ANY)		
Yes	**1.728 [1.118, 2.670]**	**0.0138**
No	*	*
***REFERENCE GROUP**		

APPENDIX D

ASSOCIATION OF INFANT BIRTHWEIGHT WITH DENTAL CLEANING USING BIRTHWEIGHT AS A CONTINUOUS VARIABLE

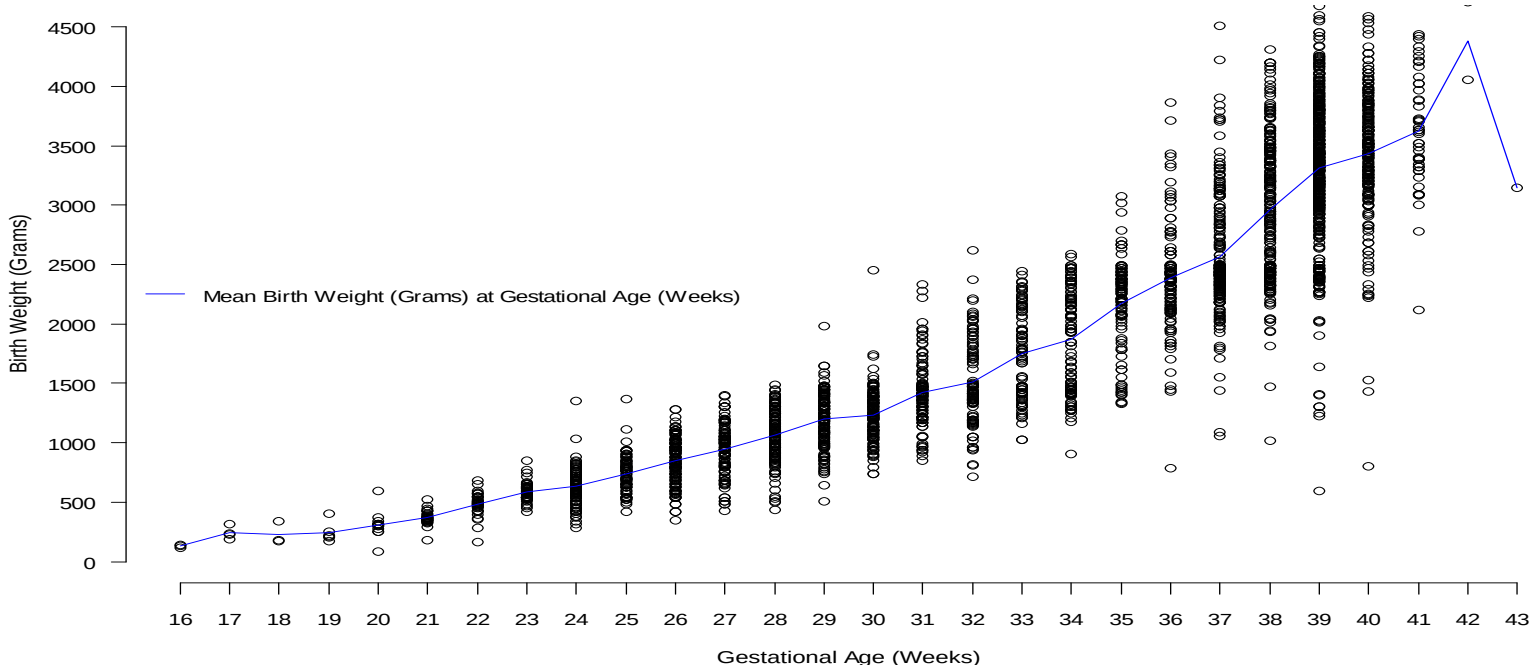

Figure D.1. Plot of Birth Weight and Gestational Age.

Table D.1: Sensitivity Analysis: Adjusted Association of Infant Birth Weight (Continuous Variable) With Dental Cleaning Before or During Pregnancy.

Characteristic	Estimate	p-value	95% Confidence Interval	
Gestational Weeks	178.6640	**<.0001**	169.6429	187.6851
Age				
35 Years or More	50.9182	0.2644	-38.5202	140.3566
Below 35 Years	Reference			
Race				
Black	-194.0608	**<.0001**	**-258.4301**	**-129.6914**
White and Other	Reference			
First Prenatal Care Visit				
Delayed (After 13 Weeks)	-117.1476	**0.0097**	**-205.8880**	**-28.4073**
Timely (13 Weeks or Earlier)	Reference			
Prenatal Insurance				
Medicaid	111.0273	0.1306	-32.9604	255.0151
Private Insurance/Military/Other	182.3275	**0.0141**	**36.8207**	**327.8343**
Uninsured	Reference			
Prepregnancy BMI				
Obese	103.5889	**0.0021**	**37.6763**	**169.5015**
Overweight	70.4484	**0.0309**	**6.4716**	**134.4251**
Underweight	97.8218	0.1444	-33.5736	229.2173
Normal	Reference			
Newborn Sex				
Female	173.8292	**<.0001**	**122.6240**	**225.0343**
Male	Reference			
Previous Live Birth				
Yes	151.3392	**<.0001**	**97.0281**	**205.6504**
No	Reference			
Gestational Weight Gain				
Less than Recommended	-77.0861	**0.0377**	**-149.7692**	**-4.4031**
More than Recommended	104.6587	**0.0007**	**44.0376**	**165.2797**
Recommended	Reference			
Diabetes				
Gestational diabetes (During pregnancy only)	173.1501	**0.0002**	**83.6223**	**262.6778**
Prepregnancy diabetes	214.9721	0.0883	-32.2661	462.2103
No diabetes prior or during pregnancy	Reference			
Previous Low Birth Weight				
Yes	-201.2689	**<.0001**	-299.7415	-102.7963
No	Reference			

Continued

Characteristic	Estimate	p-value	95% Confidence Interval	
Preconception Oral Health Counseling				
Yes	-95.6303	**0.0372**	**-185.5677**	**-5.6929**
No	Reference			
Before or During Dental Cleaning				
Yes	34.1465	0.2475	-23.7375	92.0304
No	Reference			
Smoking Last 3 months of Pregnancy				
Yes	-186.7977	**<.0001**	**-267.1448**	**-106.4505**
No	Reference			
Interactions of Dental Cleaning and Alcohol Consumption				
Dental Cleaning yes/Drinking yes	6.6522	0.9128	-112.41	125.71
Dental Cleaning yes/Drinking no	Reference			
Dental Cleaning yes/Drinking yes	-217.68	**0.0491**	**-434.55**	**-0.8129**
Dental Cleaning no/Drinking yes	Reference			
Dental Cleaning yes/Drinking yes	40.7987	0.5248	-84.9813	166.58
Dental Cleaning no/Drinking no	Reference			
Dental Cleaning yes/Drinking no	-224.34	**0.0190**	**-411.83**	**-36.8463**
Dental Cleaning no/Drinking yes	Reference			
Dental Cleaning yes/Drinking no	34.1465	0.2475	-23.7375	92.0304
Dental Cleaning no/Drinking no	Reference			
Dental Cleaning no/Drinking yes	258.48	**0.0066**	**71.9018**	**445.06**
Dental Cleaning no/Drinking no	Reference			

Analysis Notes: We conducted a sensitivity analysis of the birth weight using multiple linear regression. Adjusting for gestational age (weeks) and other factors affecting birth weight, we studied the association of birth weight and dental cleaning during or before pregnancy. Mean birth weight was plotted against gestational age to ascertain the exclusion point defined by the point at which gestational age values no

longer sustained the upward linear association with birth weight. High gestational age was excluded due to possible factors that may confound an underlying linear association between birth weight and dental cleaning. For this study the exclusion point was 41 weeks, excluding all newborns over 41 weeks gestation. Potential interaction effects of dental cleaning with control variables were tested in logistic and linear models. Adjusted ORs from the final models were assessed using a 95% Confidence Interval (CI). Sensitivity analysis results of birth weight and dental cleaning were driven by alcohol consumption in the last three months of pregnancy. Among mothers who drank, mothers who received a dental cleaning before or during pregnancy were expected to have newborns who weighed 217.68 grams less than mothers who did not clean their teeth.

APPENDIX E

MATERNAL DEMOGRAPHIC, PSYCHOSOCIAL AND MEDICAL CHARACTERISTICS CLASSIFIED BY PREGNANCY OUTCOMES- PRETERM BIRTH (<37 WEEKS) AND LOW BIRTH WEIGHT (<2500 GRAMS)

Table E.1: Maternal Demographic, Psychosocial and Medical Characteristics Classified by Pregnancy Outcomes- Preterm Birth (<37 weeks) And Low Birth Weight (<2500 Grams).

Characteristics	**Total Sample Unweighted Frequency (Weighted %)**	**Preterm Birth *n*=2,867 respondents**		**Low Birth Weight *n*=2,858 respondents**	
		Yes *n*=1,627 respond-ents	**p-value**	**Yes *n*=1,882 respond-ents**	**p-value**
Predisposing Factors					
Age					
Below 35 years	2,417 (86.97)	1,336 (8.34)	0.1192	1,573 (7.66)	0.7012
35 years or more	453 (13.03)	291 (11.34)		310 (8.04)	
Race					
White	1,504 (61.27)	728 (6.54)	**<.0001**	831 (4.99)	**<.0001**
Black	1,106 (29.55)	758 (13.21)		887 (13.66)	
Other	260 (9.18)	141 (8.92)		164 (6.69)	
Education					
> 12 Years	1,766 (59.36)	963 (7.73)	0.1687	1,097 (6.89)	**0.0371**
12 Years	667 (23.82)	402 (10.80)		481 (8.96)	
Under 12 Years	424 (16.81)	252 (9.23)		292 (8.63)	
Marital Status					
Married	1,443 (52.06)	722 (7.44)	**0.0439**	833 (5.37)	**<.0001**

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,867 respondents		Low Birth Weight *n*=2,858 respondents	
		Yes *n*=1,627 respond-ents	p-value	Yes *n*=1,882 respond-ents	p-value
Unmarried	1,427 (47.94)	905 (10.13)		1,049 (10.24)	
Enabling Factors					
Household Income (Annual)					
$0 to $19,000	1,057 (37.13)	657 (11.62)	**0.0029**	779 (10.28)	**<.0001**
$19,001 to $37,000	645 (24.85)	371 (7.45)		425 (7.92)	
$37,001 to $67,000	432 (15.02	239 (6.04))		275 (6.28)	
$67,001 or More	523 (23.00)	231 (6.57)		259 (4.14)	
Health Insurance					
Medicaid	1,564 (54.75)	957 (10.31)	**0.0248**	1,114 (9.3)	**<.0001**
Private/Military/ Other	1,083 (40.14)	543 (6.59)		624 (5.58)	
Uninsured	112 (5.11)	59 (08.65)		67 (5.89)	
Rurality					
Urban	2,407 (85.64)	1,332 (8.38)	0.2023	1,547 (7.42)	**0.0585**
Rural	463 (14.36)	295 (10.81)		335 (9.44)	
Oral Health Counseling					
Yes	261 (8.43)	156 (12.14)	0.1666	175 (7.90)	0.8712
No	2,609 (91.57)	1,471 (8.42)		1,707 (7.69)	
Oral Hygiene Instructions					
Received	1,266 (47.06)	678 (7.63)	0.1056	796 (7.14)	0.1137
No receipt	1,545 (52.94)	915 (9.80)		1,048 (8.25)	
Need Factor					
Dental Knowledge					
Yes	2,460 (87.74)	1,333 (8.01)	**0.0073**	1,561 (7.49)	0.1256
No	393 (12.26)	264 (14.07)		287 (9.24)	
Dental Problem					
Yes	2,169 (76.88)	375 (9.04)	0.8527	434 (8.13)	0.5669
No	636 (23.12)	1,210 (8.75)		1,409 (7.63)	
Pregnancy Intention					
Trying	1,078 (40.96)	563 (7.24)	**0.0502**	645 (5.49)	**<.0001**
Not Trying	1,662 (59.04)	991 (10.01)		1,148 (9.15)	

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,867 respondents		Low Birth Weight *n*=2,858 respondents	
		Yes *n*=1,627 respond-ents	p-value	Yes *n*=1,882 respond-ents	p-value
Self Health Practices					
Dental Cleaning (Before or During)					
Yes	1,546 (58.91)	819 (7.56)	**0.0329**	945 (6.54)	**0.0001**
No	1,253 (41.09)	764 (10.48)		887 (9.33)	
Problem Dental Visit					
Yes	2,460 (87.46)	190 (8.49)	0.8640	221 (7.60)	0.8852
No	336 (12.54)	1,395 (8.84)		1,613 (7.75)	
Prenatal Care Initiation					
Timely (≤13 weeks)	2,601 (94.07)	1,465 (8.58)	0.3513	1,691 (7.38)	**0.0318**
Delayed (> 13 weeks)	176 (5.93)	100 (11.11)		120 (10.88)	
Alcohol (During)					
Yes	167 (7.95)	74 (7.44)	0.6067	80 (3.23)	**<.0001**
No	2,703 (92.05)	1,553 (8.85)		1,802 (8.09)	
Smoking (During)					
Yes	376 (12.77)	215 (9.80)	0.5232	268 (10.80)	**0.0024**
No	2,494 (87.23)	1,412 (8.58)		1,614 (7.25)	
Exercise					
<3 times per week	2,023 (69.08)	1,188 (9.19)	0.2966	1,369 (7.93)	0.3756
3 or more times per week	771 (30.92)	391 (7.74)		460 (7.26)	
Vitamin supplement					
Yes	1,608 (58.65)	614 (7.49)	0.0897	705 (6.69)	**0.0250**
No	1,134 (41.35)	940 (9.79)		1,089 (8.27)	
Biological Factors					
Hypertension					
Yes	539 (8.58)	430 (18.32)	**<.0001**	463 (17.91)	**<.0001**
No	2,331 (91.43)	1,197 (7.83)		1,419 (6.75)	
Diabetes					
Yes	180 (7.24)	89 (9.74)	0.6987	104 (6.42)	0.2863
No	2,690 (92.75)	1,538 (8.65)		1,778 (7.81)	
Obesity					
Underweight	244 (8.44)	139 (10.45)	0.5942	173 (11.15)	**0.0089**

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,867 respondents		Low Birth Weight *n*=2,858 respondents	
		Yes *n*=1,627 respond-ents	p-value	Yes *n*=1,882 respond-ents	p-value
Normal	1,112 (42.80)	563 (8.13)		665 (6.93)	
Overweight	673 (23.520	381 (8.04)		441 (7.02)	
Obese	841 (25.24	544 (9.84)		603 (8.52)	
Medical Risk Factors					
Yes	1,058 (22.47)	761 (14.86)	**<.0001**	842 (13.58)	**<.0001**
No	1,812 (77.53)	866 (6.960		1,040 (6.00)	
History Preterm Birth					
Yes	377 (8.51)	270 (15.01)	**0.0014**	312 (15.77)	**<.0001**
No	1,098 (52.47)	501 (6.820		581 (5.13)	
No Previous Live Birth	1,314 (39.02)	808 (9.900		933 (9.43)	
History Low Birth Weight					
Yes	378 (8.85))	266 (15.14)	**0.0009**	308 (15.11)	**<.0001**
No	1,092 (52.17)	498 (6.67)		579 (5.11)	
No Previous Live Birth	1,315 (38.98)	809 (9.91)		934 (9.43)	
Newborn Sex					
Male	1,408 (48.24)	776 (8.69)	0.9552	934 (8.31)	0.0939
Female	1,462 (51.76)	851 (8.77)		948 (7.14)	
Psychobiological Factors					
Physical Abuse (Before or During)					
Yes	153 (4.23)	100 (17.76)	**0.0100**	116 (13.92)	**0.0018**
No	2,675 (95.77)	1,500 (8.40)		1,735 (7.44)	
Psychological Abuse					
Yes	142 (4.94)	88 (20.06)	**0.0012**	101 (10.81)	0.0731
No	2,646 (95.06)	1,488 (8.25)		1,723 (7.53)	
Traumatic Stress					
Yes	463 (17.91)	259 (8.80)	0.9937	308 (7.97)	0.7050
No	2,366 (82.09)	1,344 (8.79)		1,543 (7.62)	
Financial Stress					
Yes	1,101 (37.33)	653 (10.57)	**0.0398**	748 (8.53)	0.0638
No	1,728 (62.67)	950 (7.73)		1,103 (7.17)	
Partner-Related Stress					
Yes	1,906 (69.38)	572 (11.60)	**0.0064**	657 (9.36)	**0.0024**

Continued

Characteristics	Total Sample Unweighted Frequency (Weighted %)	Preterm Birth *n*=2,867 respondents		Low Birth Weight *n*=2,858 respondents	
		Yes *n*=1,627 respond-ents	p-value	Yes *n*=1,882 respond-ents	p-value
No	923 (30.63)	1,031 (7.55)		1,194 (6.94)	
Emotional Stress					
Yes	1,050 (38.73)	582 (8.62)	0.8402	687 (7.71)	0.9530
No	1,781 (61.73)	1,022 (8.90)		1,166 (7.67)	

APPENDIX F

ADJUSTED ASSOCIATION OF LOW BIRTH WEIGHT WITH DENTAL CLEANING BEFORE OR DURING PREGNANCY (N=2,870 MOTHERS)

Table F.1: Adjusted Association of Low Birth Weight With Dental Cleaning Before Or During Pregnancy (n=2,870 Mothers).

Characteristics	Adjusted Odds Ratio (AOR) [95% Confidence Interval (CI)]	p-value
Age		
35 Years or More	1.389 [0.788, 2.450]	0.2557
Below 35 Years	Reference	
Race		
Black	2.534 [1.650, 3.891]	**<.0001**
White and Other	Reference	
Dental Cleaning (Before/During)		
Yes	0.948 [0.634, 1.416]	0.7930
No	Reference	
Medical Risk Factors		
Yes	2.018 [1.307, 3.114]	**0.0015**
No	Reference	
Previous Live Birth		
Two or More	0.469 [0.272, 0.808]	**0.0064**
One	0.635 [0.399, 1.011]	**0.0556**
None	Reference	
Diabetes (During Only)		
During Only	0.307 [0.138,0.685]	**0.0039**
Pre-Diabetes	0.680 [0.220, 2.104]	0.5030
Neither Pre nor During Diabetes	Reference	
Previous Preterm Birth		
Yes	2.388 [1.359, 4.198]	**0.0025**
No	Reference	

Continued

Current Preterm Birth		
Yes	36.674 [23.655, 56.858]	**<.0001**
No	Reference	
Smoking (Before)		
Yes	2.095 [1.387, 3.164]	**0.0004**
No	Reference	
Drinking (Before)		
Yes	0.478 [0.325, 0.704]	**0.0002**
No	Reference	
Drinking (During)		
Yes	0.191 [0.069, 0.526]	**0.0014**
No	Reference	

APPENDIX G

ASSOCIATION OF DENTAL CLEANING WITH PRETERM BIRTH: USING DENTAL CLEANING AS A 4-CATEGORY VARIABLE (SAS INPUT AND OUTPUT WITHOUT INTERACTIONS) FULL MODELS

Objective 3 (without interactions)

Assess the association of preventive dental service utilization (having teeth cleaned by a dentist or dental hygienist anytime during the twelve months before pregnancy or during pregnancy) with PTB.

```
*--- Objective 3
*--- Dental cleaning is main exposure
*--- Multivariable Analyses
*--- Binary Logistic Regression
*--- Adjusted Associations between Dependent and Independent Variables
*--- Without interaction full model;
ods rtf file =
'F:\University of South Carolina\WILLIAMS, MONIQUE - Dissertation for Monique
Williams\Post Defense Outputs\
```

```
20200404_Objective_3a_wo_Interaction_Full_Model_Binary_Logistic_Regression_Out
puts.rtf';
ods graphics on;
proc surveylogistic data = prep_prams1215;
strata STRAT_YR_n;
weight WTANAL;
class
BD_DCLN(ref = '1 Neither before nor During')
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n(ref = "Below 35 Years")
maternal_race_n2r(ref = "White and Other")
mat_edu_yrs2(ref = "Below 12 Years")
maritlstatus_n(ref = "Unmarried")
/*--- Enabling Factors*/
rural_n(ref = "No")
INCOME7n(ref = "$0 to $19,000")
PNC_1ST_n2(ref = "Delayed (After 13 Weeks)")
prenatal_ins_n3(ref = "Uninsured")
/*--- Need Factors*/
DDS_PROB_n(ref = "No")
PREG_TRY_n(ref = "No")
/*Biological Factors*/
mom_pre_bmi_cat_n(ref = "Normal")
```

MM_MD_n(ref = "Yes")

SEX_n(ref = "Male")

PRE_LB_n2(ref = "No")

NewWghtGain(ref = "Recommended")

MM_HBP_n(ref = "Yes")

BD_DIAB (ref = "Diabetes")

PREV_LBW_n2(ref = "Yes")

PREV_PRE_n2(ref = "Yes")

/*Health Behaviors*/

BPG_DDS_n(ref = "No")

smoke_before_n(ref = "Yes")

smoke_during_n(ref = "Yes")

/*DRK_2YRS_n(ref = "No") */

DRK6_3B_RAW_n(ref = "Yes")

DRK6_3L_RAW_n(ref = "Yes")

EXERAPWK_n2(ref = "< 3 Times per Week")

VITAMIN_YN(ref = "No")

/*Psychobiological Factors*/

PABDHUS(ref = "Yes")

psych_abuse_any(ref = "Yes")

traumatic_stress_any_ai(ref = "Yes")

financial_stress_any_ai(ref = "Yes")

partner_stress_any_ai(ref = "Yes")

```
emotional_stress_any_ai(ref = "Yes")

/ param = glm;

model PTL (event = 'Yes') =

/*--- Predisposing Factors*/

MAT_AGE_GROUP_n maternal_race_n2r mat_edu_yrs2 maritlstatus_n

/*--- Enabling Factors*/

rural_n INCOME7n PNC_1ST_n2 prenatal_ins_n3

/*--- Need Factors*/

DDS_PROB_n PREG_TRY_n

/*--- Biological Factors*/

mom_pre_bmi_cat_n MM_MD_n SEX_n PRE_LB_n2 NewWghtGain MM_HBP_n

BD_DIAB PREV_LBW_n2 PREV_PRE_n2

/*--- Health Behaviors*/

BPG_DDS_n BD_DCLN smoke_before_n smoke_during_n DRK6_3B_RAW_n

DRK6_3L_RAW_n EXERAPWK_n2 VITAMIN_YN

/*-- Psychobiological factors*/

PABDHUS

psych_abuse_any

traumatic_stress_any_ai

financial_stress_any_ai

partner_stress_any_ai

emotional_stress_any_ai

/ expb clodds rsquare PARMLABEL;
```

/**/

title 'Objective 3a Binary Logistic Regression, wo Interaction Full Model';

run;

ods rtf close;

Table G.1: Model Information.

Data Set	WORK.PREP_PRAMS1215	
Response Variable	PTL	Preterm Labor
Number of Response Levels	2	
Stratum Variable	STRAT_YR_n	
Number of Strata	4	
Weight Variable	WTANAL	BC WT: ANALYSIS WT
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Table G.2: Variance Estimation.

Method	Taylor Series
Variance Adjustment	Degrees of Freedom (DF)

Table G.3: Observations and Weights.

Number of Observations Read	2870
Number of Observations Used	2229
Sum of Weights Read	208452.5
Sum of Weights Used	164987.4

Table G.4: Response Profiles.

Ordered Value	PTL	Total Frequency	Total Weight
1	No	988	150356.99
2	Yes	1241	14630.45

Probability modeled is PTL='Yes'

Note: 641 observations were deleted due to missing values for the response or explanatory variables.

Table G.5: Class Level Information.

Class	Value	Design Variables			
BD_DCLN	**2 Before Only**	1	0	0	0
	3 During Only	0	1	0	0
	4 Both Before and During	0	0	1	0
	1 Neither before nor During	0	0	0	1
MAT_AGE_GROUP_n	**35 Years or More**	1	0		
	Below 35 Years	0	1		
maternal_race_n2r	**Black**	1	0		
	White and Other	0	1		
mat_edu_yrs2	**12 Years or More**	1	0		
	Below 12 Years	0	1		
maritlstatus_n	**Married**	1	0		
	Unmarried	0	1		
rural_n	**Yes**	1	0		
	No	0	1		
INCOME7n	**$19,001 to $37,000**	1	0	0	0
	$37,001 to $67,000	0	1	0	0
	$67,001 or More	0	0	1	0
	$0 to $19,000	0	0	0	1
PNC_1ST_n2	**Timely (13 Weeks or Earlier)**	1	0		

Continued

Class	Value	Design Variables			
	Delayed (After 13 Weeks)	0	1		
prenatal_ins_n3	Medicaid	1	0	0	
	Private Insurance/Military/Other	0	1	0	
	Uninsured	0	0	1	
DDS_PROB_n	Yes	1	0		
	No	0	1		
PREG_TRY_n	Yes	1	0		
	No	0	1		
mom_pre_bmi_cat_n	Obese	1	0	0	0
	Overweight	0	1	0	0
	Underweight	0	0	1	0
	Normal	0	0	0	1
MM_MD_n	No	1	0		
	Yes	0	1		
SEX_n	Female	1	0		
	Male	0	1		
PRE_LB_n2	Yes	1	0		
	No	0	1		
NewWghtGain	Less than Recommended	1	0	0	
	More than Recommended	0	1	0	
	Recommended	0	0	1	
MM_HBP_n	No	1	0		
	Yes	0	1		
BD_DIAB	During Only	1	0	0	
	Neither Before nor During Diabetes	0	1	0	
	Diabetes	0	0	1	
PREV_LBW_n2	No	1	0		
	Yes	0	1		
PREV_PRE_n2	No	1	0		

Continued

Class	Value	Design Variables			
	Yes	0	1		
BPG_DDS_n	Yes	1	0		
	No	0	1		
smoke_before_n	No	1	0		
	Yes	0	1		
smoke_during_n	No	1	0		
	Yes	0	1		
DRK6_3B_RAW_n	No	1	0		
	Yes	0	1		
DRK6_3L_RAW_n	No	1	0		
	Yes	0	1		
EXERAPWK_n2	3 or More Times per Week	1	0		
	< 3 Times per Week	0	1		
VITAMIN_YN	Yes	1	0		
	No	0	1		
PABDHUS	No	1	0		
	Yes	0	1		
psych_abuse_any	No	1	0		
	Yes	0	1		
traumatic_stress_any_ai	No	1	0		
	Yes	0	1		
financial_stress_any_ai	No	1	0		
	Yes	0	1		
partner_stress_any_ai	No	1	0		
	Yes	0	1		
emotional_stress_any_ai	No	1	0		
	Yes	0	1		

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Table G.6: Model Fit Statistics.

Criterion	Intercept Only	Intercept and Covariates
AIC	98817.649	87756.813
SC	98827.663	88187.399
-2 Log L	98815.649	87670.813

R-Square 0.0653

Max-rescaled R-Square 0.1450

Table G.7: Testing Global Null Hypothesis: BETA=0.

Test	F Value	Num DF	Den DF	Pr > F
Likelihood Ratio	265.37	41.9987	93447	<.0001
Score	4.16	42	2184	<.0001
Wald	3.20	42	2184	<.0001
Note: Second-order Rao-Scott design correction 0.0000 applied to the Likelihood Ratio test.				

Table G.8: Type 3 Analysis of Effects.

Effect	F Value	Num DF	Den DF	Pr > F
MAT_AGE_GROUP_n	4.26	1	2225	0.0391
maternal_race_n2r	4.24	1	2225	0.0396
mat_edu_yrs2	0.12	1	2225	0.7271
maritlstatus_n	0.67	1	2225	0.4117
rural_n	0.09	1	2225	0.7613
INCOME7n	1.32	3	2223	0.2645
PNC_1ST_n2	0.20	1	2225	0.6548

Continued

Effect	F Value	Num DF	Den DF	Pr > F
prenatal_ins_n3	0.16	2	2224	0.8512
DDS_PROB_n	0.26	1	2225	0.6095
PREG_TRY_n	0.36	1	2225	0.5488
mom_pre_bmi_cat_n	0.03	3	2223	0.9937
MM_MD_n	9.79	1	2225	0.0018
SEX_n	1.02	1	2225	0.3117
PRE_LB_n2	8.12	1	2225	0.0044
NewWghtGain	2.61	2	2224	0.0735
MM_HBP_n	0.44	1	2225	0.5095
BD_DIAB	2.14	2	2224	0.1174
PREV_LBW_n2	1.22	1	2225	0.2698
PREV_PRE_n2	0.40	1	2225	0.5259
BPG_DDS_n	3.52	1	2225	0.0607
BD_DCLN	0.36	3	2223	0.7803
smoke_before_n	0.81	1	2225	0.3669
smoke_during_n	0.00	1	2225	0.9573
DRK6_3B_RAW_n	3.13	1	2225	0.0769
DRK6_3L_RAW_n	0.82	1	2225	0.3646
EXERAPWK_n2	0.39	1	2225	0.5338
VITAMIN_YN	0.43	1	2225	0.5118
PABDHUS	0.04	1	2225	0.8390
psych_abuse_any	4.22	1	2225	0.0401
traumatic_stress_any	3.08	1	2225	0.0792
financial_stress_any	2.31	1	2225	0.1285
partner_stress_any_a	0.76	1	2225	0.3842
emotional_stress_any	0.12	1	2225	0.7246

Table G.9: Analysis of Maximum Likelihood Estimates.

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
Intercept		-0.2418	1.1873	-0.20	0.8386	0.785
MAT_AGE_GROUP_n	35 Years or More	0.6238	0.3022	2.06	0.0391	1.866
MAT_AGE_GROUP_n	Below 35 Years	0	.	.	.	.
maternal_race_n2r	Black	0.5283	0.2565	2.06	0.0396	1.696
maternal_race_n2r	White and Other	0	.	.	.	.
mat_edu_yrs2	12 Years or More	0.1125	0.3223	0.35	0.7271	1.119
mat_edu_yrs2	Below 12 Years	0	.	.	.	.
maritlstatus_n	Married	0.2638	0.3213	0.82	0.4117	1.302
maritlstatus_n	Unmarried	0	.	.	.	.
rural_n	Yes	0.0894	0.2942	0.30	0.7613	1.094
rural_n	No	0	.	.	.	.
INCOME7n	$19,001 to $37,000	-0.5029	0.2647	-1.90	0.0576	0.605
INCOME7n	$37,001 to $67,000	-0.4851	0.4110	-1.18	0.2380	0.616
INCOME7n	$67,001 or More	-0.3423	0.4642	-0.74	0.4609	0.710
INCOME7n	$0 to $19,000	0	.	.	.	.
PNC_1ST_n2	Timely (13 Weeks or Earlier)	-0.1911	0.4274	-0.45	0.6548	0.826
PNC_1ST_n2	Delayed (After 13 Weeks)	0	.	.	.	.
prenatal_ins_n3	Medicaid	0.1098	0.6164	0.18	0.8586	1.116
prenatal_ins_n3	Private Insurance/Military/Other	-0.0836	0.6721	-0.12	0.9011	0.920

Continued

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
prenatal_ins_n3	**Uninsured**	0	.	.	.	.
DDS_PROB_n	**Yes**	-0.1391	0.2723	-0.51	0.6095	0.870
DDS_PROB_n	**No**	0	.	.	.	.
PREG_TRY_n	**Yes**	-0.1959	0.3267	-0.60	0.5488	0.822
PREG_TRY_n	**No**	0	.	.	.	.
mom_pre_bmi_cat_n	**Obese**	0.0705	0.2656	0.27	0.7908	1.073
mom_pre_bmi_cat_n	**Overweight**	0.0618	0.2960	0.21	0.8345	1.064
mom_pre_bmi_cat_n	**Underweight**	0.0245	0.4230	0.06	0.9538	1.025
mom_pre_bmi_cat_n	**Normal**	0	.	.	.	.
MM_MD_n	**No**	-0.9196	0.2939	-3.13	0.0018	0.399
MM_MD_n	**Yes**	0	.	.	.	.
SEX_n	**Female**	0.2269	0.2242	1.01	0.3117	1.255
SEX_n	**Male**	0	.	.	.	.
PRE_LB_n2	**Yes**	-0.7396	0.2595	-2.85	0.0044	0.477
PRE_LB_n2	**No**	0	.	.	.	.
NewWghtGain	**Less than Recommended**	0.3850	0.2685	1.43	0.1517	1.470
NewWghtGain	**More than Recommended**	-0.2217	0.2934	-0.76	0.4500	0.801
NewWghtGain	**Recommended**	0	.	.	.	.
MM_HBP_n	**No**	-0.2252	0.3413	-0.66	0.5095	0.798
MM_HBP_n	**Yes**	0	.	.	.	.
BD_DIAB	**During Only**	-0.5452	0.6724	-0.81	0.4176	0.580
BD_DIAB	**Neither Before nor During Diabetes**	0.2941	0.5815	0.51	0.6130	1.342
BD_DIAB	**Diabetes**	0	.	.	.	.
PREV_LBW_n2	**No**	-0.5678	0.5144	-1.10	0.2698	0.567

Continued

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
PREV_LBW_n2	**Yes**	0	.	.	.	.
PREV_PRE_n2	**No**	-0.2980	0.4698	-0.63	0.5259	0.742
PREV_PRE_n2	**Yes**	0	.	.	.	.
BPG_DDS_n	**Yes**	0.7131	0.3799	1.88	0.0607	2.040
BPG_DDS_n	**No**	0	.	.	.	.
BD_DCLN	**2 Before Only**	-0.0300	0.3231	-0.09	0.9259	0.970
BD_DCLN	**3 During Only**	-0.2374	0.5525	-0.43	0.6674	0.789
BD_DCLN	**4 Both Before and During**	-0.2378	0.2555	-0.93	0.3520	0.788
BD_DCLN	**1 Neither before nor During**	0	.	.	.	.
smoke_before_n	**No**	0.2888	0.3200	0.90	0.3669	1.335
smoke_before_n	**Yes**	0	.	.	.	.
smoke_during_n	**No**	0.0205	0.3829	0.05	0.9573	1.021
smoke_during_n	**Yes**	0	.	.	.	.
DRK6_3B_RAW_n	**No**	-0.4034	0.2279	-1.77	0.0769	0.668
DRK6_3B_RAW_n	**Yes**	0	.	.	.	.
DRK6_3L_RAW_n	**No**	0.4166	0.4594	0.91	0.3646	1.517
DRK6_3L_RAW_n	**Yes**	0	.	.	.	.
EXERAPWK_n2	**3 or More Times per Week**	-0.1445	0.2322	-0.62	0.5338	0.865
EXERAPWK_n2	**< 3 Times per Week**	0	.	.	.	.
VITAMIN_YN	**Yes**	-0.1618	0.2465	-0.66	0.5118	0.851
VITAMIN_YN	**No**	0	.	.	.	.
PABDHUS	**No**	0.1275	0.6273	0.20	0.8390	1.136
PABDHUS	**Yes**	0	.	.	.	.
psych_abuse_any	**No**	-1.1272	0.5489	-2.05	0.0401	0.324

Continued

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
psych_abuse_any	**Yes**	0	.	.	.	.
traumatic_stress_any	**No**	0.5495	0.3129	1.76	0.0792	1.732
traumatic_stress_any	**Yes**	0	.	.	.	.
financial_stress_any	**No**	-0.3443	0.2265	-1.52	0.1285	0.709
financial_stress_any	**Yes**	0	.	.	.	.
partner_stress_any_a	**No**	-0.2016	0.2316	-0.87	0.3842	0.817
partner_stress_any_a	**Yes**	0	.	.	.	.
emotional_stress_any	**No**	0.0822	0.2333	0.35	0.7246	1.086
emotional_stress_any	**Yes**	0	.	.	.	.
Note: The degrees of freedom for the t tests is 2225.						

Table G.10: Analysis of Maximum Likelihood Estimates.

Parameter		Label
Intercept		Intercept: PTL=No
MAT_AGE_GROUP_n	**35 Years or More**	Maternal Age Group 35 Years or More
MAT_AGE_GROUP_n	**Below 35 Years**	Maternal Age Group Below 35 Years
maternal_race_n2r	**Black**	Maternal Race (2 Cat) Black
maternal_race_n2r	**White and Other**	Maternal Race (2 Cat) White and Other
mat_edu_yrs2	**12 Years or More**	Maternal Education (2 Cat) 12 Years or More
mat_edu_yrs2	**Below 12 Years**	Maternal Education (2 Cat) Below 12 Years
maritlstatus_n	**Married**	Marital Status Married
maritlstatus_n	**Unmarried**	Marital Status Unmarried
rural_n	**Yes**	Rurality Yes

Continued

Parameter		Label
rural_n	**No**	Rurality No
INCOME7n	**$19,001 to $37,000**	Household Income Categories $19,001 to $37,000
INCOME7n	**$37,001 to $67,000**	Household Income Categories $37,001 to $67,000
INCOME7n	**$67,001 or More**	Household Income Categories $67,001 or More
INCOME7n	**$0 to $19,000**	Household Income Categories $0 to $19,000
PNC_1ST_n2	**Timely (13 Weeks or Earlier)**	Prenatal Care Initiation Timely (13 Weeks or Earlier)
PNC_1ST_n2	**Delayed (After 13 Weeks)**	Prenatal Care Initiation Delayed (After 13 Weeks)
prenatal_ins_n3	**Medicaid**	Medicaid Insurance (Poverty Proxy) 3 Cat Medicaid
prenatal_ins_n3	**Private Insurance/Military/Other**	Medicaid Insurance (Poverty Proxy) 3 Cat Private Insurance/Military/Other
prenatal_ins_n3	**Uninsured**	Medicaid Insurance (Poverty Proxy) 3 Cat Uninsured
DDS_PROB_n	**Yes**	Dental Problem During Pregnancy Yes
DDS_PROB_n	**No**	Dental Problem During Pregnancy No
PREG_TRY_n	**Yes**	Were Trying to Get Pregnant Yes
PREG_TRY_n	**No**	Were Trying to Get Pregnant No
mom_pre_bmi_cat_n	**Obese**	Prepregnancy BMI Obese
mom_pre_bmi_cat_n	**Overweight**	Prepregnancy BMI Overweight
mom_pre_bmi_cat_n	**Underweight**	Prepregnancy BMI Underweight
mom_pre_bmi_cat_n	**Normal**	Prepregnancy BMI Normal
MM_MD_n	**No**	Medical Risk Factor No
MM_MD_n	**Yes**	Medical Risk Factor Yes
SEX_n	**Female**	Newborn Sex Female
SEX_n	**Male**	Newborn Sex Male
PRE_LB_n2	**Yes**	Previous Live Births Yes
PRE_LB_n2	**No**	Previous Live Births No
NewWghtGain	**Less than Recommended**	Maternal Weight Gain Less than Recommended
NewWghtGain	**More than Recommended**	Maternal Weight Gain More than Recommended
NewWghtGain	**Recommended**	Maternal Weight Gain Recommended

Continued

Parameter		Label
MM_HBP_n	**No**	Hypertension During Pregnancy No
MM_HBP_n	**Yes**	Hypertension During Pregnancy Yes
BD_DIAB	**During Only**	Pre-During Diabetes During Only
BD_DIAB	**Neither Before nor During Diabetes**	Pre-During Diabetes Neither Before nor During Diabetes
BD_DIAB	**Diabetes**	Pre-During Diabetes
PREV_LBW_n2	**No**	Previous Low Birth Weight No
PREV_LBW_n2	**Yes**	Previous Low Birth Weight Yes
PREV_PRE_n2	**No**	Previous Preterm Birth No
PREV_PRE_n2	**Yes**	Previous Preterm Birth Yes
BPG_DDS_n	**Yes**	Oral Health Counselling Before Pregnancy Yes
BPG_DDS_n	**No**	Oral Health Counselling Before Pregnancy No
BD_DCLN	**2 Before Only**	Dental Cleaning Before-During Pregnancy 2 Before Only
BD_DCLN	**3 During Only**	Dental Cleaning Before-During Pregnancy 3 During Only
BD_DCLN	**4 Both Before and During**	Dental Cleaning Before-During Pregnancy 4 Both Before and During
BD_DCLN	**1 Neither before nor During**	Dental Cleaning Before-During Pregnancy 1 Neither Before nor During
smoke_before_n	**No**	Mom Smoked 3 Months Before Pregnancy No
smoke_before_n	**Yes**	Mom Smoked 3 Months Before Pregnancy Yes
smoke_during_n	**No**	Mom Smoked During Pregnancy No
smoke_during_n	**Yes**	Mom Smoked During Pregnancy Yes
DRK6_3B_RAW_n	**No**	Alcoholic Drinks 3 Months Before Pregnancy No
DRK6_3B_RAW_n	**Yes**	Alcoholic Drinks 3 Months Before Pregnancy Yes
DRK6_3L_RAW_n	**No**	Alcoholic Drinks in Last 3 Months of Pregnancy No
DRK6_3L_RAW_n	**Yes**	Alcoholic Drinks in Last 3 Months of Pregnancy Yes
EXERAPWK_n2	**3 or More Times per Week**	Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week

Continued

Parameter		Label
EXERAPWK_n2	**< 3 Times per Week**	Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
VITAMIN_YN	**Yes**	Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
VITAMIN_YN	**No**	Multivitamin Consumption During Month Before Pregnancy (Y/N) No
PABDHUS	**No**	Physical Abuse Before or During Pregnancy No
PABDHUS	**Yes**	Physical Abuse Before or During Pregnancy Yes
psych_abuse_any	**No**	Any Psychological Abuse During Pregnancy No
psych_abuse_any	**Yes**	Any Psychological Abuse During Pregnancy Yes
traumatic_stress_any	**No**	Any Traumatic Stress No
traumatic_stress_any	**Yes**	Any Traumatic Stress Yes
financial_stress_any	**No**	Any Financial Stress No
financial_stress_any	**Yes**	Any Financial Stress Yes
partner_stress_any_a	**No**	Any Partner Related Stress No
partner_stress_any_a	**Yes**	Any Partner Related Stress Yes
emotional_stress_any	**No**	Any Emotional Stress No
emotional_stress_any	**Yes**	Any Emotional Stress Yes
Note: The degrees of freedom for the t tests is 2225.		

Table G.11: Association of Predicted Probabilities and Observed Responses.

Percent Concordant	73.6	**Somers' D**	0.479
Percent Discordant	25.7	**Gamma**	0.482
Percent Tied	0.7	**Tau-a**	0.236
Pairs	1226108	**c**	0.739

Table G.12: Odds Ratio Estimates and t Confidence Intervals.

Effect	Unit	Estimate	95% Confidence Limits	
MAT_AGE_GROUP_n 35 Years or More versus Below 35 Years	1.0000	1.866	1.032	3.375
maternal_race_n2r Black versus White and Other	1.0000	1.696	1.026	2.805
mat_edu_yrs2 12 Years or More versus Below 12 Years	1.0000	1.119	0.595	2.106
maritlstatus_n Married versus Unmarried	1.0000	1.302	0.693	2.445
rural_n Yes versus No	1.0000	1.094	0.614	1.947
INCOME7n $19,001 to $37,000 versus $0 to $19,000	1.0000	0.605	0.360	1.016
INCOME7n $37,001 to $67,000 versus $0 to $19,000	1.0000	0.616	0.275	1.378
INCOME7n $67,001 or More versus $0 to $19,000	1.0000	0.710	0.286	1.765
PNC_1ST_n2 Timely (13 Weeks or Earlier) versus Delayed (After 13 Weeks)	1.0000	0.826	0.357	1.910
prenatal_ins_n3 Medicaid versus Uninsured	1.0000	1.116	0.333	3.738
prenatal_ins_n3 Private Insurance/Military/Other versus Uninsured	1.0000	0.920	0.246	3.436
DDS_PROB_n Yes versus No	1.0000	0.870	0.510	1.484

Continued

Effect	Unit	Estimate	95% Confidence Limits	
PREG_TRY_n Yes versus No	1.0000	0.822	0.433	1.560
mom_pre_bmi_cat_n Obese versus Normal	1.0000	1.073	0.637	1.806
mom_pre_bmi_cat_n Overweight versus Normal	1.0000	1.064	0.595	1.901
mom_pre_bmi_cat_n Underweight versus Normal	1.0000	1.025	0.447	2.349
MM_MD_n No versus Yes	1.0000	0.399	0.224	0.709
SEX_n Female versus Male	1.0000	1.255	0.808	1.947
PRE_LB_n2 Yes versus No	1.0000	0.477	0.287	0.794
NewWghtGain Less than Recommended versus Recommended	1.0000	1.470	0.868	2.488
NewWghtGain More than Recommended versus Recommended	1.0000	0.801	0.451	1.424
MM_HBP_n No versus Yes	1.0000	0.798	0.409	1.559
BD_DIAB During Only versus Diabetes	1.0000	0.580	0.155	2.167
BD_DIAB Neither Before nor During Diabetes versus Diabetes	1.0000	1.342	0.429	4.197
PREV_LBW_n2 No versus Yes	1.0000	0.567	0.207	1.554
PREV_PRE_n2 No versus Yes	1.0000	0.742	0.295	1.865
BPG_DDS_n Yes versus No	1.0000	2.040	0.969	4.298
BD_DCLN 2 Before Only versus 1 Neither before nor During	1.0000	0.970	0.515	1.829
BD_DCLN 3 During Only versus 1 Neither before nor During	1.0000	0.789	0.267	2.331
BD_DCLN 4 Both Before and During versus 1 Neither before nor During	1.0000	0.788	0.478	1.301
smoke_before_n No versus Yes	1.0000	1.335	0.713	2.500
smoke_during_n No versus Yes	1.0000	1.021	0.482	2.163
DRK6_3B_RAW_n No versus Yes	1.0000	0.668	0.427	1.045
DRK6_3L_RAW_n No versus Yes	1.0000	1.517	0.616	3.734
EXERAPWK_n2 3 or More Times per Week versus < 3 Times per Week	1.0000	0.865	0.549	1.365
VITAMIN_YN Yes versus No	1.0000	0.851	0.525	1.379

Continued

Effect	Unit	Estimate	95% Confidence Limits	
PABDHUS No versus Yes	1.0000	1.136	0.332	3.887
psych_abuse_any No versus Yes	1.0000	0.324	0.110	0.950
traumatic_stress_any No versus Yes	1.0000	1.732	0.938	3.200
financial_stress_any No versus Yes	1.0000	0.709	0.455	1.105
partner_stress_any_a No versus Yes	1.0000	0.817	0.519	1.287
emotional_stress_any No versus Yes	1.0000	1.086	0.687	1.716
Note: The degrees of freedom in computing the confidence limits is 2225.				

Objective 3 (without interactions)

Assess the association of preventive dental service utilization (having teeth cleaned by a dentist or dental hygienist anytime during the twelve months before pregnancy or during pregnancy) with PTB.

Table G.13: Multivariable Model Selection Steps.

Step	Dropped Variable	p-value	Remarks
1	mom_pre_bmi_cat_n	0.99	Highest p-value
2	smoke_during_n	0.96	Highest p-value
3	prenatal_ins_n3	0.86	Highest p-value
4	PABDHUS	0.82	Highest p-value
5	mat_edu_yrs2	0.75	Not highest p-value[2]
6	rural_n	0.76	Not highest p-value[2]
7	PNC_1ST_n2	0.74	Not highest p-value[2]
8	emotional_stress_any_ai	0.70	Not highest p-value[2]
9	DDS_PROB_n	0.63	Not highest p-value[2]
10	PREV_PRE_n2	0.58	Not highest p-value[2]
11	MM_HBP_n	0.57	Not highest p-value[2]
12	PREG_TRY_n	0.53	Not highest p-value[2]
13	maritlstatus_n	0.55	Not highest p-value[2]
14	EXERAPWK_n2	0.51	Not highest p-value[2]
15	VITAMIN_YN	0.37	Not highest p-value[2]
16	SEX_n	0.37	Not highest p-value[2]
17	DRK6_3L_RAW_n	0.33	Not highest p-value[2]
18	partner_stress_any_ai	0.29	Not highest p-value[2]
19	INCOME7n	0.20	Not highest p-value[2]
20	smoke_before_n	0.33	Not highest p-value[2]
21	DRK6_3B_RAW_n	0.27	Not highest p-value[2]
22	BPG_DDS_n	0.12	Not highest p-value[2]
23	BD_DIAB	0.11	Not highest p-value[2]

[1]There were variable(s) with higher p-value(s) but were retained as their interaction(s) were still in the model. Main effects cannot be dropped while associated interaction(s) are still in the model. The associated p-value was highest after these noted variables.

[2] There were variable(s) with higher p-value(s) decided to be must keep variables in the model. The associated p-value was highest after these noted variables.

APPENDIX H

ASSOCIATION OF DENTAL CLEANING WITH PRETERM BIRTH: USING DENTAL CLEANING AS A 4-CATEGORY VARIABLE (SAS INPUT AND OUTPUT WITH INTERACTIONS)

FULL MODELS

```
*--- Dental cleaning is main exposure
*--- Multivariable Analyses
*--- Binary Logistic Regression
*--- Adjusted Associations between Dependent and Independent Variables
*--- With interaction full model;
ods rtf file =
'F:\University of South Carolina\WILLIAMS, MONIQUE - Dissertation for Monique
Williams\Post Defense Outputs\
20200404_Objective_3a_w_Interaction_Full_Model_Binary_Logistic_Regression_Outp
uts.rtf';
ods graphics on;
proc surveylogistic data = prep_prams1215;
strata STRAT_YR_n;
weight WTANAL;
class
```

```
BD_DCLN(ref = '1 Neither before nor During')
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n(ref = "Below 35 Years")
maternal_race_n2r(ref = "White and Other")
mat_edu_yrs2(ref = "Below 12 Years")
maritlstatus_n(ref = "Unmarried")
/*--- Enabling Factors*/
rural_n(ref = "No")
INCOME7n(ref = "$0 to $19,000")
PNC_1ST_n2(ref = "Delayed (After 13 Weeks)")
prenatal_ins_n3(ref = "Uninsured")
/*--- Need Factors*/
DDS_PROB_n(ref = "No")
PREG_TRY_n(ref = "No")
/*Biological Factors*/
mom_pre_bmi_cat_n(ref = "Normal")
MM_MD_n(ref = "Yes")
SEX_n(ref = "Male")
PRE_LB_n2(ref = "No")
NewWghtGain(ref = "Recommended")
MM_HBP_n(ref = "Yes")
BD_DIAB (ref = "Diabetes")
PREV_LBW_n2(ref = "Yes")
```

PREV_PRE_n2(ref = "Yes")

/*Health Behaviors*/

BPG_DDS_n(ref = "No")

smoke_before_n(ref = "Yes")

smoke_during_n(ref = "Yes")

/*DRK_2YRS_n(ref = "No") */

DRK6_3B_RAW_n(ref = "Yes")

DRK6_3L_RAW_n(ref = "Yes")

EXERAPWK_n2(ref = "< 3 Times per Week")

VITAMIN_YN(ref = "No")

/*Psychobiological Factors*/

PABDHUS(ref = "Yes")

psych_abuse_any(ref = "Yes")

traumatic_stress_any_ai(ref = "Yes")

financial_stress_any_ai(ref = "Yes")

partner_stress_any_ai(ref = "Yes")

emotional_stress_any_ai(ref = "Yes")

/ param = glm;

model PTL (event = 'Yes') =

/*--- Predisposing Factors*/

MAT_AGE_GROUP_n maternal_race_n2r mat_edu_yrs2 maritlstatus_n

/*--- Enabling Factors*/

rural_n INCOME7n PNC_1ST_n2 prenatal_ins_n3

/*--- Need Factors*/

DDS_PROB_n PREG_TRY_n

/*--- Biological Factors*/

mom_pre_bmi_cat_n MM_MD_n SEX_n PRE_LB_n2 NewWghtGain MM_HBP_n

BD_DIAB PREV_LBW_n2 PREV_PRE_n2

/*--- Health Behaviors*/

BPG_DDS_n BD_DCLN smoke_before_n smoke_during_n DRK6_3B_RAW_n

DRK6_3L_RAW_n EXERAPWK_n2 VITAMIN_YN

/*-- Psychobiological factors*/

PABDHUS

psych_abuse_any

traumatic_stress_any_ai

financial_stress_any_ai

partner_stress_any_ai

emotional_stress_any_ai

/*--- Interactions*/

BD_DCLN*PNC_1ST_n2

BD_DCLN*MM_MD_n

BD_DCLN*MM_HBP_n

BD_DCLN*BD_DIAB

BD_DCLN*PREV_PRE_n2

BD_DCLN*PABDHUS

BD_DCLN*smoke_during_n

BD_DCLN*DRK6_3L_RAW_n

BD_DCLN*EXERAPWK_n2

BD_DCLN*VITAMIN_YN

BD_DCLN*traumatic_stress_any_ai

BD_DCLN*financial_stress_any_ai

BD_DCLN*partner_stress_any_ai

BD_DCLN*emotional_stress_any_ai

/ expb clodds rsquare PARMLABEL;

title 'Objective 3a Binary Logistic Regression, w Interaction Full Model';

run;

ods rtf close;

Table H.1: Model Information.

Data Set	WORK.PREP_PRAMS1215	
Response Variable	PTL	Preterm Labor
Number of Response Levels	2	
Stratum Variable	STRAT_YR_n	
Number of Strata	4	
Weight Variable	WTANAL	BC WT: ANALYSIS WT
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Table H.2: Variance Estimation.

Method	Taylor Series
Variance Adjustment	Degrees of Freedom (DF)

Table H.3: Observations and Weights.

Number of Observations Read	2870
Number of Observations Used	2229
Sum of Weights Read	208452.5
Sum of Weights Used	164987.4

Table H.4: Response Profile.

Ordered Value	PTL	Total Frequency	Total Weight
1	No	988	150356.99
2	Yes	1241	14630.45

Probability modeled is PTL='Yes'

Note: 641 observations were deleted due to missing values for the response or explanatory variables.

Table H.5 Class Level Information.

Class	Value	Design Variables			
BD_DCLN	**2 Before Only**	1	0	0	0
	3 During Only	0	1	0	0
	4 Both Before and During	0	0	1	0
	1 Neither before nor During	0	0	0	1
MAT_AGE_GROUP_n	**35 Years or More**	1	0		
	Below 35 Years	0	1		
maternal_race_n2r	**Black**	1	0		
	White and Other	0	1		
mat_edu_yrs2	**12 Years or More**	1	0		
	Below 12 Years	0	1		
maritlstatus_n	**Married**	1	0		
	Unmarried	0	1		

Continued

Class	Value	Design Variables			
rural_n	Yes	1	0		
	No	0	1		
INCOME7n	$19,001 to $37,000	1	0	0	0
	$37,001 to $67,000	0	1	0	0
	$67,001 or More	0	0	1	0
	$0 to $19,000	0	0	0	1
PNC_1ST_n2	Timely (13 Weeks or Earlier)	1	0		
	Delayed (After 13 Weeks)	0	1		
prenatal_ins_n3	Medicaid	1	0	0	
	Private Insurance/Military/Other	0	1	0	
	Uninsured	0	0	1	
DDS_PROB_n	Yes	1	0		
	No	0	1		
PREG_TRY_n	Yes	1	0		
	No	0	1		
mom_pre_bmi_cat_n	Obese	1	0	0	0
	Overweight	0	1	0	0
	Underweight	0	0	1	0
	Normal	0	0	0	1
MM_MD_n	No	1	0		
	Yes	0	1		
SEX_n	Female	1	0		
	Male	0	1		
PRE_LB_n2	Yes	1	0		
	No	0	1		
NewWghtGain	Less than Recommended	1	0	0	
	More than Recommended	0	1	0	
	Recommended	0	0	1	
MM_HBP_n	No	1	0		
	Yes	0	1		
BD_DIAB	During Only	1	0	0	
	Neither Before nor During Diabetes	0	1	0	
	Diabetes	0	0	1	
PREV_LBW_n2	No	1	0		
	Yes	0	1		
PREV_PRE_n2	No	1	0		
	Yes	0	1		

Continued

Class	Value	Design Variables			
BPG_DDS_n	**Yes**	1	0		
	No	0	1		
smoke_before_n	**No**	1	0		
	Yes	0	1		
smoke_during_n	**No**	1	0		
	Yes	0	1		
DRK6_3B_RAW_n	**No**	1	0		
	Yes	0	1		
DRK6_3L_RAW_n	**No**	1	0		
	Yes	0	1		
EXERAPWK_n2	**3 or More Times per Week**	1	0		
	< 3 Times per Week	0	1		
VITAMIN_YN	**Yes**	1	0		
	No	0	1		
PABDHUS	**No**	1	0		
	Yes	0	1		
psych_abuse_any	**No**	1	0		
	Yes	0	1		
traumatic_stress_any_ai	**No**	1	0		
	Yes	0	1		
financial_stress_any_ai	**No**	1	0		
	Yes	0	1		
partner_stress_any_ai	**No**	1	0		
	Yes	0	1		
emotional_stress_any_ai	**No**	1	0		
	Yes	0	1		

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Table H.6: Model Fit Statistics.

Criterion	Intercept Only	Intercept and Covariates
AIC	98817.649	82435.838
SC	98827.663	83317.037
-2 Log L	98815.649	82259.838

R-Square 0.0955

Max-rescaled R-Square 0.2119

Table H.7: Testing Global Null Hypothesis: BETA=0.

Test	F Value	Num DF	Den DF	Pr > F
Likelihood Ratio	190.30	86.9951	193564	<.0001
Score	3.05	87	2139	<.0001
Wald	2.39	87	2139	<.0001

Note: Second-order Rao-Scott design correction 0.0001 applied to the Likelihood Ratio test.

Table H.8: Type 3 Analysis of Effects.

Effect	F Value	Num DF	Den DF	Pr > F
MAT_AGE_GROUP_n	4.74	1	2225	0.0295
maternal_race_n2r	4.98	1	2225	0.0258
mat_edu_yrs2	0.11	1	2225	0.7450
maritlstatus_n	0.58	1	2225	0.4446
rural_n	0.31	1	2225	0.5757
INCOME7n	1.86	3	2223	0.1341
PNC_1ST_n2	8.29	1	2225	0.0040

Continued

Effect	F Value	Num DF	Den DF	Pr > F
prenatal_ins_n3	0.01	2	2224	0.9929
DDS_PROB_n	0.32	1	2225	0.5734
PREG_TRY_n	0.91	1	2225	0.3391
mom_pre_bmi_cat_n	0.09	3	2223	0.9664
MM_MD_n	9.38	1	2225	0.0022
SEX_n	0.78	1	2225	0.3762
PRE_LB_n2	10.72	1	2225	0.0011
NewWghtGain	2.39	2	2224	0.0923
MM_HBP_n	1.11	1	2225	0.2931
BD_DIAB	3.83	2	2224	0.0218
PREV_LBW_n2	1.17	1	2225	0.2793
PREV_PRE_n2	0.26	1	2225	0.6116
BPG_DDS_n	4.05	1	2225	0.0443
BD_DCLN	1.78	3	2223	0.1488
smoke_before_n	0.14	1	2225	0.7039
smoke_during_n	0.15	1	2225	0.6954
DRK6_3B_RAW_n	2.70	1	2225	0.1008
DRK6_3L_RAW_n	8.57	1	2225	0.0035
EXERAPWK_n2	1.82	1	2225	0.1773
VITAMIN_YN	0.29	1	2225	0.5923
PABDHUS	0.54	1	2225	0.4606
psych_abuse_any	3.79	1	2225	0.0516
traumatic_stress_any	7.29	1	2225	0.0070
financial_stress_any	1.49	1	2225	0.2216
partner_stress_any_a	1.40	1	2225	0.2362
emotional_stress_any	0.10	1	2225	0.7521
BD_DCLN*PNC_1ST_n2	2.94	3	2223	0.0319
BD_DCLN*MM_MD_n	0.42	3	2223	0.7408
BD_DCLN*MM_HBP_n	0.23	3	2223	0.8754
BD_DCLN*BD_DIAB	2.95	6	2220	0.0072
BD_DCLN*PREV_PRE_n2	0.72	3	2223	0.5378
BD_DCLN*PABDHUS	1.07	3	2223	0.3616
BD_DCLN*smoke_during	1.76	3	2223	0.1521
BD_DCLN*DRK6_3L_RAW_	2.88	3	2223	0.0349
BD_DCLN*EXERAPWK_n2	2.63	3	2223	0.0488
BD_DCLN*VITAMIN_YN	1.91	3	2223	0.1257
BD_DCLN*traumatic_st	3.50	3	2223	0.0150
BD_DCLN*financial_st	2.38	3	2223	0.0680
BD_DCLN*partner_stre	0.97	3	2223	0.4079
BD_DCLN*emotional_st	0.22	3	2223	0.8847

Table H.9: Analysis of Maximum Likelihood Estimates.

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
Intercept			-0.1064	1.4716	-0.07	0.9424	0.899
MAT_AGE_GROUP_n	35 Years or More		0.6525	0.2997	2.18	0.0295	1.920
MAT_AGE_GROUP_n	Below 35 Years		0	.	.	.	.
maternal_race_n2r	Black		0.6059	0.2716	2.23	0.0258	1.833
maternal_race_n2r	White and Other		0	.	.	.	.
mat_edu_yrs2	12 Years or More		0.1024	0.3148	0.33	0.7450	1.108
mat_edu_yrs2	Below 12 Years		0	.	.	.	.
maritlstatus_n	Married		0.2668	0.3489	0.76	0.4446	1.306
maritlstatus_n	Unmarried		0	.	.	.	.
rural_n	Yes		0.1647	0.2943	0.56	0.5757	1.179
rural_n	No		0	.	.	.	.
INCOME7n	$19,001 to $37,000		-0.6166	0.3032	-2.03	0.0421	0.540
INCOME7n	$37,001 to $67,000		-0.7673	0.3887	-1.97	0.0485	0.464
INCOME7n	$67,001 or More		-0.5713	0.4621	-1.24	0.2164	0.565
INCOME7n	$0 to $19,000		0	.	.	.	.
PNC_1ST_n2	Timely (13 Weeks or Earlier)		0.1976	0.4336	0.46	0.6487	1.218
PNC_1ST_n2	Delayed (After 13 Weeks)		0	.	.	.	.
prenatal_ins_n3	Medicaid		0.0579	0.6366	0.09	0.9276	1.060
prenatal_ins_n3	Private Insurance/Military/Other		0.0805	0.6844	0.12	0.9064	1.084
prenatal_ins_n3	Uninsured		0	.	.	.	.
DDS_PROB_n	Yes		-0.1582	0.2810	-0.56	0.5734	0.854
DDS_PROB_n	No		0	.	.	.	.
PREG_TRY_n	Yes		-0.3305	0.3457	-0.96	0.3391	0.719

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
PREG_TRY_n	No		0	.	.	.	.
mom_pre_bmi_cat_n	Obese		0.1157	0.2850	0.41	0.6847	1.123
mom_pre_bmi_cat_n	Overweight		0.0583	0.3135	0.19	0.8526	1.060
mom_pre_bmi_cat_n	Underweight		0.2086	0.4845	0.43	0.6668	1.232
mom_pre_bmi_cat_n	Normal		0	.	.	.	.
MM_MD_n	No		-0.9077	0.4414	-2.06	0.0399	0.403
MM_MD_n	Yes		0	.	.	.	.
SEX_n	Female		0.2108	0.2381	0.89	0.3762	1.235
SEX_n	Male		0	.	.	.	.
PRE_LB_n2	Yes		-0.8530	0.2605	-3.27	0.0011	0.426
PRE_LB_n2	No		0	.	.	.	.
NewWghtGain	Less than Recommended		0.3366	0.2701	1.25	0.2128	1.400
NewWghtGain	More than Recommended		-0.3436	0.3082	-1.11	0.2652	0.709
NewWghtGain	Recommended		0	.	.	.	.
MM_HBP_n	No		-0.1761	0.5481	-0.32	0.7481	0.839
MM_HBP_n	Yes		0	.	.	.	.
BD_DIAB	During Only		0.1569	1.0235	0.15	0.8781	1.170
BD_DIAB	Neither Before nor During Diabetes		0.5276	0.9388	0.56	0.5742	1.695
BD_DIAB	Diabetes		0	.	.	.	.
PREV_LBW_n2	No		-0.5522	0.5103	-1.08	0.2793	0.576
PREV_LBW_n2	Yes		0	.	.	.	.
PREV_PRE_n2	No		-0.6538	0.5283	-1.24	0.2160	0.520
PREV_PRE_n2	Yes		0	.	.	.	.
BPG_DDS_n	Yes		0.8425	0.4186	2.01	0.0443	2.322
BPG_DDS_n	No		0	.	.	.	.
BD_DCLN	2 Before Only		1.7012	2.4207	0.70	0.4823	5.481

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN	3 During Only		-3.8770	4.4801	-0.87	0.3869	0.021
BD_DCLN	4 Both Before and During		-1.8623	2.4067	-0.77	0.4391	0.155
BD_DCLN	1 Neither before nor During		0	.	.	.	.
smoke_before_n	No		0.1240	0.3264	0.38	0.7039	1.132
smoke_before_n	Yes		0	.	.	.	.
smoke_during_n	No		0.6916	0.4590	1.51	0.1320	1.997
smoke_during_n	Yes		0	.	.	.	.
DRK6_3B_RAW_n	No		-0.4374	0.2665	-1.64	0.1008	0.646
DRK6_3B_RAW_n	Yes		0	.	.	.	.
DRK6_3L_RAW_n	No		0.3247	0.7157	0.45	0.6501	1.384
DRK6_3L_RAW_n	Yes		0	.	.	.	.
EXERAPWK_n2	3 or More Times per Week		0.3225	0.3440	0.94	0.3485	1.381
EXERAPWK_n2	< 3 Times per Week		0	.	.	.	.
VITAMIN_YN	Yes		-0.3089	0.3433	-0.90	0.3684	0.734
VITAMIN_YN	No		0	.	.	.	.
PABDHUS	No		-0.0638	0.7189	-0.09	0.9292	0.938
PABDHUS	Yes		0	.	.	.	.
psych_abuse_any	No		-1.1154	0.5726	-1.95	0.0516	0.328
psych_abuse_any	Yes		0	.	.	.	.
traumatic_stress_any	No		-0.0579	0.4190	-0.14	0.8902	0.944
traumatic_stress_any	Yes		0	.	.	.	.
financial_stress_any	No		-0.4485	0.3151	-1.42	0.1547	0.639
financial_stress_any	Yes		0	.	.	.	.
partner_stress_any_a	No		-0.4195	0.3216	-1.30	0.1922	0.657
partner_stress_any_a	Yes		0	.	.	.	.

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
emotional_stress_any	No		0.1382	0.3221	0.43	0.6680	1.148
emotional_stress_any	Yes		0	.	.	.	.
BD_DCLN*PNC_1ST_n2	2 Before Only	Timely (13 Weeks or Earlier)	-1.0313	1.1535	-0.89	0.3714	0.357
BD_DCLN*PNC_1ST_n2	2 Before Only	Delayed (After 13 Weeks)	0	.	.	.	.
BD_DCLN*PNC_1ST_n2	3 During Only	Timely (13 Weeks or Earlier)	-8.3551	2.9859	-2.80	0.0052	0.000
BD_DCLN*PNC_1ST_n2	3 During Only	Delayed (After 13 Weeks)	0	.	.	.	.
BD_DCLN*PNC_1ST_n2	4 Both Before and During	Timely (13 Weeks or Earlier)	-0.8921	0.9757	-0.91	0.3607	0.410
BD_DCLN*PNC_1ST_n2	4 Both Before and During	Delayed (After 13 Weeks)	0	.	.	.	.
BD_DCLN*PNC_1ST_n2	1 Neither before nor During	Timely (13 Weeks or Earlier)	0	.	.	.	.
BD_DCLN*PNC_1ST_n2	1 Neither before nor During	Delayed (After 13 Weeks)	0	.	.	.	.
BD_DCLN*MM_MD_n	2 Before Only	No	0.0350	1.0287	0.03	0.9729	1.036
BD_DCLN*MM_MD_n	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*MM_MD_n	3 During Only	No	-1.3692	1.2357	-1.11	0.2680	0.254
BD_DCLN*MM_MD_n	3 During Only	Yes	0	.	.	.	.
BD_DCLN*MM_MD_n	4 Both Before and During	No	-0.1361	0.7167	-0.19	0.8494	0.873

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*MM_MD_n	**4 Both Before and During**	**Yes**	0	.	.	.	.
BD_DCLN*MM_MD_n	**1 Neither before nor During**	**No**	0	.	.	.	.
BD_DCLN*MM_MD_n	**1 Neither before nor During**	**Yes**	0	.	.	.	.
BD_DCLN*MM_HBP_n	**2 Before Only**	**No**	-0.6390	1.0400	-0.61	0.5390	0.528
BD_DCLN*MM_HBP_n	**2 Before Only**	**Yes**	0	.	.	.	.
BD_DCLN*MM_HBP_n	**3 During Only**	**No**	-0.6823	1.4674	-0.46	0.6420	0.505
BD_DCLN*MM_HBP_n	**3 During Only**	**Yes**	0	.	.	.	.
BD_DCLN*MM_HBP_n	**4 Both Before and During**	**No**	0.1334	0.8237	0.16	0.8713	1.143
BD_DCLN*MM_HBP_n	**4 Both Before and During**	**Yes**	0	.	.	.	.
BD_DCLN*MM_HBP_n	**1 Neither before nor During**	**No**	0	.	.	.	.
BD_DCLN*MM_HBP_n	**1 Neither before nor During**	**Yes**	0	.	.	.	.
BD_DCLN*BD_DIAB	**2 Before Only**	**During Only**	-2.0399	2.1189	-0.96	0.3358	0.130
BD_DCLN*BD_DIAB	**2 Before Only**	**Neither Before nor During Diabetes**	-2.2121	1.2175	-1.82	0.0694	0.109
BD_DCLN*BD_DIAB	**2 Before Only**	**Diabetes**	0	.	.	.	.
BD_DCLN*BD_DIAB	**3 During Only**	**During Only**	-4.4783	3.5183	-1.27	0.2032	0.011
BD_DCLN*BD_DIAB	**3 During Only**	**Neither Before nor During Diabetes**	2.0516	1.6699	1.23	0.2193	7.781
BD_DCLN*BD_DIAB	**3 During Only**	**Diabetes**	0	.	.	.	.
BD_DCLN*BD_DIAB	**4 Both Before and During**	**During Only**	-0.5481	1.5087	-0.36	0.7164	0.578

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*BD_DIAB	4 Both Before and During	Neither Before nor During Diabetes	0.6903	1.4370	0.48	0.6310	1.994
BD_DCLN*BD_DIAB	4 Both Before and During	Diabetes	0	.	.	.	.
BD_DCLN*BD_DIAB	1 Neither before nor During	During Only	0	.	.	.	.
BD_DCLN*BD_DIAB	1 Neither before nor During	Neither Before nor During Diabetes	0	.	.	.	.
BD_DCLN*BD_DIAB	1 Neither before nor During	Diabetes	0	.	.	.	.
BD_DCLN*PREV_PRE_n2	2 Before Only	No	0.8089	0.8287	0.98	0.3291	2.245
BD_DCLN*PREV_PRE_n2	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*PREV_PRE_n2	3 During Only	No	1.0070	1.2107	0.83	0.4056	2.737
BD_DCLN*PREV_PRE_n2	3 During Only	Yes	0	.	.	.	.
BD_DCLN*PREV_PRE_n2	4 Both Before and During	No	-0.1687	0.6739	-0.25	0.8024	0.845
BD_DCLN*PREV_PRE_n2	4 Both Before and During	Yes	0	.	.	.	.
BD_DCLN*PREV_PRE_n2	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*PREV_PRE_n2	1 Neither before nor During	Yes	0	.	.	.	.
BD_DCLN*PABDHUS	2 Before Only	No	-0.0384	1.1033	-0.03	0.9723	0.962
BD_DCLN*PABDHUS	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*PABDHUS	3 During Only	No	0.2120	1.7428	0.12	0.9032	1.236
BD_DCLN*PABDHUS	3 During Only	Yes	0	.	.	.	.
BD_DCLN*PABDHUS	4 Both Before and During	No	1.9387	1.1487	1.69	0.0916	6.950
BD_DCLN*PABDHUS	4 Both Before and During	Yes	0	.	.	.	.

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*PABDHUS	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*PABDHUS	1 Neither before nor During	Yes	0	.	.	.	.
BD_DCLN*smoke_during	2 Before Only	No	-2.1437	0.9361	-2.29	0.0221	0.117
BD_DCLN*smoke_during	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*smoke_during	3 During Only	No	-0.9918	2.0449	-0.49	0.6277	0.371
BD_DCLN*smoke_during	3 During Only	Yes	0	.	.	.	.
BD_DCLN*smoke_during	4 Both Before and During	No	-0.5404	0.7252	-0.75	0.4563	0.583
BD_DCLN*smoke_during	4 Both Before and During	Yes	0	.	.	.	.
BD_DCLN*smoke_during	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*smoke_during	1 Neither before nor During	Yes	0	.	.	.	.
BD_DCLN*DRK6_3L_RAW_	2 Before Only	No	0.0859	1.3935	0.06	0.9509	1.090
BD_DCLN*DRK6_3L_RAW_	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*DRK6_3L_RAW_	3 During Only	No	9.7487	3.4492	2.83	0.0048	17131.35
BD_DCLN*DRK6_3L_RAW_	3 During Only	Yes	0	.	.	.	.
BD_DCLN*DRK6_3L_RAW_	4 Both Before and During	No	-0.2111	0.8967	-0.24	0.8140	0.810
BD_DCLN*DRK6_3L_RAW_	4 Both Before and During	Yes	0	.	.	.	.

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*DRK6_3L_RAW_	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*DRK6_3L_RAW_	1 Neither before nor During	Yes	0	.	.	.	.
BD_DCLN*EXERAPWK_n2	2 Before Only	3 or More Times per Week	-0.1630	0.6996	-0.23	0.8158	0.850
BD_DCLN*EXERAPWK_n2	2 Before Only	< 3 Times per Week	0	.	.	.	.
BD_DCLN*EXERAPWK_n2	3 During Only	3 or More Times per Week	-1.9709	1.3552	-1.45	0.1460	0.139
BD_DCLN*EXERAPWK_n2	3 During Only	< 3 Times per Week	0	.	.	.	.
BD_DCLN*EXERAPWK_n2	4 Both Before and During	3 or More Times per Week	-1.2488	0.5050	-2.47	0.0135	0.287
BD_DCLN*EXERAPWK_n2	4 Both Before and During	< 3 Times per Week	0	.	.	.	.
BD_DCLN*EXERAPWK_n2	1 Neither before nor During	3 or More Times per Week	0	.	.	.	.
BD_DCLN*EXERAPWK_n2	1 Neither before nor During	< 3 Times per Week	0	.	.	.	.
BD_DCLN*VITAMIN_YN	2 Before Only	Yes	-0.3942	0.5911	-0.67	0.5050	0.674
BD_DCLN*VITAMIN_YN	2 Before Only	No	0	.	.	.	.
BD_DCLN*VITAMIN_YN	3 During Only	Yes	1.6127	0.9561	1.69	0.0918	5.016

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*VITAMIN_YN	3 During Only	No	0	.	.	.	.
BD_DCLN*VITAMIN_YN	4 Both Before and During	Yes	0.6599	0.4873	1.35	0.1758	1.935
BD_DCLN*VITAMIN_YN	4 Both Before and During	No	0	.	.	.	.
BD_DCLN*VITAMIN_YN	1 Neither before nor During	Yes	0	.	.	.	.
BD_DCLN*VITAMIN_YN	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*traumatic_st	2 Before Only	No	3.0110	0.9568	3.15	0.0017	20.307
BD_DCLN*traumatic_st	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*traumatic_st	3 During Only	No	0.5725	1.2514	0.46	0.6474	1.773
BD_DCLN*traumatic_st	3 During Only	Yes	0	.	.	.	.
BD_DCLN*traumatic_st	4 Both Before and During	No	1.0479	0.6414	1.63	0.1025	2.852
BD_DCLN*traumatic_st	4 Both Before and During	Yes	0	.	.	.	.
BD_DCLN*traumatic_st	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*traumatic_st	1 Neither before nor During	Yes	0	.	.	.	.
BD_DCLN*financial_st	2 Before Only	No	-0.1106	0.6207	-0.18	0.8586	0.895
BD_DCLN*financial_st	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*financial_st	3 During Only	No	3.3705	1.2923	2.61	0.0092	29.094
BD_DCLN*financial_st	3 During Only	Yes	0	.	.	.	.
BD_DCLN*financial_st	4 Both Before and During	No	0.2845	0.4922	0.58	0.5632	1.329
BD_DCLN*financial_st	4 Both Before and During	Yes	0	.	.	.	.
BD_DCLN*financial_st	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*financial_st	1 Neither before nor During	Yes	0	.	.	.	.

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*partner_stre	**2 Before Only**	**No**	0.9332	0.6608	1.41	0.1580	2.543
BD_DCLN*partner_stre	**2 Before Only**	**Yes**	0	.	.	.	.
BD_DCLN*partner_stre	**3 During Only**	**No**	-0.6475	0.9756	-0.66	0.5070	0.523
BD_DCLN*partner_stre	**3 During Only**	**Yes**	0	.	.	.	.
BD_DCLN*partner_stre	**4 Both Before and During**	**No**	-0.0727	0.5117	-0.14	0.8870	0.930
BD_DCLN*partner_stre	**4 Both Before and During**	**Yes**	0	.	.	.	.
BD_DCLN*partner_stre	**1 Neither before nor During**	**No**	0	.	.	.	.
BD_DCLN*partner_stre	**1 Neither before nor During**	**Yes**	0	.	.	.	.
BD_DCLN*emotional_st	**2 Before Only**	**No**	0.0849	0.7162	0.12	0.9057	1.089
BD_DCLN*emotional_st	**2 Before Only**	**Yes**	0	.	.	.	.
BD_DCLN*emotional_st	**3 During Only**	**No**	-0.9660	1.4052	-0.69	0.4919	0.381
BD_DCLN*emotional_st	**3 During Only**	**Yes**	0	.	.	.	.
BD_DCLN*emotional_st	**4 Both Before and During**	**No**	-0.1838	0.4939	-0.37	0.7098	0.832
BD_DCLN*emotional_st	**4 Both Before and During**	**Yes**	0	.	.	.	.
BD_DCLN*emotional_st	**1 Neither before nor During**	**No**	0	.	.	.	.
BD_DCLN*emotional_st	**1 Neither before nor During**	**Yes**	0	.	.	.	.

Note: The degrees of freedom for the t tests is 2225.

Table H.10: Analysis of Maximum Likelihood Estimates.

Parameter			Label
Intercept			Intercept: PTL=No
MAT_AGE_GROUP_n	**35 Years or More**		Maternal Age Group 35 Years or More
MAT_AGE_GROUP_n	**Below 35 Years**		Maternal Age Group Below 35 Years
maternal_race_n2r	**Black**		Maternal Race (2 Cat) Black
maternal_race_n2r	**White and Other**		Maternal Race (2 Cat) White and Other
mat_edu_yrs2	**12 Years or More**		Maternal Education (2 Cat) 12 Years or More
mat_edu_yrs2	**Below 12 Years**		Maternal Education (2 Cat) Below 12 Years
maritlstatus_n	**Married**		Marital Status Married
maritlstatus_n	**Unmarried**		Marital Status Unmarried
rural_n	**Yes**		Rurality Yes
rural_n	**No**		Rurality No
INCOME7n	**$19,001 to $37,000**		Household Income Categories $19,001 to $37,000
INCOME7n	**$37,001 to $67,000**		Household Income Categories $37,001 to $67,000
INCOME7n	**$67,001 or More**		Household Income Categories $67,001 or More
INCOME7n	**$0 to $19,000**		Household Income Categories $0 to $19,000
PNC_1ST_n2	**Timely (13 Weeks or Earlier)**		Prenatal Care Initiation Timely (13 Weeks or Earlier)
PNC_1ST_n2	**Delayed (After 13 Weeks)**		Prenatal Care Initiation Delayed (After 13 Weeks)
prenatal_ins_n3	**Medicaid**		Medicaid Insurance (Poverty Proxy) 3 Cat Medicaid
prenatal_ins_n3	**Private Insurance/Military/Other**		Medicaid Insurance (Poverty Proxy) 3 Cat Private Insurance/Military/Other
prenatal_ins_n3	**Uninsured**		Medicaid Insurance (Poverty Proxy) 3 Cat Uninsured
DDS_PROB_n	**Yes**		Dental Problem During Pregnancy Yes
DDS_PROB_n	**No**		Dental Problem During Pregnancy No
PREG_TRY_n	**Yes**		Were Trying to Get Pregnant Yes
PREG_TRY_n	**No**		Were Trying to Get Pregnant No

Continued

Parameter			Label
mom_pre_bmi_cat_n	**Obese**		Prepregnancy BMI Obese
mom_pre_bmi_cat_n	**Overweight**		Prepregnancy BMI Overweight
mom_pre_bmi_cat_n	**Underweight**		Prepregnancy BMI Underweight
mom_pre_bmi_cat_n	**Normal**		Prepregnancy BMI Normal
MM_MD_n	**No**		Medical Risk Factor No
MM_MD_n	**Yes**		Medical Risk Factor Yes
SEX_n	**Female**		Newborn Sex Female
SEX_n	**Male**		Newborn Sex Male
PRE_LB_n2	**Yes**		Previous Live Births Yes
PRE_LB_n2	**No**		Previous Live Births No
NewWghtGain	**Less than Recommended**		Maternal Weight Gain Less than Recommended
NewWghtGain	**More than Recommended**		Maternal Weight Gain More than Recommended
NewWghtGain	**Recommended**		Maternal Weight Gain Recommended
MM_HBP_n	**No**		Hypertension During Pregnancy No
MM_HBP_n	**Yes**		Hypertension During Pregnancy Yes
BD_DIAB	**During Only**		Pre-During Diabetes During Only
BD_DIAB	**Neither Before nor During Diabetes**		Pre-During Diabetes Neither Before nor During Diabetes
BD_DIAB	**Diabetes**		Pre-During Diabetes
PREV_LBW_n2	**No**		Previous Low Birth Weight No
PREV_LBW_n2	**Yes**		Previous Low Birth Weight Yes
PREV_PRE_n2	**No**		Previous Preterm Birth No
PREV_PRE_n2	**Yes**		Previous Preterm Birth Yes
BPG_DDS_n	**Yes**		Oral Health Counselling Before Pregnancy Yes
BPG_DDS_n	**No**		Oral Health Counselling Before Pregnancy No
BD_DCLN	**2 Before Only**		Dental Cleaning Before-During Pregnancy 2 Before Only

Continued

Parameter			Label
BD_DCLN	**3 During Only**		Dental Cleaning Before-During Pregnancy 3 During Only
BD_DCLN	**4 Both Before and During**		Dental Cleaning Before-During Pregnancy 4 Both Before and During
BD_DCLN	**1 Neither before nor During**		Dental Cleaning Before-During Pregnancy 1 Neither before nor During
smoke_before_n	**No**		Mom Smoked 3 Months Before Pregnancy No
smoke_before_n	**Yes**		Mom Smoked 3 Months Before Pregnancy Yes
smoke_during_n	**No**		Mom Smoked During Pregnancy No
smoke_during_n	**Yes**		Mom Smoked During Pregnancy Yes
DRK6_3B_RAW_n	**No**		Alcoholic Drinks 3 Months Before Pregnancy No
DRK6_3B_RAW_n	**Yes**		Alcoholic Drinks 3 Months Before Pregnancy Yes
DRK6_3L_RAW_n	**No**		Alcoholic Drinks in Last 3 Months of Pregnancy No
DRK6_3L_RAW_n	**Yes**		Alcoholic Drinks in Last 3 Months of Pregnancy Yes
EXERAPWK_n2	**3 or More Times per Week**		Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week
EXERAPWK_n2	**< 3 Times per Week**		Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
VITAMIN_YN	**Yes**		Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
VITAMIN_YN	**No**		Multivitamin Consumption During Month Before Pregnancy (Y/N) No
PABDHUS	**No**		Physical Abuse Before or During Pregnancy No
PABDHUS	**Yes**		Physical Abuse Before or During Pregnancy Yes
psych_abuse_any	**No**		Any Psychological Abuse During Pregnancy No
psych_abuse_any	**Yes**		Any Psychological Abuse During Pregnancy Yes
traumatic_stress_any	**No**		Any Traumatic Stress No
traumatic_stress_any	**Yes**		Any Traumatic Stress Yes

Continued

Parameter			Label
financial_stress_any	**No**		Any Financial Stress No
financial_stress_any	**Yes**		Any Financial Stress Yes
partner_stress_any_a	**No**		Any Partner Related Stress No
partner_stress_any_a	**Yes**		Any Partner Related Stress Yes
emotional_stress_any	**No**		Any Emotional Stress No
emotional_stress_any	**Yes**		Any Emotional Stress Yes
BD_DCLN*PNC_1ST_n2	**2 Before Only**	**Timely (13 Weeks or Earlier)**	Dental Cleaning Before-During Pregnancy 2 Before Only * Prenatal Care Initiation Timely (13 Weeks or Earlier)
BD_DCLN*PNC_1ST_n2	**2 Before Only**	**Delayed (After 13 Weeks)**	Dental Cleaning Before-During Pregnancy 2 Before Only * Prenatal Care Initiation Delayed (After 13 Weeks)
BD_DCLN*PNC_1ST_n2	**3 During Only**	**Timely (13 Weeks or Earlier)**	Dental Cleaning Before-During Pregnancy 3 During Only * Prenatal Care Initiation Timely (13 Weeks or Earlier)
BD_DCLN*PNC_1ST_n2	**3 During Only**	**Delayed (After 13 Weeks)**	Dental Cleaning Before-During Pregnancy 3 During Only * Prenatal Care Initiation Delayed (After 13 Weeks)
BD_DCLN*PNC_1ST_n2	**4 Both Before and During**	**Timely (13 Weeks or Earlier)**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Prenatal Care Initiation Timely (13 Weeks or Earlier)
BD_DCLN*PNC_1ST_n2	**4 Both Before and During**	**Delayed (After 13 Weeks)**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Prenatal Care Initiation Delayed (After 13 Weeks)
BD_DCLN*PNC_1ST_n2	**1 Neither before nor During**	**Timely (13 Weeks or Earlier)**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Prenatal Care Initiation Timely (13 Weeks or Earlier)

Continued

Parameter			Label
BD_DCLN*PNC_1ST_n2	**1 Neither before nor During**	**Delayed (After 13 Weeks)**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Prenatal Care Initiation Delayed (After 13 Weeks)
BD_DCLN*MM_MD_n	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Medical Risk Factor No
BD_DCLN*MM_MD_n	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Medical Risk Factor Yes
BD_DCLN*MM_MD_n	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Medical Risk Factor No
BD_DCLN*MM_MD_n	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Medical Risk Factor Yes
BD_DCLN*MM_MD_n	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Medical Risk Factor No
BD_DCLN*MM_MD_n	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Medical Risk Factor Yes
BD_DCLN*MM_MD_n	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Medical Risk Factor No
BD_DCLN*MM_MD_n	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Medical Risk Factor Yes
BD_DCLN*MM_HBP_n	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Hypertension During Pregnancy No
BD_DCLN*MM_HBP_n	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Hypertension During Pregnancy Yes
BD_DCLN*MM_HBP_n	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Hypertension During Pregnancy No
BD_DCLN*MM_HBP_n	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Hypertension During Pregnancy Yes

Continued

Parameter			Label
BD_DCLN*MM_HBP_n	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Hypertension During Pregnancy No
BD_DCLN*MM_HBP_n	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Hypertension During Pregnancy Yes
BD_DCLN*MM_HBP_n	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Hypertension During Pregnancy No
BD_DCLN*MM_HBP_n	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Hypertension During Pregnancy Yes
BD_DCLN*BD_DIAB	**2 Before Only**	**During Only**	Dental Cleaning Before-During Pregnancy 2 Before Only * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**2 Before Only**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Pre-During Diabetes Neither Before nor During Diabetes
BD_DCLN*BD_DIAB	**2 Before Only**	**Diabetes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Pre-During Diabetes
BD_DCLN*BD_DIAB	**3 During Only**	**During Only**	Dental Cleaning Before-During Pregnancy 3 During Only * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**3 During Only**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 3 During Only * Pre-During Diabetes Neither Before nor During Diabetes
BD_DCLN*BD_DIAB	**3 During Only**	**Diabetes**	Dental Cleaning Before-During Pregnancy 3 During Only * Pre-During Diabetes

Continued

Parameter			Label
BD_DCLN*BD_DIAB	**4 Both Before and During**	**During Only**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**4 Both Before and During**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Pre-During Diabetes Neither Before nor During Diabetes
BD_DCLN*BD_DIAB	**4 Both Before and During**	**Diabetes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Pre-During Diabetes
BD_DCLN*BD_DIAB	**1 Neither before nor During**	**During Only**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**1 Neither before nor During**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Pre-During Diabetes Neither Before nor During Diabetes
BD_DCLN*BD_DIAB	**1 Neither before nor During**	**Diabetes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Pre-During Diabetes
BD_DCLN*PREV_PRE_n2	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Previous Preterm Birth No
BD_DCLN*PREV_PRE_n2	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Previous Preterm Birth Yes
BD_DCLN*PREV_PRE_n2	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Previous Preterm Birth No
BD_DCLN*PREV_PRE_n2	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Previous Preterm Birth Yes
BD_DCLN*PREV_PRE_n2	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Previous Preterm Birth No
BD_DCLN*PREV_PRE_n2	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Previous Preterm Birth Yes

Continued

Parameter			Label
BD_DCLN*PREV_PRE_n2	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Previous Preterm Birth No
BD_DCLN*PREV_PRE_n2	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Previous Preterm Birth Yes
BD_DCLN*PABDHUS	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Physical Abuse Before or During Pregnancy No
BD_DCLN*PABDHUS	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Physical Abuse Before or During Pregnancy Yes
BD_DCLN*PABDHUS	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Physical Abuse Before or During Pregnancy No
BD_DCLN*PABDHUS	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Physical Abuse Before or During Pregnancy Yes
BD_DCLN*PABDHUS	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Physical Abuse Before or During Pregnancy No
BD_DCLN*PABDHUS	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Physical Abuse Before or During Pregnancy Yes
BD_DCLN*PABDHUS	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Physical Abuse Before or During Pregnancy No
BD_DCLN*PABDHUS	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Physical Abuse Before or During Pregnancy Yes

Continued

Parameter			Label
BD_DCLN*smoke_during	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Mom Smoked During Pregnancy Yes
BD_DCLN*smoke_during	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Mom Smoked During Pregnancy Yes
BD_DCLN*smoke_during	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Mom Smoked During Pregnancy Yes
BD_DCLN*smoke_during	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Mom Smoked During Pregnancy Yes
BD_DCLN*DRK6_3L_RAW_	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Alcoholic Drinks in Last 3 Months of Pregnancy No
BD_DCLN*DRK6_3L_RAW_	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Alcoholic Drinks in Last 3 Months of Pregnancy Yes

Continued

Parameter			Label
BD_DCLN*DRK6_3L_RAW_	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Alcoholic Drinks in Last 3 Months of Pregnancy No
BD_DCLN*DRK6_3L_RAW_	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Alcoholic Drinks in Last 3 Months of Pregnancy Yes
BD_DCLN*DRK6_3L_RAW_	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Alcoholic Drinks in Last 3 Months of Pregnancy No
BD_DCLN*DRK6_3L_RAW_	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Alcoholic Drinks in Last 3 Months of Pregnancy Yes
BD_DCLN*DRK6_3L_RAW_	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Alcoholic Drinks in Last 3 Months of Pregnancy No
BD_DCLN*DRK6_3L_RAW_	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Alcoholic Drinks in Last 3 Months of Pregnancy Yes
BD_DCLN*EXERAPWK_n2	**2 Before Only**	**3 or More Times per Week**	Dental Cleaning Before-During Pregnancy 2 Before Only * Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week
BD_DCLN*EXERAPWK_n2	**2 Before Only**	**< 3 Times per Week**	Dental Cleaning Before-During Pregnancy 2 Before Only * Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
BD_DCLN*EXERAPWK_n2	**3 During Only**	**3 or More Times per Week**	Dental Cleaning Before-During Pregnancy 3 During Only * Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week

Continued

Parameter			Label
BD_DCLN*EXERAPWK_n2	**3 During Only**	**< 3 Times per Week**	Dental Cleaning Before-During Pregnancy 3 During Only * Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
BD_DCLN*EXERAPWK_n2	**4 Both Before and During**	**3 or More Times per Week**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week
BD_DCLN*EXERAPWK_n2	**4 Both Before and During**	**< 3 Times per Week**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
BD_DCLN*EXERAPWK_n2	**1 Neither before nor During**	**3 or More Times per Week**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week
BD_DCLN*EXERAPWK_n2	**1 Neither before nor During**	**< 3 Times per Week**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
BD_DCLN*VITAMIN_YN	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
BD_DCLN*VITAMIN_YN	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Multivitamin Consumption During Month Before Pregnancy (Y/N) No
BD_DCLN*VITAMIN_YN	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
BD_DCLN*VITAMIN_YN	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Multivitamin Consumption During Month Before Pregnancy (Y/N) No

Continued

Parameter			Label
BD_DCLN*VITAMIN_YN	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
BD_DCLN*VITAMIN_YN	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Multivitamin Consumption During Month Before Pregnancy (Y/N) No
BD_DCLN*VITAMIN_YN	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
BD_DCLN*VITAMIN_YN	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Multivitamin Consumption During Month Before Pregnancy (Y/N) No
BD_DCLN*traumatic_st	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Traumatic Stress No
BD_DCLN*traumatic_st	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Traumatic Stress Yes
BD_DCLN*traumatic_st	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Traumatic Stress No
BD_DCLN*traumatic_st	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Traumatic Stress Yes
BD_DCLN*traumatic_st	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Traumatic Stress No
BD_DCLN*traumatic_st	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Traumatic Stress Yes
BD_DCLN*traumatic_st	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Traumatic Stress No
BD_DCLN*traumatic_st	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Traumatic Stress Yes

Continued

Parameter			Label
BD_DCLN*financial_st	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Financial Stress No
BD_DCLN*financial_st	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Financial Stress Yes
BD_DCLN*financial_st	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Financial Stress No
BD_DCLN*financial_st	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Financial Stress Yes
BD_DCLN*financial_st	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Financial Stress No
BD_DCLN*financial_st	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Financial Stress Yes
BD_DCLN*financial_st	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Financial Stress No
BD_DCLN*financial_st	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Financial Stress Yes
BD_DCLN*partner_stre	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Partner Related Stress No
BD_DCLN*partner_stre	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Partner Related Stress Yes
BD_DCLN*partner_stre	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Partner Related Stress No
BD_DCLN*partner_stre	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Partner Related Stress Yes
BD_DCLN*partner_stre	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Partner Related Stress No
BD_DCLN*partner_stre	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Partner Related Stress Yes

Continued

Parameter			Label
BD_DCLN*partner_stre	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Partner Related Stress No
BD_DCLN*partner_stre	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Partner Related Stress Yes
BD_DCLN*emotional_st	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Emotional Stress No
BD_DCLN*emotional_st	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Emotional Stress Yes
BD_DCLN*emotional_st	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Emotional Stress No
BD_DCLN*emotional_st	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Emotional Stress Yes
BD_DCLN*emotional_st	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Emotional Stress No
BD_DCLN*emotional_st	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Emotional Stress Yes
BD_DCLN*emotional_st	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Emotional Stress No
BD_DCLN*emotional_st	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Emotional Stress Yes
Note: The degrees of freedom for the t tests is 2225.			

Table H.11: Association of Predicted Probabilities and Observed Responses.

Percent Concordant	71.8	**Somers' D**	0.443
Percent Discordant	27.5	**Gamma**	0.446
Percent Tied	0.7	**Tau-a**	0.219
Pairs	1226108	**c**	0.722

Table H.12: Odds Ratio Estimates and t Confidence Intervals.

Effect	Unit	Estimate	95% Confidence Limits	
MAT_AGE_GROUP_n 35 Years or More versus Below 35 Years	1.0000	1.920	1.067	3.456
maternal_race_n2r Black versus White and Other	1.0000	1.833	1.076	3.122
mat_edu_yrs2 12 Years or More versus Below 12 Years	1.0000	1.108	0.598	2.054
maritlstatus_n Married versus Unmarried	1.0000	1.306	0.659	2.588
rural_n Yes versus No	1.0000	1.179	0.662	2.100
INCOME7n $19,001 to $37,000 versus $0 to $19,000	1.0000	0.540	0.298	0.978
INCOME7n $37,001 to $67,000 versus $0 to $19,000	1.0000	0.464	0.217	0.995
INCOME7n $67,001 or More versus $0 to $19,000	1.0000	0.565	0.228	1.398
prenatal_ins_n3 Medicaid versus Uninsured	1.0000	1.060	0.304	3.692
prenatal_ins_n3 Private Insurance/Military/Other versus Uninsured	1.0000	1.084	0.283	4.148
DDS_PROB_n Yes versus No	1.0000	0.854	0.492	1.481
PREG_TRY_n Yes versus No	1.0000	0.719	0.365	1.415
mom_pre_bmi_cat_n Obese versus Normal	1.0000	1.123	0.642	1.963
mom_pre_bmi_cat_n Overweight versus Normal	1.0000	1.060	0.573	1.960
mom_pre_bmi_cat_n Underweight versus Normal	1.0000	1.232	0.476	3.186
SEX_n Female versus Male	1.0000	1.235	0.774	1.970
PRE_LB_n2 Yes versus No	1.0000	0.426	0.256	0.710
NewWghtGain Less than Recommended versus Recommended	1.0000	1.400	0.824	2.378
NewWghtGain More than Recommended versus Recommended	1.0000	0.709	0.388	1.298
PREV_LBW_n2 No versus Yes	1.0000	0.576	0.212	1.566
BPG_DDS_n Yes versus No	1.0000	2.322	1.022	5.277
smoke_before_n No versus Yes	1.0000	1.132	0.597	2.147

Continued

Effect	Unit	Estimate	95% Confidence Limits	
DRK6_3B_RAW_n No versus Yes	1.0000	0.646	0.383	1.089
psych_abuse_any No versus Yes	1.0000	0.328	0.107	1.008
Note: The degrees of freedom in computing the confidence limits is 2225.				

Table H.13: Four Category Dental Cleaning SAS Input and Output: Association of Dental Cleaning With Preterm Birth Including Interactions.

Multivariable Model Selection Steps:			
Step	**Dropped Variable**	**p-value**	**Remarks**
1	prenatal_ins_n3	0.99	Highest p-value
2	mom_pre_bmi_cat_n	0.97	Highest p-value
3	BD_DCLN*emotional_stress_any_ai	0.89	Highest p-value
4	BD_DCLN*MM_MD_n	0.93	Highest p-value
5	emotional_stress_any_ai	0.81	Highest p-value
6	mat_edu_yrs2	0.77	Highest p-value
7	smoke_before_n	0.68	Highest p-value
8	rural_n	0.57	Not highest p-value[1]
9	BD_DCLN*partner_stress_any_ai	0.58	Not highest p-value[1]
10	BD_DCLN*PREV_PRE_n2	0.60	Not highest p-value[1]
11	DDS_PROB_n	0.59	Not highest p-value[1]
12	maritlstatus_n	0.43	Not highest p-value[1]
13	PREV_LBW_n2	0.42	Not highest p-value[1]
14	SEX_n	0.41	Not highest p-value[1]
15	PREG_TRY_n	0.36	Not highest p-value[1]
16	BD_DCLN*MM_HBP_n	0.34	Not highest p-value[1]
17	MM_HBP_n	0.48	Not highest p-value[1]
18	BD_DCLN*PABDHUS	0.34	Not highest p-value[1]
19	PABDHUS	0.77	Highest p-value
20	partner_stress_any_ai	0.23	Not highest p-value[1]
21	BD_DCLN*VITAMIN_YN	0.14	Not highest p-value[1]
22	VITAMIN_YN	0.53	Not highest p-value[1]
23	BD_DCLN*financial_stress_any_ai	0.18	Not highest p-value[1,2]
24	BD_DCLN*PNC_1ST_n2	0.25	Not highest p-value[1]
25	PNC_1ST_n2	0.57	Not highest p-value[1]
26	BD_DCLN*DRK6_3L_RAW_n	0.16	Not highest p-value[1]
27	DRK6_3L_RAW_n	0.31	Not highest p-value[1]
28	financial_stress_any_ai	0.16	Not highest p-value[1]
29	BD_DCLN*EXERAPWK_n2	0.12	Not highest p-value[1]
30	EXERAPWK_n2	0.39	Highest p-value

Continued

Multivariable Model Selection Steps:			
Step	**Dropped Variable**	**p-value**	**Remarks**
31	DRK6_3B_RAW_n	0.18	Not highest p-value[1]
32	INCOME7n	0.13	Not highest p-value[1]

[1]*There were variable(s) with higher p-value(s) but were retained as their interaction(s) were still in the model. Main effects cannot be dropped while associated interaction(s) are still in the model. The associated p-value was highest after these noted variables.*

[2]*There were variable(s) with higher p-value(s) decided to be must keep variables in the model. The associated p-value was highest after these noted variables.*

APPENDIX I

ASSOCIATION OF DENTAL CLEANING WITH PRETERM BIRTH: USING DENTAL CLEANING AS A 4-CATEGORY VARIABLE (SAS INPUT AND OUTPUT WITH INTERACTIONS)

SELECTED MODELS

```
*--- Dental cleaning is main exposure
*--- Manual Backward Model Building
*--- See steps recorded separately
*--- With interaction selected model;
ods rtf file =
'F:\University of South Carolina\WILLIAMS, MONIQUE - Dissertation for Monique
Williams\Post Defense Outputs\
20200404_Objective_3a_w_Interaction_Selected_Model_Binary_Logistic_Regression_
Outputs.rtf';
ods graphics on;
/*ods output ModelANOVA = type3table2;*/
proc surveylogistic data = prep_prams1215;
strata STRAT_YR_n;
weight WTANAL;
class
```

```
BD_DCLN(ref = '1 Neither before nor During')
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n(ref = "Below 35 Years")
maternal_race_n2r(ref = "White and Other")
mat_edu_yrs2(ref = "Below 12 Years")
maritlstatus_n(ref = "Unmarried")
/*--- Enabling Factors*/
rural_n(ref = "No")
INCOME7n(ref = "$0 to $19,000")
PNC_1ST_n2(ref = "Delayed (After 13 Weeks)")
prenatal_ins_n3(ref = "Uninsured")
/*--- Need Factors*/
DDS_PROB_n(ref = "No")
PREG_TRY_n(ref = "No")
/*Biological Factors*/
mom_pre_bmi_cat_n(ref = "Normal")
MM_MD_n(ref = "Yes")
SEX_n(ref = "Male")
PRE_LB_n2(ref = "No")
NewWghtGain(ref = "Recommended")
MM_HBP_n(ref = "Yes")
BD_DIAB (ref = "Diabetes")
PREV_LBW_n2(ref = "Yes")
```

```
PREV_PRE_n2(ref = "Yes")
/*Health Behaviors*/
BPG_DDS_n(ref = "No")
smoke_before_n(ref = "Yes")
smoke_during_n(ref = "Yes")
/*DRK_2YRS_n(ref = "No") */
DRK6_3B_RAW_n(ref = "Yes")
DRK6_3L_RAW_n(ref = "Yes")
EXERAPWK_n2(ref = "< 3 Times per Week")
VITAMIN_YN(ref = "No")
/*Psychobiological Factors*/
PABDHUS(ref = "Yes")
psych_abuse_any(ref = "Yes")
traumatic_stress_any_ai(ref = "Yes")
financial_stress_any_ai(ref = "Yes")
partner_stress_any_ai(ref = "Yes")
emotional_stress_any_ai(ref = "Yes")
/ param = glm;
model PTL (event = 'Yes') =
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n maternal_race_n2r
/*--- Enabling Factors*/
/**/
```

```
/*--- Need Factors*/
/**/
/*--- Biological Factors*/
MM_MD_n PRE_LB_n2 NewWghtGain BD_DIAB PREV_PRE_n2
/*--- Health Behaviors*/
BPG_DDS_n BD_DCLN smoke_during_n
/*-- Psychobiological factors*/
psych_abuse_any
traumatic_stress_any_ai
/*--- Interactions*/
BD_DCLN*BD_DIAB
BD_DCLN*smoke_during_n
BD_DCLN*traumatic_stress_any_ai
/ expb clodds rsquare PARMLABEL;
/*--- Interaction Contrasts*/
lsmeans BD_DCLN*BD_DIAB /oddsratio cl diff plots = none;
lsmeans BD_DCLN*smoke_during_n /oddsratio cl diff plots = none;
lsmeans BD_DCLN*traumatic_stress_any_ai /oddsratio cl diff plots = none;
/**/
title 'Objective 3a Binary Logistic Regression, w interaction Selected Model';
run;
ods rtf close;
```

Table I.1: Model Information.

Data Set	WORK.PREP_PRAMS1215	
Response Variable	PTL	Preterm Labor
Number of Response Levels	2	
Stratum Variable	STRAT_YR_n	
Number of Strata	4	
Weight Variable	WTANAL	BC WT: ANALYSIS WT
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Table I.2: Variance Estimation.

Method	Taylor Series
Variance Adjustment	Degrees of Freedom (DF)

Table I.3: Observations and Weights.

Number of Observations Read	2870
Number of Observations Used	2229
Sum of Weights Read	208452.5
Sum of Weights Used	164987.4

Table I.4: Response Profile.

Ordered Value	PTL	Total Frequency	Total Weight
1	No	988	150356.99
2	Yes	1241	14630.45

Probability modeled is PTL='Yes'.

Note: 641 observations were deleted due to missing values for the response or explanatory variables.

Table I.5: Class Level Information.

Class	Value	Design Variables			
BD_DCLN	**2 Before Only**	1	0	0	0
	3 During Only	0	1	0	0
	4 Both Before and During	0	0	1	0
	1 Neither before nor During	0	0	0	1
MAT_AGE_GROUP_n	**35 Years or More**	1	0		
	Below 35 Years	0	1		
maternal_race_n2r	**Black**	1	0		
	White and Other	0	1		
MM_MD_n	**No**	1	0		
	Yes	0	1		
PRE_LB_n2	**Yes**	1	0		
	No	0	1		
NewWghtGain	**Less than Recommended**	1	0	0	
	More than Recommended	0	1	0	
	Recommended	0	0	1	
BD_DIAB	**During Only**	1	0	0	
	Neither Before nor During Diabetes	0	1	0	
	Diabetes	0	0	1	
PREV_PRE_n2	**No**	1	0		
	Yes	0	1		
BPG_DDS_n	**Yes**	1	0		
	No	0	1		
smoke_during_n	**No**	1	0		

Continued

Class	Value	Design Variables			
	Yes	0	1		
psych_abuse_any	**No**	1	0		
	Yes	0	1		
traumatic_stress_any_ai	**No**	1	0		
	Yes	0	1		

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Table I.6: Model Fit Statistics.

Criterion	Intercept Only	Intercept and Covariates
AIC	98817.649	87185.700
SC	98827.663	87476.095
-2 Log L	98815.649	87127.700

R-Square 0.0684

Max-rescaled R-Square 0.1518

Table I.7: Testing Global Null Hypothesis: BETA=0.

Test	F Value	Num DF	Den DF	Pr > F
Likelihood Ratio	417.43	27.9995	69691	<.0001
Score	4.63	28	2462	<.0001
Wald	4.50	28	2462	<.0001
Note: Second-order Rao-Scott design correction 0.0000 applied to the Likelihood Ratio test.				

Table I.8: Type 3 Analysis of Effects.

Effect	F Value	Num DF	Den DF	Pr > F
MAT_AGE_GROUP_n	3.65	1	2489	0.0562
maternal_race_n2r	7.87	1	2489	0.0051
MM_MD_n	17.86	1	2489	<.0001
PRE_LB_n2	10.33	1	2489	0.0013
NewWghtGain	3.64	2	2488	0.0263
BD_DIAB	3.48	2	2488	0.0310
PREV_PRE_n2	3.89	1	2489	0.0486
BPG_DDS_n	3.56	1	2489	0.0593
BD_DCLN	1.99	3	2487	0.1132
smoke_during_n	1.91	1	2489	0.1673
psych_abuse_any	10.69	1	2489	0.0011
traumatic_stress_any	7.65	1	2489	0.0057
BD_DCLN*BD_DIAB	2.08	6	2484	0.0523
BD_DCLN*smoke_during	2.15	3	2487	0.0920
BD_DCLN*traumatic_st	4.49	3	2487	0.0038

Table I.9: Analysis of Maximum Likelihood Estimates.

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
Intercept			-0.1065	1.0165	-0.10	0.9165	0.899
MAT_AGE_GROUP_n	35 Years or More		0.5769	0.3020	1.91	0.0562	1.781
MAT_AGE_GROUP_n	Below 35 Years		0	.	.	.	.
maternal_race_n2r	Black		0.6480	0.2309	2.81	0.0051	1.912
maternal_race_n2r	White and Other		0	.	.	.	.
MM_MD_n	No		-1.0314	0.2440	-4.23	<.0001	0.357
MM_MD_n	Yes		0	.	.	.	.
PRE_LB_n2	Yes		-0.7554	0.2351	-3.21	0.0013	0.470
PRE_LB_n2	No		0	.	.	.	.
NewWghtGain	Less than Recommended		0.3880	0.2585	1.50	0.1334	1.474
NewWghtGain	More than Recommended		-0.3219	0.2798	-1.15	0.2500	0.725
NewWghtGain	Recommended		0	.	.	.	.
BD_DIAB	During Only		0.00788	0.9177	0.01	0.9931	1.008
BD_DIAB	Neither Before nor During Diabetes		0.4720	0.8175	0.58	0.5638	1.603
BD_DIAB	Diabetes		0	.	.	.	.
PREV_PRE_n2	No		-0.6674	0.3382	-1.97	0.0486	0.513
PREV_PRE_n2	Yes		0	.	.	.	.
BPG_DDS_n	Yes		0.7174	0.3802	1.89	0.0593	2.049
BPG_DDS_n	No		0	.	.	.	.
BD_DCLN	2 Before Only		1.0431	1.2801	0.81	0.4152	2.838
BD_DCLN	3 During Only		-1.0794	2.4970	-0.43	0.6656	0.340
BD_DCLN	4 Both Before and During		-0.6049	1.3370	-0.45	0.6510	0.546
BD_DCLN	1 Neither before nor During		0	.	.	.	.

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
smoke_during_n	**No**		0.5176	0.3522	1.47	0.1418	1.678
smoke_during_n	**Yes**		0	.	.	.	.
psych_abuse_any	**No**		-1.3565	0.4148	-3.27	0.0011	0.258
psych_abuse_any	**Yes**		0	.	.	.	.
traumatic_stress_any	**No**		-0.3145	0.3732	-0.84	0.3995	0.730
traumatic_stress_any	**Yes**		0	.	.	.	.
BD_DCLN*BD_DIAB	**2 Before Only**	**During Only**	-1.5183	1.6221	-0.94	0.3493	0.219
BD_DCLN*BD_DIAB	**2 Before Only**	**Neither Before nor During Diabetes**	-1.9090	1.1409	-1.67	0.0944	0.148
BD_DCLN*BD_DIAB	**2 Before Only**	**Diabetes**	0	.	.	.	.
BD_DCLN*BD_DIAB	**3 During Only**	**During Only**	-1.0491	1.6708	-0.63	0.5301	0.350
BD_DCLN*BD_DIAB	**3 During Only**	**Neither Before nor During Diabetes**	1.3924	1.4335	0.97	0.3315	4.025
BD_DCLN*BD_DIAB	**3 During Only**	**Diabetes**	0	.	.	.	.
BD_DCLN*BD_DIAB	**4 Both Before and During**	**During Only**	-1.4812	1.2007	-1.23	0.2175	0.227
BD_DCLN*BD_DIAB	**4 Both Before and During**	**Neither Before nor During Diabetes**	-0.1883	1.0702	-0.18	0.8604	0.828
BD_DCLN*BD_DIAB	**4 Both Before and During**	**Diabetes**	0	.	.	.	.
BD_DCLN*BD_DIAB	**1 Neither before nor During**	**During Only**	0	.	.	.	.

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*BD_DIAB	1 Neither before nor During	Neither Before nor During Diabetes	0	.	.	.	.
BD_DCLN*BD_DIAB	1 Neither before nor During	Diabetes	0	.	.	.	.
BD_DCLN*smoke_during	2 Before Only	No	-2.4157	1.0210	-2.37	0.0181	0.089
BD_DCLN*smoke_during	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*smoke_during	3 During Only	No	-1.4932	1.4366	-1.04	0.2987	0.225
BD_DCLN*smoke_during	3 During Only	Yes	0	.	.	.	.
BD_DCLN*smoke_during	4 Both Before and During	No	-0.6426	0.6357	-1.01	0.3122	0.526
BD_DCLN*smoke_during	4 Both Before and During	Yes	0	.	.	.	.
BD_DCLN*smoke_during	1 Neither before nor During	No	0	.	.	.	.
BD_DCLN*smoke_during	1 Neither before nor During	Yes	0	.	.	.	.
BD_DCLN*traumatic_st	2 Before Only	No	3.1470	0.9170	3.43	0.0006	23.267
BD_DCLN*traumatic_st	2 Before Only	Yes	0	.	.	.	.
BD_DCLN*traumatic_st	3 During Only	No	1.0017	1.0895	0.92	0.3580	2.723
BD_DCLN*traumatic_st	3 During Only	Yes	0	.	.	.	.
BD_DCLN*traumatic_st	4 Both Before and During	No	1.2104	0.6000	2.02	0.0438	3.355
BD_DCLN*traumatic_st	4 Both Before and During	Yes	0	.	.	.	.
BD_DCLN*traumatic_st	1 Neither before nor During	No	0	.	.	.	.

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
BD_DCLN*traumatic_st	**1 Neither before nor During**	**Yes**	0	.	.	.	.
Note: The degrees of freedom for the t tests is 2489.							

Table I.10: Analysis of Maximum Likelihood Estimates.

Parameter			Label
Intercept			Intercept: PTL=No
MAT_AGE_GROUP_n	**35 Years or More**		Maternal Age Group 35 Years or More
MAT_AGE_GROUP_n	**Below 35 Years**		Maternal Age Group Below 35 Years
maternal_race_n2r	**Black**		Maternal Race (2 Cat) Black
maternal_race_n2r	**White and Other**		Maternal Race (2 Cat) White and Other
MM_MD_n	**No**		Medical Risk Factor No
MM_MD_n	**Yes**		Medical Risk Factor Yes
PRE_LB_n2	**Yes**		Previous Live Births Yes
PRE_LB_n2	**No**		Previous Live Births No
NewWghtGain	**Less than Recommended**		Maternal Weight Gain Less than Recommended
NewWghtGain	**More than Recommended**		Maternal Weight Gain More than Recommended
NewWghtGain	**Recommended**		Maternal Weight Gain Recommended
BD_DIAB	**During Only**		Pre-During Diabetes During Only
BD_DIAB	**Neither Before nor During Diabetes**		Pre-During Diabetes Neither Before nor During Diabetes
BD_DIAB	**Diabetes**		Pre-During Diabetes
PREV_PRE_n2	**No**		Previous Preterm Birth No
PREV_PRE_n2	**Yes**		Previous Preterm Birth Yes
BPG_DDS_n	**Yes**		Oral Health Counselling Before Pregnancy Yes

Continued

Parameter			Label
BPG_DDS_n	**No**		Oral Health Counselling Before Pregnancy No
BD_DCLN	**2 Before Only**		Dental Cleaning Before-During Pregnancy 2 Before Only
BD_DCLN	**3 During Only**		Dental Cleaning Before-During Pregnancy 3 During Only
BD_DCLN	**4 Both Before and During**		Dental Cleaning Before-During Pregnancy 4 Both Before and During
BD_DCLN	**1 Neither before nor During**		Dental Cleaning Before-During Pregnancy 1 Neither before nor During
smoke_during_n	**No**		Mom Smoked During Pregnancy No
smoke_during_n	**Yes**		Mom Smoked During Pregnancy Yes
psych_abuse_any	**No**		Any Psychological Abuse During Pregnancy No
psych_abuse_any	**Yes**		Any Psychological Abuse During Pregnancy Yes
traumatic_stress_any	**No**		Any Traumatic Stress No
traumatic_stress_any	**Yes**		Any Traumatic Stress Yes
BD_DCLN*BD_DIAB	**2 Before Only**	**During Only**	Dental Cleaning Before-During Pregnancy 2 Before Only * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**2 Before Only**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Pre-During Diabetes Neither Before nor During Diabetes
BD_DCLN*BD_DIAB	**2 Before Only**	**Diabetes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Pre-During Diabetes
BD_DCLN*BD_DIAB	**3 During Only**	**During Only**	Dental Cleaning Before-During Pregnancy 3 During Only * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**3 During Only**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 3 During Only * Pre-During Diabetes Neither Before nor During Diabetes

Continued

Parameter			Label
BD_DCLN*BD_DIAB	**3 During Only**	**Diabetes**	Dental Cleaning Before-During Pregnancy 3 During Only * Pre-During Diabetes
BD_DCLN*BD_DIAB	**4 Both Before and During**	**During Only**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**4 Both Before and During**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Pre-During Diabetes Neither Before nor During Diabetes
BD_DCLN*BD_DIAB	**4 Both Before and During**	**Diabetes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Pre-During Diabetes
BD_DCLN*BD_DIAB	**1 Neither before nor During**	**During Only**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Pre-During Diabetes During Only
BD_DCLN*BD_DIAB	**1 Neither before nor During**	**Neither Before nor During Diabetes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Pre-During Diabetes Neither Before nor During Diabetes
BD_DCLN*BD_DIAB	**1 Neither before nor During**	**Diabetes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Pre-During Diabetes
BD_DCLN*smoke_during	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Mom Smoked During Pregnancy Yes
BD_DCLN*smoke_during	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Mom Smoked During Pregnancy Yes

Continued

Parameter			Label
BD_DCLN*smoke_during	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Mom Smoked During Pregnancy Yes
BD_DCLN*smoke_during	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Mom Smoked During Pregnancy No
BD_DCLN*smoke_during	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Mom Smoked During Pregnancy Yes
BD_DCLN*traumatic_st	**2 Before Only**	**No**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Traumatic Stress No
BD_DCLN*traumatic_st	**2 Before Only**	**Yes**	Dental Cleaning Before-During Pregnancy 2 Before Only * Any Traumatic Stress Yes
BD_DCLN*traumatic_st	**3 During Only**	**No**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Traumatic Stress No
BD_DCLN*traumatic_st	**3 During Only**	**Yes**	Dental Cleaning Before-During Pregnancy 3 During Only * Any Traumatic Stress Yes
BD_DCLN*traumatic_st	**4 Both Before and During**	**No**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Traumatic Stress No
BD_DCLN*traumatic_st	**4 Both Before and During**	**Yes**	Dental Cleaning Before-During Pregnancy 4 Both Before and During * Any Traumatic Stress Yes
BD_DCLN*traumatic_st	**1 Neither before nor During**	**No**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Traumatic Stress No

Continued

Parameter			Label
BD_DCLN*traumatic_st	**1 Neither before nor During**	**Yes**	Dental Cleaning Before-During Pregnancy 1 Neither before nor During * Any Traumatic Stress Yes
Note: The degrees of freedom for the t tests is 2489.			

Table I.11: Association of Predicted Probabilities and Observed Responses

.Percent Concordant	73.9	**Somers' D**	0.487
Percent Discordant	25.2	**Gamma**	0.492
Percent Tied	0.9	**Tau-a**	0.241
Pairs	1226108	**c**	0.744

Table I.12: Odds Ratio Estimates and t Confidence Intervals.

Effect	Unit	Estimate	95% Confidence Limits	
MAT_AGE_GROUP_n 35 Years or More versus Below 35 Years	1.0000	1.781	0.985	3.219
maternal_race_n2r Black versus White and Other	1.0000	1.912	1.215	3.006
MM_MD_n No versus Yes	1.0000	0.357	0.221	0.575
PRE_LB_n2 Yes versus No	1.0000	0.470	0.296	0.745
NewWghtGain Less than Recommended versus Recommended	1.0000	1.474	0.888	2.447
NewWghtGain More than Recommended versus Recommended	1.0000	0.725	0.419	1.254
PREV_PRE_n2 No versus Yes	1.0000	0.513	0.264	0.996
BPG_DDS_n Yes versus No	1.0000	2.049	0.972	4.319
psych_abuse_any No versus Yes	1.0000	0.258	0.114	0.581
Note: The degrees of freedom in computing the confidence limits is 2489.				

Table I.13: BD_DCLN*BD_DIAB Least Squares Means.

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper
2 Before Only	During Only	-1.0188	1.0411	2489	-0.98	0.3279	0.05	-3.0602	1.0226
2 Before Only	Neither Before nor During Diabetes	-0.9454	0.4272	2489	-2.21	0.0270	0.05	-1.7830	-0.1078
2 Before Only	Diabetes	0.4916	0.8005	2489	0.61	0.5391	0.05	-1.0780	2.0613
3 During Only	During Only	-3.2835	1.4851	2489	-2.21	0.0271	0.05	-6.1957	-0.3712
3 During Only	Neither Before nor During Diabetes	-0.3778	0.7450	2489	-0.51	0.6121	0.05	-1.8388	1.0831
3 During Only	Diabetes	-2.2422	1.3725	2489	-1.63	0.1024	0.05	-4.9336	0.4491
4 Both Before and During	During Only	-2.7114	0.5031	2489	-5.39	<.0001	0.05	-3.6979	-1.7250
4 Both Before and During	Neither Before nor During Diabetes	-0.9544	0.4154	2489	-2.30	0.0217	0.05	-1.7690	-0.1398
4 Both Before and During	Diabetes	-1.2381	0.7974	2489	-1.55	0.1206	0.05	-2.8017	0.3255
1 Neither before nor During	During Only	-0.9092	0.5502	2489	-1.65	0.0986	0.05	-1.9882	0.1697
1 Neither before nor During	Neither Before nor During Diabetes	-0.4452	0.3341	2489	-1.33	0.1829	0.05	-1.1003	0.2100
1 Neither before nor During	Diabetes	-0.9171	0.8276	2489	-1.11	0.2679	0.05	-2.5400	0.7057

Table I.14: Differences of BD_DCLN*BD_DIAB Least Squares Means.

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
2 Before Only	During Only	2 Before Only	Neither Before nor During Diabetes	-0.07340	1.1039	2489	-0.07	0.9470	0.05
2 Before Only	During Only	2 Before Only	Diabetes	-1.5104	1.3061	2489	-1.16	0.2476	0.05
2 Before Only	During Only	3 During Only	During Only	2.2647	1.7761	2489	1.28	0.2024	0.05
2 Before Only	During Only	3 During Only	Neither Before nor During Diabetes	-0.6410	1.2358	2489	-0.52	0.6040	0.05
2 Before Only	During Only	3 During Only	Diabetes	1.2234	1.6827	2489	0.73	0.4672	0.05
2 Before Only	During Only	4 Both Before and During	During Only	1.6926	1.0563	2489	1.60	0.1092	0.05
2 Before Only	During Only	4 Both Before and During	Neither Before nor During Diabetes	-0.06441	1.0785	2489	-0.06	0.9524	0.05
2 Before Only	During Only	4 Both Before and During	Diabetes	0.2193	1.2348	2489	0.18	0.8591	0.05
2 Before Only	During Only	1 Neither before nor During	During Only	-0.1095	1.1067	2489	-0.10	0.9212	0.05
2 Before Only	During Only	1 Neither Before nor During	Neither Before nor During Diabetes	-0.5736	1.0531	2489	-0.54	0.5860	0.05
2 Before Only	During Only	1 Neither Before nor During	Diabetes	-0.1017	1.2797	2489	-0.08	0.9367	0.05
2 Before Only	Neither Before nor During Diabetes	2 Before Only	Diabetes	-1.4370	0.8019	2489	-1.79	0.0733	0.05

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
2 Before Only	Neither Before nor During Diabetes	3 During Only	During Only	2.3381	1.5246	2489	1.53	0.1253	0.05
2 Before Only	Neither Before nor During Diabetes	3 During Only	Neither Before nor During Diabetes	-0.5676	0.7407	2489	-0.77	0.4436	0.05
2 Before Only	Neither Before nor During Diabetes	3 During Only	Diabetes	1.2968	1.3808	2489	0.94	0.3477	0.05
2 Before Only	Neither Before nor During Diabetes	4 Both Before and During	During Only	1.7660	0.5684	2489	3.11	0.0019	0.05
2 Before Only	Neither Before nor During Diabetes	4 Both Before and During	Neither Before nor During Diabetes	0.008993	0.4093	2489	0.02	0.9825	0.05
2 Before Only	Neither Before nor During Diabetes	4 Both Before and During	Diabetes	0.2927	0.8544	2489	0.34	0.7320	0.05
2 Before Only	Neither Before nor During Diabetes	1 Neither Before nor During	During Only	-0.03615	0.5867	2489	-0.06	0.9509	0.05
2 Before Only	Neither Before nor During Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-0.5002	0.3614	2489	-1.38	0.1664	0.05

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
2 Before Only	Neither Before nor During Diabetes	1 Neither Before nor During	Diabetes	-0.02827	0.9122	2489	-0.03	0.9753	0.05
2 Before Only	Diabetes	3 During Only	During Only	3.7751	1.6687	2489	2.26	0.0238	0.05
2 Before Only	Diabetes	3 During Only	Neither Before nor During Diabetes	0.8695	1.0176	2489	0.85	0.3930	0.05
2 Before Only	Diabetes	3 During Only	Diabetes	2.7339	1.5264	2489	1.79	0.0734	0.05
2 Before Only	Diabetes	4 Both Before and During	During Only	3.2031	0.8784	2489	3.65	0.0003	0.05
2 Before Only	Diabetes	4 Both Before and During	Neither Before nor During Diabetes	1.4460	0.7941	2489	1.82	0.0687	0.05
2 Before Only	Diabetes	4 Both Before and During	Diabetes	1.7297	1.0774	2489	1.61	0.1085	0.05
2 Before Only	Diabetes	1 Neither Before nor During	During Only	1.4009	0.8908	2489	1.57	0.1159	0.05
2 Before Only	Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	0.9368	0.7730	2489	1.21	0.2257	0.05
2 Before Only	Diabetes	1 Neither Before nor During	Diabetes	1.4088	1.1355	2489	1.24	0.2149	0.05
3 During Only	During Only	3 During Only	Neither Before nor During Diabetes	-2.9056	1.3231	2489	-2.20	0.0282	0.05
3 During Only	During Only	3 During Only	Diabetes	-1.0412	1.3614	2489	-0.76	0.4444	0.05
3 During Only	During Only	4 Both Before and During	During Only	-0.5720	1.5596	2489	-0.37	0.7138	0.05

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
3 During Only	During Only	4 Both Before and During	Neither Before nor During Diabetes	-2.3291	1.5219	2489	-1.53	0.1260	0.05
3 During Only	During Only	4 Both Before and During	Diabetes	-2.0454	1.6826	2489	-1.22	0.2243	0.05
3 During Only	During Only	1 Neither Before nor During	During Only	-2.3742	1.5697	2489	-1.51	0.1305	0.05
3 During Only	During Only	1 Neither Before nor During	Neither Before nor During Diabetes	-2.8383	1.5014	2489	-1.89	0.0588	0.05
3 During Only	During Only	1 Neither Before nor During	Diabetes	-2.3663	1.7069	2489	-1.39	0.1658	0.05
3 During Only	Neither Before nor During Diabetes	3 During Only	Diabetes	1.8644	1.1519	2489	1.62	0.1057	0.05
3 During Only	Neither Before nor During Diabetes	4 Both Before and During	During Only	2.3336	0.8337	2489	2.80	0.0052	0.05
3 During Only	Neither Before nor During Diabetes	4 Both Before and During	Neither Before nor During Diabetes	0.5766	0.7376	2489	0.78	0.4345	0.05
3 During Only	Neither Before nor During Diabetes	4 Both Before and During	Diabetes	0.8603	1.0511	2489	0.82	0.4132	0.05
3 During Only	Neither Before nor During Diabetes	1 Neither Before nor During	During Only	0.5314	0.8492	2489	0.63	0.5315	0.05

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
3 During Only	Neither Before nor During Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	0.06732	0.7124	2489	0.09	0.9247	0.05
3 During Only	Neither Before nor During Diabetes	1 Neither before nor During	Diabetes	0.5393	1.1007	2489	0.49	0.6242	0.05
3 During Only	Diabetes	4 Both Before and During	During Only	0.4692	1.4266	2489	0.33	0.7423	0.05
3 During Only	Diabetes	4 Both Before and During	Neither Before nor During Diabetes	-1.2879	1.3671	2489	-0.94	0.3463	0.05
3 During Only	Diabetes	4 Both Before and During	Diabetes	-1.0041	1.5566	2489	-0.65	0.5189	0.05
3 During Only	Diabetes	1 Neither Before nor During	During Only	-1.3330	1.4381	2489	-0.93	0.3541	0.05
3 During Only	Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-1.7971	1.3601	2489	-1.32	0.1865	0.05
3 During Only	Diabetes	1 Neither Before nor During	Diabetes	-1.3251	1.6167	2489	-0.82	0.4125	0.05
4 Both Before and During	During Only	4 Both Before and During	Neither Before nor During Diabetes	-1.7570	0.4245	2489	-4.14	<.0001	0.05
4 Both Before and During	During Only	4 Both Before and During	Diabetes	-1.4733	0.7851	2489	-1.88	0.0607	0.05
4 Both Before and During	During Only	1 Neither Before nor During	During Only	-1.8022	0.6618	2489	-2.72	0.0065	0.05

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
4 Both Before and During	During Only	1 Neither Before nor During	Neither Before nor During Diabetes	-2.2663	0.5086	2489	-4.46	<.0001	0.05
4 Both Before and During	During Only	1 Neither Before nor During	Diabetes	-1.7943	0.9347	2489	-1.92	0.0550	0.05
4 Both Before and During	Neither Before nor During Diabetes	4 Both Before and During	Diabetes	0.2837	0.7548	2489	0.38	0.7070	0.05
4 Both Before and During	Neither Before nor During Diabetes	1 Neither Before nor During	During Only	-0.04514	0.5737	2489	-0.08	0.9373	0.05
4 Both Before and During	Neither Before nor During Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-0.5092	0.3497	2489	-1.46	0.1454	0.05
4 Both Before and During	Neither Before nor During Diabetes	1 Neither Before nor During	Diabetes	-0.03726	0.9046	2489	-0.04	0.9671	0.05
4 Both Before and During	Diabetes	1 Neither Before nor During	During Only	-0.3288	0.9247	2489	-0.36	0.7222	0.05
4 Both Before and During	Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-0.7929	0.8189	2489	-0.97	0.3330	0.05
4 Both Before and During	Diabetes	1 Neither Before nor During	Diabetes	-0.3210	1.1287	2489	-0.28	0.7762	0.05
1 Neither Before nor During	During Only	1 Neither Before nor During	Neither Before nor During Diabetes	-0.4641	0.4889	2489	-0.95	0.3425	0.05

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
1 Neither Before nor During	During Only	1 Neither Before nor During	Diabetes	0.007880	0.9177	2489	0.01	0.9931	0.05
1 Neither Before nor During	Neither Before nor During Diabetes	1 Neither Before nor During	Diabetes	0.4720	0.8175	2489	0.58	0.5638	0.05

Table I.15: Differences of BD_DCLN*BD_DIAB Least Squares Means.

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	During Only	2 Before Only	Neither Before nor During Diabetes	-2.2381	2.0913	0.929	0.107	8.096
2 Before Only	During Only	2 Before Only	Diabetes	-4.0716	1.0508	0.221	0.017	2.860
2 Before Only	During Only	3 During Only	During Only	-1.2181	5.7474	9.628	0.296	313.385
2 Before Only	During Only	3 During Only	Neither Before nor During Diabetes	-3.0642	1.7823	0.527	0.047	5.944
2 Before Only	During Only	3 During Only	Diabetes	-2.0761	4.5230	3.399	0.125	92.112
2 Before Only	During Only	4 Both Before and During	During Only	-0.3787	3.7640	5.434	0.685	43.119

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	During Only	4 Both Before and During	Neither Before nor During Diabetes	-2.1792	2.0504	0.938	0.113	7.771
2 Before Only	During Only	4 Both Before and During	Diabetes	-2.2021	2.6407	1.245	0.111	14.023
2 Before Only	During Only	1 Neither Before nor During	During Only	-2.2798	2.0607	0.896	0.102	7.851
2 Before Only	During Only	1 Neither Before nor During	Neither Before nor During Diabetes	-2.6387	1.4914	0.563	0.071	4.443
2 Before Only	During Only	1 Neither Before nor During	Diabetes	-2.6112	2.4078	0.903	0.073	11.110
2 Before Only	Neither Before nor During Diabetes	2 Before Only	Diabetes	-3.0095	0.1355	0.238	0.049	1.145
2 Before Only	Neither Before nor During Diabetes	3 During Only	During Only	-0.6515	5.3276	10.361	0.521	205.953
2 Before Only	Neither Before nor During Diabetes	3 During Only	Neither Before nor During Diabetes	-2.0200	0.8849	0.567	0.133	2.423

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	Neither Before nor During Diabetes	3 During Only	Diabetes	-1.4107	4.0044	3.658	0.244	54.841
2 Before Only	Neither Before nor During Diabetes	4 Both Before and During	During Only	0.6515	2.8806	5.848	1.918	17.824
2 Before Only	Neither Before nor During Diabetes	4 Both Before and During	Neither Before nor During Diabetes	-0.7937	0.8117	1.009	0.452	2.252
2 Before Only	Neither Before nor During Diabetes	4 Both Before and During	Diabetes	-1.3828	1.9682	1.340	0.251	7.158
2 Before Only	Neither Before nor During Diabetes	1 Neither Before nor During	During Only	-1.1866	1.1143	0.964	0.305	3.047
2 Before Only	Neither Before nor During Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-1.2088	0.2083	0.606	0.299	1.232

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	Neither Before nor During Diabetes	1 Neither before nor During	Diabetes	-1.8170	1.7605	0.972	0.163	5.815
2 Before Only	Diabetes	3 During Only	During Only	0.5030	7.0472	43.602	1.654	>999.999
2 Before Only	Diabetes	3 During Only	Neither Before nor During Diabetes	-1.1260	2.8649	2.386	0.324	17.548
2 Before Only	Diabetes	3 During Only	Diabetes	-0.2593	5.7271	15.393	0.772	307.077
2 Before Only	Diabetes	4 Both Before and During	During Only	1.4806	4.9255	24.608	4.396	137.760
2 Before Only	Diabetes	4 Both Before and During	Neither Before nor During Diabetes	-0.1112	3.0032	4.246	0.895	20.150
2 Before Only	Diabetes	4 Both Before and During	Diabetes	-0.3830	3.8425	5.639	0.682	46.642
2 Before Only	Diabetes	1 Neither Before nor During	During Only	-0.3459	3.1476	4.059	0.708	23.281
2 Before Only	Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-0.5790	2.4525	2.552	0.560	11.618
2 Before Only	Diabetes	1 Neither Before nor During	Diabetes	-0.8179	3.6354	4.091	0.441	37.917

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
3 During Only	During Only	3 During Only	Neither Before nor During Diabetes	-5.5001	-0.3112	0.055	0.004	0.733
3 During Only	During Only	3 During Only	Diabetes	-3.7107	1.6283	0.353	0.024	5.095
3 During Only	During Only	4 Both Before and During	During Only	-3.6302	2.4861	0.564	0.027	12.015
3 During Only	During Only	4 Both Before and During	Neither Before nor During Diabetes	-5.3134	0.6552	0.097	0.005	1.926
3 During Only	During Only	4 Both Before and During	Diabetes	-5.3448	1.2541	0.129	0.005	3.505
3 During Only	During Only	1 Neither Before nor During	During Only	-5.4523	0.7039	0.093	0.004	2.022
3 During Only	During Only	1 Neither Before nor During	Neither Before nor During Diabetes	-5.7825	0.1058	0.059	0.003	1.112
3 During Only	During Only	1 Neither Before nor During	Diabetes	-5.7135	0.9808	0.094	0.003	2.667
3 During Only	Neither Before nor During Diabetes	3 During Only	Diabetes	-0.3944	4.1232	6.452	0.674	61.756

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
3 During Only	Neither Before nor During Diabetes	4 Both Before and During	During Only	0.6988	3.9684	10.315	2.011	52.901
3 During Only	Neither Before nor During Diabetes	4 Both Before and During	Neither Before nor During Diabetes	-0.8699	2.0230	1.780	0.419	7.561
3 During Only	Neither Before nor During Diabetes	4 Both Before and During	Diabetes	-1.2008	2.9214	2.364	0.301	18.567
3 During Only	Neither Before nor During Diabetes	1 Neither Before nor During	During Only	-1.1337	2.1966	1.701	0.322	8.994
3 During Only	Neither Before nor During Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-1.3297	1.4644	1.070	0.265	4.325
3 During Only	Neither Before nor During Diabetes	1 Neither Before nor During	Diabetes	-1.6191	2.6977	1.715	0.198	14.845

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
3 During Only	Diabetes	4 Both Before and During	During Only	-2.3283	3.2667	1.599	0.097	26.226
3 During Only	Diabetes	4 Both Before and During	Neither Before nor During Diabetes	-3.9685	1.3928	0.276	0.019	4.026
3 During Only	Diabetes	4 Both Before and During	Diabetes	-4.0564	2.0482	0.366	0.017	7.754
3 During Only	Diabetes	1 Neither Before nor During	During Only	-4.1529	1.4869	0.264	0.016	4.424
3 During Only	Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-4.4641	0.8699	0.166	0.012	2.387
3 During Only	Diabetes	1 Neither Before nor During	Diabetes	-4.4953	1.8451	0.266	0.011	6.328
4 Both Before and During	During Only	4 Both Before and During	Neither Before nor During Diabetes	-2.5895	-0.9246	0.173	0.075	0.397
4 Both Before and During	During Only	4 Both Before and During	Diabetes	-3.0129	0.06619	0.229	0.049	1.068
4 Both Before and During	During Only	1 Neither Before nor During	During Only	-3.0998	-0.5045	0.165	0.045	0.604
4 Both Before and During	During Only	1 Neither Before nor During	Neither Before nor During Diabetes	-3.2636	-1.2690	0.104	0.038	0.281

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
4 Both Before and During	During Only	1 Neither Before nor During	Diabetes	-3.6271	0.03847	0.166	0.027	1.039
4 Both Before and During	Neither Before nor During Diabetes	4 Both Before and During	Diabetes	-1.1964	1.7638	1.328	0.302	5.835
4 Both Before and During	Neither Before nor During Diabetes	1 Neither Before nor During	During Only	-1.1702	1.0799	0.956	0.310	2.944
4 Both Before and During	Neither Before nor During Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-1.1949	0.1764	0.601	0.303	1.193
4 Both Before and During	Neither Before nor During Diabetes	1 Neither Before nor During	Diabetes	-1.8112	1.7367	0.963	0.163	5.678
4 Both Before and During	Diabetes	1 Neither Before nor During	During Only	-2.1422	1.4845	0.720	0.117	4.413
4 Both Before and During	Diabetes	1 Neither Before nor During	Neither Before nor During Diabetes	-2.3988	0.8129	0.453	0.091	2.254
4 Both Before and During	Diabetes	1 Neither Before nor During	Diabetes	-2.5342	1.8923	0.725	0.079	6.635

Continued

Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Dental Cleaning Before-During Pregnancy	Pre-During Diabetes	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
1 Neither Before nor During	During Only	1 Neither Before nor During Before	Neither Before nor During Diabetes	-1.4227	0.4945	0.629	0.241	1.640
1 Neither Before nor During	During Only	1 Neither Before nor During	Diabetes	-1.7917	1.8075	1.008	0.167	6.095
1 Neither Before nor During	Neither Before nor During Diabetes	1 Neither Before nor During	Diabetes	-1.1311	2.0750	1.603	0.323	7.965

Table I.16: BD_DCLN*smoke_during Least Squares Means.

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper
2 Before Only	No	-1.4399	0.6381	2489	-2.26	0.0241	0.05	-2.6911	-0.1887
2 Before Only	Yes	0.4582	0.7238	2489	0.63	0.5267	0.05	-0.9611	1.8775
3 During Only	No	-2.4557	0.6119	2489	-4.01	<.0001	0.05	-3.6555	-1.2558
3 During Only	Yes	-1.4800	1.6098	2489	-0.92	0.3580	0.05	-4.6367	1.6766
4 Both Before and During	No	-1.6971	0.4151	2489	-4.09	<.0001	0.05	-2.5111	-0.8832
4 Both Before and During	Yes	-1.5721	0.6097	2489	-2.58	0.0100	0.05	-2.7677	-0.3766

Continued

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper
1 Neither Before nor During	No	-0.4984	0.3848	2489	-1.30	0.1954	0.05	-1.2530	0.2562
1 Neither Before nor During	Yes	-1.0160	0.5080	2489	-2.00	0.0456	0.05	-2.0121	-0.01986

Table I.17: Differences of BD_DCLN*smoke_during Least Squares Means.

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
2 Before Only	No	2 Before Only	Yes	-1.8981	0.9513	2489	-2.00	0.0461	0.05
2 Before Only	No	3 During Only	No	1.0157	0.8108	2489	1.25	0.2104	0.05
2 Before Only	No	3 During Only	Yes	0.04013	1.6953	2489	0.02	0.9811	0.05
2 Before Only	No	4 Both Before and During	No	0.2572	0.6647	2489	0.39	0.6988	0.05
2 Before Only	No	4 Both Before and During	Yes	0.1322	0.7920	2489	0.17	0.8674	0.05
2 Before Only	No	1 Neither Before nor During	No	-0.9415	0.6586	2489	-1.43	0.1529	0.05
2 Before Only	No	1 Neither Before nor During	Yes	-0.4239	0.7434	2489	-0.57	0.5685	0.05
2 Before Only	Yes	3 During Only	No	2.9139	0.8834	2489	3.30	0.0010	0.05
2 Before Only	Yes	3 During Only	Yes	1.9383	1.7156	2489	1.13	0.2587	0.05

Continued

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
2 Before Only	Yes	4 Both Before and During	No	2.1553	0.7391	2489	2.92	0.0036	0.05
2 Before Only	Yes	4 Both Before and During	Yes	2.0304	0.8653	2489	2.35	0.0190	0.05
2 Before Only	Yes	1 Neither Before nor During	No	0.9566	0.7363	2489	1.30	0.1940	0.05
2 Before Only	Yes	1 Neither Before nor During	Yes	1.4742	0.8213	2489	1.79	0.0728	0.05
3 During Only	No	3 During Only	Yes	-0.9756	1.3894	2489	-0.70	0.4826	0.05
3 During Only	No	4 Both Before and During	No	-0.7585	0.6656	2489	-1.14	0.2546	0.05
3 During Only	No	4 Both Before and During	Yes	-0.8835	0.8031	2489	-1.10	0.2714	0.05
3 During Only	No	1 Neither Before nor During	No	-1.9573	0.6556	2489	-2.99	0.0029	0.05
3 During Only	No	1 Neither Before nor During	Yes	-1.4397	0.7478	2489	-1.93	0.0543	0.05
3 During Only	Yes	4 Both Before and During	No	0.2171	1.6307	2489	0.13	0.8941	0.05
3 During Only	Yes	4 Both Before and During	Yes	0.09209	1.6992	2489	0.05	0.9568	0.05
3 During Only	Yes	1 Neither Before nor During	No	-0.9817	1.6336	2489	-0.60	0.5479	0.05
3 During Only	Yes	1 Neither Before nor During	Yes	-0.4641	1.6755	2489	-0.28	0.7818	0.05

Continued

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
4 Both Before and During	No	4 Both Before and During	Yes	-0.1250	0.5292	2489	-0.24	0.8133	0.05
4 Both Before and During	No	1 Neither Before nor During	No	-1.1988	0.4616	2489	-2.60	0.0095	0.05
4 Both Before and During	No	1 Neither Before nor During	Yes	-0.6812	0.5906	2489	-1.15	0.2489	0.05
4 Both Before and During	Yes	1 Neither Before nor During	No	-1.0738	0.6434	2489	-1.67	0.0953	0.05
4 Both Before and During	Yes	1 Neither Before nor During	Yes	-0.5562	0.7415	2489	-0.75	0.4533	0.05
1 Neither Before nor During	No	1 Neither Before nor During	Yes	0.5176	0.3522	2489	1.47	0.1418	0.05

Table I.18: Differences of BD_DCLN*smoke_during Least Squares Means.

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	No	2 Before Only	Yes	-3.7634	-0.03280	0.150	**0.023**	**0.968**
2 Before Only	No	3 During Only	No	-0.5742	2.6057	2.761	0.563	13.540
2 Before Only	No	3 During Only	Yes	-3.2842	3.3644	1.041	0.037	28.917
2 Before Only	No	4 Both Before and During	No	-1.0462	1.5607	1.293	0.351	4.762

Continued

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	No	4 Both Before and During	Yes	-1.4209	1.6853	1.141	0.242	5.394
2 Before Only	No	1 Neither Before nor During	No	-2.2329	0.3499	0.390	0.107	1.419
2 Before Only	No	1 Neither Before nor During	Yes	-1.8817	1.0338	0.654	0.152	2.812
2 Before Only	Yes	3 During Only	No	1.1816	4.6461	18.428	3.260	104.176
2 Before Only	Yes	3 During Only	Yes	-1.4259	5.3024	6.947	0.240	200.816
2 Before Only	Yes	4 Both Before and During	No	0.7060	3.6047	8.631	2.026	36.771
2 Before Only	Yes	4 Both Before and During	Yes	0.3337	3.7270	7.617	1.396	41.556
2 Before Only	Yes	1 Neither Before nor During	No	-0.4872	2.4004	2.603	0.614	11.027
2 Before Only	Yes	1 Neither Before nor During	Yes	-0.1363	3.0846	4.367	0.873	21.859
3 During Only	No	3 During Only	Yes	-3.7002	1.7489	0.377	0.025	5.749
3 During Only	No	4 Both Before and During	No	-2.0637	0.5466	0.468	0.127	1.727
3 During Only	No	4 Both Before and During	Yes	-2.4583	0.6913	0.413	0.086	1.996
3 During Only	No	1 Neither Before nor During	No	-3.2429	-0.6717	0.141	0.039	0.511
3 During Only	No	1 Neither Before nor During	Yes	-2.9061	0.02677	0.237	0.055	1.027

Continued

Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Dental Cleaning Before-During Pregnancy	Mom Smoked During Pregnancy	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
3 During Only	Yes	4 Both Before and During	No	-2.9805	3.4147	1.242	0.051	30.409
3 During Only	Yes	4 Both Before and During	Yes	-3.2399	3.4241	1.096	0.039	30.694
3 During Only	Yes	1 Neither Before nor During	No	-4.1849	2.2216	0.375	0.015	9.222
3 During Only	Yes	1 Neither Before nor During	Yes	-3.7496	2.8215	0.629	0.024	16.802
4 Both Before and During	No	4 Both Before and During	Yes	-1.1626	0.9126	0.882	0.313	2.491
4 Both Before and During	No	1 Neither Before nor During	No	-2.1038	-0.2937	0.302	0.122	0.746
4 Both Before and During	No	1 Neither Before nor During	Yes	-1.8394	0.4770	0.506	0.159	1.611
4 Both Before and During	Yes	1 Neither Before nor During	No	-2.3354	0.1879	0.342	0.097	1.207
4 Both Before and During	Yes	1 Neither Before nor During	Yes	-2.0103	0.8979	0.573	0.134	2.455
1 Neither Before nor During	No	1 Neither Before nor During	Yes	-0.1730	1.2082	1.678	0.841	3.347

Table I.19: BD_DCLN*traumatic_st Least Squares Means.

Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper
2 Before Only	No	0.9254	0.6635	2489	1.39	0.1632	0.05	-0.3757	2.2265
2 Before Only	Yes	-1.9071	0.6283	2489	-3.04	0.0024	0.05	-3.1392	-0.6750
3 During Only	No	-1.6243	0.7827	2489	-2.08	0.0381	0.05	-3.1591	-0.08939
3 During Only	Yes	-2.3114	1.3881	2489	-1.67	0.0960	0.05	-5.0333	0.4105
4 Both Before and During	No	-1.1867	0.4535	2489	-2.62	0.0089	0.05	-2.0760	-0.2974
4 Both Before and During	Yes	-2.0826	0.5558	2489	-3.75	0.0002	0.05	-3.1725	-0.9927
1 Neither Before nor During	No	-0.9144	0.4379	2489	-2.09	0.0369	0.05	-1.7731	-0.05579
1 Neither Before nor During	Yes	-0.5999	0.4712	2489	-1.27	0.2031	0.05	-1.5239	0.3241

Table I.20: Differences of BD_DCLN*traumatic_st Least Squares Means.

Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
2 Before Only	No	2 Before Only	Yes	2.8325	0.8445	2489	3.35	0.0008	0.05
2 Before Only	No	3 During Only	No	2.5497	0.9405	2489	2.71	0.0068	0.05
2 Before Only	No	3 During Only	Yes	3.2368	1.5008	2489	2.16	0.0311	0.05
2 Before Only	No	4 Both Before and During	No	2.1121	0.6956	2489	3.04	0.0024	0.05
2 Before Only	No	4 Both Before and During	Yes	3.0080	0.7642	2489	3.94	<.0001	0.05
2 Before Only	No	1 Neither Before nor During	No	1.8398	0.6952	2489	2.65	0.0082	0.05

Continued

Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
2 Before Only	No	1 Neither Before nor During	Yes	1.5253	0.7516	2489	2.03	0.0425	0.05
2 Before Only	Yes	3 During Only	No	-0.2828	0.9263	2489	-0.31	0.7601	0.05
2 Before Only	Yes	3 During Only	Yes	0.4043	1.4884	2489	0.27	0.7859	0.05
2 Before Only	Yes	4 Both Before and During	No	-0.7204	0.6812	2489	-1.06	0.2903	0.05
2 Before Only	Yes	4 Both Before and During	Yes	0.1755	0.7627	2489	0.23	0.8180	0.05
2 Before Only	Yes	1 Neither Before nor During	No	-0.9927	0.6739	2489	-1.47	0.1409	0.05
2 Before Only	Yes	1 Neither Before nor During	Yes	-1.3072	0.7240	2489	-1.81	0.0711	0.05
3 During Only	No	3 During Only	Yes	0.6872	1.0381	2489	0.66	0.5081	0.05
3 During Only	No	4 Both Before and During	No	-0.4376	0.8260	2489	-0.53	0.5963	0.05
3 During Only	No	4 Both Before and During	Yes	0.4583	0.8879	2489	0.52	0.6058	0.05
3 During Only	No	1 Neither Before nor During	No	-0.7098	0.8278	2489	-0.86	0.3912	0.05
3 During Only	No	1 Neither Before nor During	Yes	-1.0244	0.8722	2489	-1.17	0.2403	0.05
3 During Only	Yes	4 Both Before and During	No	-1.1248	1.4417	2489	-0.78	0.4354	0.05
3 During Only	Yes	4 Both Before and During	Yes	-0.2288	1.4743	2489	-0.16	0.8767	0.05

Continued

Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha
3 During Only	Yes	1 Neither Before nor During	No	-1.3970	1.4381	2489	-0.97	0.3314	0.05
3 During Only	Yes	1 Neither Before nor During	Yes	-1.7115	1.4538	2489	-1.18	0.2392	0.05
4 Both Before and During	No	4 Both Before and During	Yes	0.8959	0.4703	2489	1.91	0.0569	0.05
4 Both Before and During	No	1 Neither Before nor During	No	-0.2722	0.5215	2489	-0.52	0.6017	0.05
4 Both Before and During	No	1 Neither Before nor During	Yes	-0.5868	0.5903	2489	-0.99	0.3203	0.05
4 Both Before and During	Yes	1 Neither Before nor During	No	-1.1682	0.6268	2489	-1.86	0.0625	0.05
4 Both Before and During	Yes	1 Neither Before nor During	Yes	-1.4827	0.6848	2489	-2.17	0.0305	0.05
1 Neither Before nor During	No	1 Neither Before nor During	Yes	-0.3145	0.3732	2489	-0.84	0.3995	0.05

Table I.21: Differences of BD_DCLN*traumatic_st Least Squares Means.

Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	No	2 Before Only	Yes	1.1766	4.4884	16.988	3.243	88.983
2 Before Only	No	3 During Only	No	0.7054	4.3940	12.803	2.025	80.961

Continued

Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
2 Before Only	No	3 During Only	Yes	0.2939	6.1798	25.453	1.342	482.888
2 Before Only	No	4 Both Before and During	No	0.7480	3.4761	8.265	2.113	32.334
2 Before Only	No	4 Both Before and During	Yes	1.5095	4.5065	20.247	4.525	90.604
2 Before Only	No	1 Neither Before nor During	No	0.4766	3.2030	6.295	1.611	24.607
2 Before Only	No	1 Neither Before nor During	Yes	0.05150	2.9991	4.597	1.053	20.068
2 Before Only	Yes	3 During Only	No	-2.0992	1.5335	0.754	0.123	4.634
2 Before Only	Yes	3 During Only	Yes	-2.5144	3.3230	1.498	0.081	27.744
2 Before Only	Yes	4 Both Before and During	No	-2.0562	0.6153	0.487	0.128	1.850
2 Before Only	Yes	4 Both Before and During	Yes	-1.3200	1.6710	1.192	0.267	5.318
2 Before Only	Yes	1 Neither Before nor During	No	-2.3142	0.3288	0.371	0.099	1.389
2 Before Only	Yes	1 Neither Before nor During	Yes	-2.7269	0.1125	0.271	0.065	1.119
3 During Only	No	3 During Only	Yes	-1.3485	2.7228	1.988	0.260	15.224
3 During Only	No	4 Both Before and During	No	-2.0572	1.1820	0.646	0.128	3.261
3 During Only	No	4 Both Before and During	Yes	-1.2828	2.1994	1.581	0.277	9.020

Continued

Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Dental Cleaning Before-During Pregnancy	Any Traumatic Stress	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
3 During Only	No	1 Neither Before nor During	No	-2.3330	0.9134	0.492	0.097	2.493
3 During Only	No	1 Neither Before nor During	Yes	-2.7346	0.6859	0.359	0.065	1.986
3 During Only	Yes	4 Both Before and During	No	-3.9519	1.7024	0.325	0.019	5.487
3 During Only	Yes	4 Both Before and During	Yes	-3.1197	2.6621	0.795	0.044	14.326
3 During Only	Yes	1 Neither Before nor During	No	-4.2169	1.4229	0.247	0.015	4.149
3 During Only	Yes	1 Neither Before nor During	Yes	-4.5622	1.1392	0.181	0.010	3.124
4 Both Before and During	No	4 Both Before and During	Yes	-0.02622	1.8181	2.450	0.974	6.160
4 Both Before and During	No	1 Neither Before nor During	No	-1.2948	0.7503	0.762	0.274	2.118
4 Both Before and During	No	1 Neither Before nor During	Yes	-1.7442	0.5707	0.556	0.175	1.769
4 Both Before and During	Yes	1 Neither Before nor During	No	-2.3973	0.06097	0.311	0.091	1.063
4 Both Before and During	Yes	1 Neither Before nor During	Yes	-2.8255	-0.1399	0.227	0.059	0.869
1 Neither Before nor During	No	1 Neither Before nor During	Yes	-1.0464	0.4174	0.730	0.351	1.518

```
*--- PTB
*--- Dental Cleaning is main exposure
*--- Multivariable Analyses
*--- Binary Logistic Regression
*--- Adjusted Associations between Dependent and Independent Variables
*--- With All Selected Interaction Full Model;
ods rtf file =
'F:\University of South Carolina\WILLIAMS, MONIQUE - Dissertation for Monique
Williams\Post Defense Outputs\
20200427_PTB_Binary_Logistic_Regression_Full_Model_All_Selected_Interaction.rtf';
ods graphics on;
proc surveylogistic data = prep_prams1215;
strata STRAT_YR_n;
weight WTANAL;
class
BD_DCLN2(ref = 'No')
DRK6_3L_RAW_n(ref = "No")
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n(ref = "Below 35 Years")
maternal_race_n3(ref = "White")
/*maternal_race_n2(ref = "White") */
maternal_race_n2r(ref = "White and Other")
mat_edu_yrs2(ref = "Below 12 Years")
```

```
mat_edu_yrs3(ref = "Below 12 Years")

maritlstatus_n(ref = "Unmarried")

/*--- Enabling Factors*/

rural_n(ref = "No")

INCOME7n(ref = "$0 to $19,000")

INCOME7n2(ref = "$0 to $37,000")

PNC_1ST_n2(ref = "Timely (13 Weeks or Earlier)")

PNC_1ST_n(ref = "Timely (13 Weeks or Earlier)")

DDS_INS_n2(ref = "No")

DDS_INS_n(ref = "No")

prenatal_ins_n3(ref = "Uninsured")

prenatal_ins_n2(ref = "Medicaid and Anticipated Insurance (Non-insured)")

/*prenatal_ins_n2(ref = "Commercial Insurance")*/

/*--- Need Factors*/

DDS_PROB_n(ref = "No")

PREG_TRY_n(ref = "No")

DDS_CARE_n(ref = "No")

/*Biological Factors*/

mom_pre_bmi_cat_n(ref = "Normal")

mom_pre_bmi_cat_n2(ref = "Underweight/Normal")

MM_MD_n(ref = "No")

SEX_n(ref = "Male")

PRE_LB_n(ref = "None")
```

PRE_LB_n2(ref = "No")

NewWghtGain(ref = "Recommended")

MM_HBP_n(ref = "No")

MM_DIAB_n(ref = "No")

BD_DIAB (ref = "Neither Pre nor During Diabetes")

PREV_LBW_n(ref = "No")

PREV_LBW_n2(ref = "No")

PREV_PRE_n2(ref = "No")

PREV_PRE_n(ref = "No")

/*Health Behaviors*/

PRE_DDS_n(ref = "No")

smoke_before_n(ref = "No")

smoke_during_n(ref = "No")

/*DRK_2YRS_n(ref = "No") */

DRK6_3B_RAW_n(ref = "No")

EXERAPWK_n4(ref = "0 Times per Week")

EXERAPWK_n2(ref = "< 3 Times per Week")

VITAMIN_n(ref = "Didn't Take Vitamin")

VITAMIN_n2(ref = "0-3 Times per Week")

VITAMIN_YN(ref = "No")

/*Psychobiological Factors*/

PAB6HUS_n(ref = "No")

PAD6HUS_n(ref = "No")

PABDHUS(ref = "No")

psych_abuse_any(ref = "No")

traumatic_stress_any_ai(ref = "No")

financial_stress_any_ai(ref = "No")

partner_stress_any_ai(ref = "No")

emotional_stress_any_ai(ref = "No")

STRS_any(ref = "No")

PTB(ref = "No")

/ param = glm;

model PTB (event = 'Yes') =

/*--- Predisposing Factors*/

MAT_AGE_GROUP_n maternal_race_n2r mat_edu_yrs2 maritlstatus_n

/*--- Enabling Factors*/

rural_n INCOME7n PNC_1ST_n2 prenatal_ins_n3

/*--- Need Factors*/

DDS_PROB_n PREG_TRY_n

/*--- Biological Factors*/

mom_pre_bmi_cat_n MM_MD_n SEX_n PRE_LB_n2 NewWghtGain MM_HBP_n

BD_DIAB PREV_LBW_n2 PREV_PRE_n2

/*--- Health Behaviors*/

BD_DCLN2 smoke_before_n smoke_during_n DRK6_3B_RAW_n DRK6_3L_RAW_n

EXERAPWK_n2 VITAMIN_YN

/*-- Psychobiological factors*/

PABDHUS

psych_abuse_any

traumatic_stress_any_ai

financial_stress_any_ai

partner_stress_any_ai

emotional_stress_any_ai

/*--- Interactions*/

BD_DCLN2*PABDHUS

BD_DCLN2*smoke_during_n

BD_DCLN2*traumatic_stress_any_ai

/ expb clodds rsquare PARMLABEL;

title 'PTB: Binary Logistic Regression Full Model, Interaction Selected All';

run;

ods rtf close;

Table I.22: Model Information.

Data Set	WORK.PREP_PRAMS1215	
Response Variable	PTB	Preterm Birth
Number of Response Levels	2	
Stratum Variable	STRAT_YR_n	
Number of Strata	4	
Weight Variable	WTANAL	BC WT: ANALYSIS WT
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Table I.23: Variance Estimation.

Method	Taylor Series
Variance Adjustment	Degrees of Freedom (DF)

Table I.24: Observations and Weights.

Number of Observations Read	2870
Number of Observations Used	2197
Sum of Weights Read	208452.5
Sum of Weights Used	162706.2

Table I.25: Response Profile.

Ordered Value	PTB	Total Frequency	Total Weight
1	No	974	148201.38
2	Yes	1223	14504.86

Probability modeled is PTB='Yes'

Note: 673 observations were deleted due to missing values for the response or explanatory variables

Table I.26: Class Level Information.

Class	Value	Design Variables			
BD_DCLN2	**Yes**	1	0		
	No	0	1		
DRK6_3L_RAW_n	**Yes**	1	0		
	No	0	1		
MAT_AGE_GROUP_n	**35 Years or More**	1	0		

Continued

Class	Value	Design Variables			
	Below 35 Years	0	1		
maternal_race_n2r	Black	1	0		
	White and Other	0	1		
mat_edu_yrs2	12 Years or More	1	0		
	Below 12 Years	0	1		
maritlstatus_n	Married	1	0		
	Unmarried	0	1		
rural_n	Yes	1	0		
	No	0	1		
INCOME7n	$19,001 to $37,000	1	0	0	0
	$37,001 to $67,000	0	1	0	0
	$67,001 or More	0	0	1	0
	$0 to $19,000	0	0	0	1
PNC_1ST_n2	Delayed (After 13 Weeks)	1	0		
	Timely (13 Weeks or Earlier)	0	1		
prenatal_ins_n3	Medicaid	1	0	0	
	Private Insurance/Military/Other	0	1	0	
	Uninsured	0	0	1	
DDS_PROB_n	Yes	1	0		
	No	0	1		
PREG_TRY_n	Yes	1	0		
	No	0	1		
mom_pre_bmi_cat_n	Obese	1	0	0	0
	Overweight	0	1	0	0
	Underweight	0	0	1	0
	Normal	0	0	0	1
MM_MD_n	Yes	1	0		
	No	0	1		
SEX_n	Female	1	0		
	Male	0	1		
PRE_LB_n2	Yes	1	0		
	No	0	1		
NewWghtGain	Less than Recommended	1	0	0	
	More than Recommended	0	1	0	
	Recommended	0	0	1	
MM_HBP_n	Yes	1	0		
	No	0	1		
BD_DIAB	During Only	1	0	0	

Continued

Class	Value	Design Variables			
	Pre Diabetes	0	1	0	
	Neither Pre nor During Diabetes	0	0	1	
PREV_LBW_n2	**Yes**	1	0		
	No	0	1		
PREV_PRE_n2	**Yes**	1	0		
	No	0	1		
smoke_before_n	**Yes**	1	0		
	No	0	1		
smoke_during_n	**Yes**	1	0		
	No	0	1		
DRK6_3B_RAW_n	**Yes**	1	0		
	No	0	1		
EXERAPWK_n2	**3 or More Times per Week**	1	0		
	< 3 Times per Week	0	1		
VITAMIN_YN	**Yes**	1	0		
	No	0	1		
PABDHUS	**Yes**	1	0		
	No	0	1		
psych_abuse_any	**Yes**	1	0		
	No	0	1		
traumatic_stress_any_ai	**Yes**	1	0		
	No	0	1		
financial_stress_any_ai	**Yes**	1	0		
	No	0	1		
partner_stress_any_ai	**Yes**	1	0		
	No	0	1		
emotional_stress_any_ai	**Yes**	1	0		
	No	0	1		

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Table I.27: Model Fit Statistics.

Criterion	Intercept Only	Intercept and Covariates
AIC	97808.318	85770.806
SC	97818.318	86200.793
-2 Log L	97806.318	85684.806

R-Square 0.0718

Max-rescaled R-Square 0.1589

Table I.28: Testing Global Null Hypothesis: BETA=0.

Test	F Value	Num DF	Den DF	Pr > F
Likelihood Ratio	288.63	41.9986	93447	<.0001
Score	4.49	42	2184	<.0001
Wald	3.47	42	2184	<.0001
Note: Second-order Rao-Scott design correction 0.0000 applied to the Likelihood Ratio test.				

Table I.29: Type 3 Analysis of Effects.

Effect	F Value	Num DF	Den DF	Pr > F
MAT_AGE_GROUP_n	4.15	1	2225	0.0418
maternal_race_n2r	4.11	1	2225	0.0427
mat_edu_yrs2	0.14	1	2225	0.7069
maritlstatus_n	0.73	1	2225	0.3939
rural_n	0.17	1	2225	0.6843
INCOME7n	1.53	3	2223	0.2051
PNC_1ST_n2	0.11	1	2225	0.7363

Continued

Effect	F Value	Num DF	Den DF	Pr > F
prenatal_ins_n3	0.15	2	2224	0.8585
DDS_PROB_n	0.20	1	2225	0.6514
PREG_TRY_n	0.32	1	2225	0.5714
mom_pre_bmi_cat_n	0.03	3	2223	0.9945
MM_MD_n	10.41	1	2225	0.0013
SEX_n	1.24	1	2225	0.2647
PRE_LB_n2	8.47	1	2225	0.0036
NewWghtGain	2.05	2	2224	0.1292
MM_HBP_n	0.17	1	2225	0.6794
BD_DIAB	1.68	2	2224	0.1875
PREV_LBW_n2	1.38	1	2225	0.2410
PREV_PRE_n2	0.83	1	2225	0.3638
BD_DCLN2	1.91	1	2225	0.1670
smoke_before_n	0.74	1	2225	0.3895
smoke_during_n	0.27	1	2225	0.6056
DRK6_3B_RAW_n	2.16	1	2225	0.1415
DRK6_3L_RAW_n	0.46	1	2225	0.4962
EXERAPWK_n2	0.25	1	2225	0.6201
VITAMIN_YN	0.18	1	2225	0.6680
PABDHUS	0.32	1	2225	0.5694
psych_abuse_any	3.23	1	2225	0.0724
traumatic_stress_any	4.56	1	2225	0.0328
financial_stress_any	3.15	1	2225	0.0761
partner_stress_any_a	0.99	1	2225	0.3194
emotional_stress_any	0.12	1	2225	0.7289
BD_DCLN2*PABDHUS	1.51	1	2225	0.2188
BD_DCLN2*smoke_durin	4.11	1	2225	0.0427
BD_DCLN2*traumatic_s	6.57	1	2225	0.0104

Table I.30: Analysis of Maximum Likelihood Estimates.

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
Intercept			-2.8965	0.7208	-4.02	<.0001	0.055
MAT_AGE_GROUP_n	35 Years or More		0.6126	0.3008	2.04	0.0418	1.845
MAT_AGE_GROUP_n	Below 35 Years		0	.	.	.	.
maternal_race_n2r	Black		0.5167	0.2548	2.03	0.0427	1.677
maternal_race_n2r	White and Other		0	.	.	.	.
mat_edu_yrs2	12 Years or More		0.1189	0.3163	0.38	0.7069	1.126
mat_edu_yrs2	Below 12 Years		0	.	.	.	.
maritlstatus_n	Married		0.2840	0.3330	0.85	0.3939	1.328
maritlstatus_n	Unmarried		0	.	.	.	.
rural_n	Yes		0.1124	0.2763	0.41	0.6843	1.119
rural_n	No		0	.	.	.	.
INCOME7n	$19,001 to $37,000		-0.5377	0.2795	-1.92	0.0545	0.584
INCOME7n	$37,001 to $67,000		-0.6197	0.4113	-1.51	0.1320	0.538
INCOME7n	$67,001 or More		-0.3887	0.4638	-0.84	0.4021	0.678
INCOME7n	$0 to $19,000		0	.	.	.	.
PNC_1ST_n2	Delayed (After 13 Weeks)		0.1502	0.4460	0.34	0.7363	1.162
PNC_1ST_n2	Timely (13 Weeks or Earlier)		0	.	.	.	.
prenatal_ins_n3	Medicaid		0.1224	0.5938	0.21	0.8368	1.130
prenatal_ins_n3	Private Insurance/Military/Other		-0.0486	0.6416	-0.08	0.9396	0.953
prenatal_ins_n3	Uninsured		0	.	.	.	.
DDS_PROB_n	Yes		-0.1288	0.2850	-0.45	0.6514	0.879

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
DDS_PROB_n	No		0	.	.	.	.
PREG_TRY_n	Yes		-0.1854	0.3276	-0.57	0.5714	0.831
PREG_TRY_n	No		0	.	.	.	.
mom_pre_bmi_cat_n	Obese		0.0373	0.2796	0.13	0.8938	1.038
mom_pre_bmi_cat_n	Overweight		0.0299	0.2976	0.10	0.9200	1.030
mom_pre_bmi_cat_n	Underweight		0.1151	0.4263	0.27	0.7871	1.122
mom_pre_bmi_cat_n	Normal		0	.	.	.	.
MM_MD_n	Yes		0.9720	0.3013	3.23	0.0013	2.643
MM_MD_n	No		0	.	.	.	.
SEX_n	Female		0.2573	0.2306	1.12	0.2647	1.293
SEX_n	Male		0	.	.	.	.
PRE_LB_n2	Yes		-0.7421	0.2549	-2.91	0.0036	0.476
PRE_LB_n2	No		0	.	.	.	.
NewWghtGain	Less than Recommended		0.4093	0.2715	1.51	0.1317	1.506
NewWghtGain	More than Recommended		-0.1289	0.2890	-0.45	0.6557	0.879
NewWghtGain	Recommended		0	.	.	.	.
MM_HBP_n	Yes		0.1482	0.3585	0.41	0.6794	1.160
MM_HBP_n	No		0	.	.	.	.
BD_DIAB	During Only		-0.7587	0.4144	-1.83	0.0673	0.468
BD_DIAB	Pre Diabetes		-0.1111	0.5392	-0.21	0.8367	0.895
BD_DIAB	Neither Pre nor During Diabetes		0	.	.	.	.
PREV_LBW_n2	Yes		0.6190	0.5278	1.17	0.2410	1.857
PREV_LBW_n2	No		0	.	.	.	.
PREV_PRE_n2	Yes		0.4170	0.4590	0.91	0.3638	1.517

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
PREV_PRE_n2	No		0	.	.	.	.
BD_DCLN2	Yes		0.0145	0.2497	0.06	0.9536	1.015
BD_DCLN2	No		0	.	.	.	.
smoke_before_n	Yes		-0.2808	0.3262	-0.86	0.3895	0.755
smoke_before_n	No		0	.	.	.	.
smoke_during_n	Yes		-0.5474	0.4868	-1.12	0.2609	0.578
smoke_during_n	No		0	.	.	.	.
DRK6_3B_RAW_n	Yes		0.3440	0.2339	1.47	0.1415	1.411
DRK6_3B_RAW_n	No		0	.	.	.	.
DRK6_3L_RAW_n	Yes		-0.3038	0.4465	-0.68	0.4962	0.738
DRK6_3L_RAW_n	No		0	.	.	.	.
EXERAPWK_n2	3 or More Times per Week		-0.1151	0.2321	-0.50	0.6201	0.891
EXERAPWK_n2	< 3 Times per Week		0	.	.	.	.
VITAMIN_YN	Yes		-0.1039	0.2421	-0.43	0.6680	0.901
VITAMIN_YN	No		0	.	.	.	.
PABDHUS	Yes		0.1683	0.7932	0.21	0.8320	1.183
PABDHUS	No		0	.	.	.	.
psych_abuse_any	Yes		1.0683	0.5944	1.80	0.0724	2.910
psych_abuse_any	No		0	.	.	.	.
traumatic_stress_any	Yes		0.0801	0.4399	0.18	0.8555	1.083
traumatic_stress_any	No		0	.	.	.	.
financial_stress_any	Yes		0.4105	0.2314	1.77	0.0761	1.508
financial_stress_any	No		0	.	.	.	.
partner_stress_any_a	Yes		0.2345	0.2355	1.00	0.3194	1.264
partner_stress_any_a	No		0	.	.	.	.
emotional_stress_any	Yes		-0.0809	0.2334	-0.35	0.7289	0.922

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
emotional_stress_any	**No**		0	.	.	.	.
BD_DCLN2*PABDHUS	**Yes**	**Yes**	-1.0312	0.8384	-1.23	0.2188	0.357
BD_DCLN2*PABDHUS	**Yes**	**No**	0	.	.	.	.
BD_DCLN2*PABDHUS	**No**	**Yes**	0	.	.	.	.
BD_DCLN2*PABDHUS	**No**	**No**	0	.	.	.	.
BD_DCLN2*smoke_durin	**Yes**	**Yes**	1.4892	0.7345	2.03	0.0427	4.434
BD_DCLN2*smoke_durin	**Yes**	**No**	0	.	.	.	.
BD_DCLN2*smoke_durin	**No**	**Yes**	0	.	.	.	.
BD_DCLN2*smoke_durin	**No**	**No**	0	.	.	.	.
BD_DCLN2*traumatic_s	**Yes**	**Yes**	-1.6510	0.6439	-2.56	0.0104	0.192
BD_DCLN2*traumatic_s	**Yes**	**No**	0	.	.	.	.
BD_DCLN2*traumatic_s	**No**	**Yes**	0	.	.	.	.
BD_DCLN2*traumatic_s	**No**	**No**	0	.	.	.	.
Note: The degrees of freedom for the t tests is 2225.							

Table I.31: Analysis of Maximum Likelihood Estimates.

Parameter			Label
Intercept			Intercept: PTB=Yes
MAT_AGE_GROUP_n	**35 Years or More**		Maternal Age Group 35 Years or More
MAT_AGE_GROUP_n	**Below 35 Years**		Maternal Age Group Below 35 Years
maternal_race_n2r	**Black**		Maternal Race (2 Cat) Black
maternal_race_n2r	**White and Other**		Maternal Race (2 Cat) White and Other
mat_edu_yrs2	**12 Years or More**		Maternal Education (2 Cat) 12 Years or More
mat_edu_yrs2	**Below 12 Years**		Maternal Education (2 Cat) Below 12 Years
maritlstatus_n	**Married**		Marital Status Married

Continued

Parameter			Label
maritlstatus_n	**Unmarried**		Marital Status Unmarried
rural_n	**Yes**		Rurality Yes
rural_n	**No**		Rurality No
INCOME7n	**$19,001 to $37,000**		Household Income Categories $19,001 to $37,000
INCOME7n	**$37,001 to $67,000**		Household Income Categories $37,001 to $67,000
INCOME7n	**$67,001 or More**		Household Income Categories $67,001 or More
INCOME7n	**$0 to $19,000**		Household Income Categories $0 to $19,000
PNC_1ST_n2	**Delayed (After 13 Weeks)**		Prenatal Care Initiation Delayed (After 13 Weeks)
PNC_1ST_n2	**Timely (13 Weeks or Earlier)**		Prenatal Care Initiation Timely (13 Weeks or Earlier)
prenatal_ins_n3	**Medicaid**		Medicaid Insurance (Poverty Proxy) 3 Cat Medicaid
prenatal_ins_n3	**Private Insurance/Military/Other**		Medicaid Insurance (Poverty Proxy) 3 Cat Private Insurance/Military/Other
prenatal_ins_n3	**Uninsured**		Medicaid Insurance (Poverty Proxy) 3 Cat Uninsured
DDS_PROB_n	**Yes**		Dental Problem During Pregnancy Yes
DDS_PROB_n	**No**		Dental Problem During Pregnancy No
PREG_TRY_n	**Yes**		Were Trying to Get Pregnant Yes
PREG_TRY_n	**No**		Were Trying to Get Pregnant No
mom_pre_bmi_cat_n	**Obese**		Prepregnancy BMI Obese
mom_pre_bmi_cat_n	**Overweight**		Prepregnancy BMI Overweight
mom_pre_bmi_cat_n	**Underweight**		Prepregnancy BMI Underweight
mom_pre_bmi_cat_n	**Normal**		Prepregnancy BMI Normal
MM_MD_n	**Yes**		Medical Risk Factor Yes
MM_MD_n	**No**		Medical Risk Factor No
SEX_n	**Female**		Newborn Sex Female
SEX_n	**Male**		Newborn Sex Male

Continued

Parameter			Label
PRE_LB_n2	**Yes**		Previous Live Births Yes
PRE_LB_n2	**No**		Previous Live Births No
NewWghtGain	**Less than Recommended**		Maternal Weight Gain Less than Recommended
NewWghtGain	**More than Recommended**		Maternal Weight Gain More than Recommended
NewWghtGain	**Recommended**		Maternal Weight Gain Recommended
MM_HBP_n	**Yes**		Hypertension During Pregnancy Yes
MM_HBP_n	**No**		Hypertension During Pregnancy No
BD_DIAB	**During Only**		Pre-During Diabetes During Only
BD_DIAB	**Pre Diabetes**		Pre-During Diabetes Pre Diabetes
BD_DIAB	**Neither Pre nor During Diabetes**		Pre-During Diabetes Neither Pre nor During Diabetes
PREV_LBW_n2	**Yes**		Previous Low Birth Weight Yes
PREV_LBW_n2	**No**		Previous Low Birth Weight No
PREV_PRE_n2	**Yes**		Previous Preterm Birth Yes
PREV_PRE_n2	**No**		Previous Preterm Birth No
BD_DCLN2	**Yes**		Dental Cleaning Before/During Pregnancy Yes
BD_DCLN2	**No**		Dental Cleaning Before/During Pregnancy No
smoke_before_n	**Yes**		Mom Smoked 3 Months Before Pregnancy Yes
smoke_before_n	**No**		Mom Smoked 3 Months Before Pregnancy No
smoke_during_n	**Yes**		Mom Smoked During Pregnancy Yes
smoke_during_n	**No**		Mom Smoked During Pregnancy No
DRK6_3B_RAW_n	**Yes**		Alcoholic Drinks 3 Months Before Pregnancy Yes
DRK6_3B_RAW_n	**No**		Alcoholic Drinks 3 Months Before Pregnancy No
DRK6_3L_RAW_n	**Yes**		Alcoholic Drinks in Last 3 Months of Pregnancy Yes
DRK6_3L_RAW_n	**No**		Alcoholic Drinks in Last 3 Months of Pregnancy No

Continued

Parameter			Label
EXERAPWK_n2	**3 or More Times per Week**		Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week
EXERAPWK_n2	**< 3 Times per Week**		Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
VITAMIN_YN	**Yes**		Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
VITAMIN_YN	**No**		Multivitamin Consumption During Month Before Pregnancy (Y/N) No
PABDHUS	**Yes**		Physical Abuse Before or During Pregnancy Yes
PABDHUS	**No**		Physical Abuse Before or During Pregnancy No
psych_abuse_any	**Yes**		Any Psychological Abuse During Pregnancy Yes
psych_abuse_any	**No**		Any Psychological Abuse During Pregnancy No
traumatic_stress_any	**Yes**		Any Traumatic Stress Yes
traumatic_stress_any	**No**		Any Traumatic Stress No
financial_stress_any	**Yes**		Any Financial Stress Yes
financial_stress_any	**No**		Any Financial Stress No
partner_stress_any_a	**Yes**		Any Partner Related Stress Yes
partner_stress_any_a	**No**		Any Partner Related Stress No
emotional_stress_any	**Yes**		Any Emotional Stress Yes
emotional_stress_any	**No**		Any Emotional Stress No
BD_DCLN2*PABDHUS	**Yes**	**Yes**	Dental Cleaning Before/During Pregnancy Yes * Physical Abuse Before or During Pregnancy Yes
BD_DCLN2*PABDHUS	**Yes**	**No**	Dental Cleaning Before/During Pregnancy Yes * Physical Abuse Before or During Pregnancy No
BD_DCLN2*PABDHUS	**No**	**Yes**	Dental Cleaning Before/During Pregnancy No * Physical Abuse Before or During Pregnancy Yes
BD_DCLN2*PABDHUS	**No**	**No**	Dental Cleaning Before/During Pregnancy No * Physical Abuse Before or During Pregnancy No

Continued

Parameter			Label
BD_DCLN2*smoke_durin	**Yes**	**Yes**	Dental Cleaning Before/During Pregnancy Yes * Mom Smoked During Pregnancy Yes
BD_DCLN2*smoke_durin	**Yes**	**No**	Dental Cleaning Before/During Pregnancy Yes * Mom Smoked During Pregnancy No
BD_DCLN2*smoke_durin	**No**	**Yes**	Dental Cleaning Before/During Pregnancy No * Mom Smoked During Pregnancy Yes
BD_DCLN2*smoke_durin	**No**	**No**	Dental Cleaning Before/During Pregnancy No * Mom Smoked During Pregnancy No
BD_DCLN2*traumatic_s	**Yes**	**Yes**	Dental Cleaning Before/During Pregnancy Yes * Any Traumatic Stress Yes
BD_DCLN2*traumatic_s	**Yes**	**No**	Dental Cleaning Before/During Pregnancy Yes * Any Traumatic Stress No
BD_DCLN2*traumatic_s	**No**	**Yes**	Dental Cleaning Before/During Pregnancy No * Any Traumatic Stress Yes
BD_DCLN2*traumatic_s	**No**	**No**	Dental Cleaning Before/During Pregnancy No * Any Traumatic Stress No
Note: The degrees of freedom for the t tests is 2225.			

Table I.32: Association of Predicted Probabilities and Observed Response.

Percent Concordant	72.3	**Somers' D**	0.453
Percent Discordant	27.0	**Gamma**	0.456
Percent Tied	0.7	**Tau-a**	0.224
Pairs	**1191202**	**c**	**0.726**

Table I.33: Odds Ratio Estimates and t Confidence Intervals.

Effect	Unit	Estimate	95% Confidence Limits	
MAT_AGE_GROUP_n 35 Years or More versus Below 35 Years	1.0000	1.845	1.023	3.328
maternal_race_n2r Black versus White and Other	1.0000	1.677	1.017	2.763
mat_edu_yrs2 12 Years or More versus Below 12 Years	1.0000	1.126	0.606	2.094
maritlstatus_n Married versus Unmarried	1.0000	1.328	0.691	2.552
rural_n Yes versus No	1.0000	1.119	0.651	1.924
INCOME7n $19,001 to $37,000 versus $0 to $19,000	1.0000	0.584	0.338	1.010
INCOME7n $37,001 to $67,000 versus $0 to $19,000	1.0000	0.538	0.240	1.205
INCOME7n $67,001 or More versus $0 to $19,000	1.0000	0.678	0.273	1.683
PNC_1ST_n2 Delayed (After 13 Weeks) versus Timely (13 Weeks or Earlier)	1.0000	1.162	0.485	2.787
prenatal_ins_n3 Medicaid versus Uninsured	1.0000	1.130	0.353	3.621
prenatal_ins_n3 Private Insurance/Military/Other versus Uninsured	1.0000	0.953	0.271	3.352
DDS_PROB_n Yes versus No	1.0000	0.879	0.503	1.537
PREG_TRY_n Yes versus No	1.0000	0.831	0.437	1.579
mom_pre_bmi_cat_n Obese versus Normal	1.0000	1.038	0.600	1.796
mom_pre_bmi_cat_n Overweight versus Normal	1.0000	1.030	0.575	1.847
mom_pre_bmi_cat_n Underweight versus Normal	1.0000	1.122	0.486	2.589
MM_MD_n Yes versus No	1.0000	2.643	1.464	4.772
SEX_n Female versus Male	1.0000	1.293	0.823	2.033
PRE_LB_n2 Yes versus No	1.0000	0.476	0.289	0.785
NewWghtGain Less than Recommended versus Recommended	1.0000	1.506	0.884	2.564
NewWghtGain More than Recommended versus Recommended	1.0000	0.879	0.499	1.549
MM_HBP_n Yes versus No	1.0000	1.160	0.574	2.342
BD_DIAB During Only versus Neither Pre nor During Diabetes	1.0000	0.468	0.208	1.056
BD_DIAB Pre Diabetes versus Neither Pre nor During Diabetes	1.0000	0.895	0.311	2.576

Continued

Effect	Unit	Estimate	95% Confidence Limits	
PREV_LBW_n2 Yes versus No	1.0000	1.857	0.660	5.228
PREV_PRE_n2 Yes versus No	1.0000	1.517	0.617	3.733
smoke_before_n Yes versus No	1.0000	0.755	0.398	1.432
DRK6_3B_RAW_n Yes versus No	1.0000	1.411	0.892	2.231
DRK6_3L_RAW_n Yes versus No	1.0000	0.738	0.307	1.771
EXERAPWK_n2 3 or More Times per Week versus < 3 Times per Week	1.0000	0.891	0.565	1.405
VITAMIN_YN Yes versus No	1.0000	0.901	0.561	1.449
psych_abuse_any Yes versus No	1.0000	2.910	0.907	9.336
financial_stress_any Yes versus No	1.0000	1.508	0.958	2.373
partner_stress_any_a Yes versus No	1.0000	1.264	0.797	2.006
emotional_stress_any Yes versus No	1.0000	0.922	0.584	1.458
Note: The degrees of freedom in computing the confidence limits is 2225.				

APPENDIX J

ASSOCIATION OF DENTAL CLEANING WITH PRETERM BIRTH: USING DENTAL CLEANING AS A 4-CATEGORY VARIABLE (SAS INPUT AND OUTPUT WITHOUT INTERACTIONS) SELECTED MODELS

Full Model for all 3 Research Questions

```
*--- Dental-Cleaning
*--- Dental Counseling is Main Exposure
*--- Multivariable Analyses
*--- Binary Logistic Regression
*--- Adjusted Associations Between Dependent and Independent Variables
*--- Without Interaction Full Model;
ods rtf file =
'F:\University of South Carolina\WILLIAMS, MONIQUE - Dissertation for Monique
Williams\Post Defense Outputs\
20200513_Dental_Cleaning_Binary_Logistic_Regression_Full_Model_No_Interaction.rt
f';
ods graphics on;
/*ods output ModelANOVA = type3table2;*/
proc surveylogistic data = prep_prams1215;
```

```
strata STRAT_YR_n;
weight WTANAL;
class
BPG_DDS_n(ref = "No")
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n(ref = "Below 35 Years")
maternal_race_n3(ref = "White")
mat_edu_yrs2(ref = "Below 12 Years")
maritlstatus_n(ref = "Unmarried")
/*--- Enabling Factors*/
rural_n(ref = "No")
INCOME7n(ref = "$0 to $19,000")
PNC_1ST_n2(ref = "Timely (13 Weeks or Earlier)")
DDS_INS_n2(ref = "No")
/*prenatal_ins_n2(ref = "Commercial Insurance")*/
prenatal_ins_n3(ref = "Uninsured")
/*--- Need Factors*/
DDS_PROB_n(ref = "No")
PREG_TRY_n(ref = "No")
DDS_CARE_n(ref = "No")
/*Biological Factors*/
mom_pre_bmi_cat_n(ref = "Normal")
MM_MD_n(ref = "No")
```

/*SEX_n(ref = "Male") */

PRE_LB_n2(ref = "No")

/*NewWghtGain(ref = "Recommended") */

MM_HBP_n(ref = "No")

MM_DIAB_n(ref = "No")

PREV_LBW_n2(ref = "No")

PREV_PRE_n2(ref = "No")

/*Health Behaviors*/

PRE_DDS_n(ref = "No")

smoke_before_n(ref = "No")

smoke_during_n(ref = "No")

/*DRK_2YRS_n(ref = "No") */

DRK6_3B_RAW_n(ref = "No")

DRK6_3L_RAW_n(ref = "No")

EXERAPWK_n2(ref = "< 3 Times per Week")

VITAMIN_YN(ref = "No")

/*Psychobiological Factors*/

PABDHUS(ref = "No")

psych_abuse_any(ref = "No")

traumatic_stress_any_ai(ref = "No")

financial_stress_any_ai(ref = "No")

partner_stress_any_ai(ref = "No")

emotional_stress_any_ai(ref = "No")

```
/ param = glm;
model BD_DCLN2 (event = 'Yes') =
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n maternal_race_n2r mat_edu_yrs2 maritlstatus_n
/*--- Enabling Factors*/
rural_n INCOME7n PNC_1ST_n2 DDS_INS_n2 prenatal_ins_n3
/*--- Need Factors*/
DDS_PROB_n PREG_TRY_n DDS_CARE_n
/*--- Biological Factors*/
mom_pre_bmi_cat_n MM_MD_n PRE_LB_n2 MM_HBP_n MM_DIAB_n
PREV_LBW_n2 PREV_PRE_n2
/*--- Health Behaviors*/
BPG_DDS_n smoke_before_n smoke_during_n DRK6_3B_RAW_n DRK6_3L_RAW_n
EXERAPWK_n2 VITAMIN_YN
/*-- Psychobiological factors*/
PABDHUS
psych_abuse_any
traumatic_stress_any_ai
financial_stress_any_ai
partner_stress_any_ai
emotional_stress_any_ai
/ expb clodds rsquare;
title 'Dental-Cleaning: Binary Logistic Regression Full Model, No Interaction';
```

run;

/*ods output close;*/

/*proc sort data = type3table2;*/

/*by ProbF;*/

/*run;*/

/*proc print data = type3table2;*/

/*run;*/

ods rtf close;

Table J.1: Model Information.

Data Set	WORK.PREP_PRAMS1215	
Response Variable	BD_DCLN2	Dental Cleaning Before/During Pregnancy
Number of Response Levels	2	
Stratum Variable	STRAT_YR_n	
Number of Strata	4	
Weight Variable	WTANAL	BC WT: ANALYSIS WT
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Table J.2: Variance Estimation.

Method	Taylor Series
Variance Adjustment	Degrees of Freedom (DF)

Table J.3: Observations and Weights.

Number of Observations Read	2870
Number of Observations Used	2245
Sum of Weights Read	208452.5
Sum of Weights Used	165834.4

Table J.4: Response Profile.

Ordered Value	BD_DCLN2	Total Frequency	Total Weight
1	No	966	64787.14
2	Yes	1279	101047.27

Probability modeled is BD_DCLN2='Yes'

Note: 625 observations were deleted due to missing values for the response or explanatory variables

Table J.5: Class Level Information.

Class	Value	Design Variables			
BPG_DDS_n	**Yes**	1	0		
	No	0	1		
MAT_AGE_GROUP_n	**35 Years or More**	1	0		
	Below 35 Years	0	1		
mat_edu_yrs2	**12 Years or More**	1	0		
	Below 12 Years	0	1		
maritlstatus_n	**Married**	1	0		
	Unmarried	0	1		
rural_n	**Yes**	1	0		
	No	0	1		
INCOME7n	**$19,001 to $37,000**	1	0	0	0
	$37,001 to $67,000	0	1	0	0

Continued

Class	Value	Design Variables			
	$67,001 or More	0	0	1	0
	$0 to $19,000	0	0	0	1
PNC_1ST_n2	**Delayed (After 13 Weeks)**	1	0		
	Timely (13 Weeks or Earlier)	0	1		
DDS_INS_n2	**Yes**	1	0		
	No	0	1		
prenatal_ins_n3	**Medicaid**	1	0	0	
	Private Insurance/Military/Other	0	1	0	
	Uninsured	0	0	1	
DDS_PROB_n	**Yes**	1	0		
	No	0	1		
PREG_TRY_n	**Yes**	1	0		
	No	0	1		
DDS_CARE_n	**Yes**	1	0		
	No	0	1		
mom_pre_bmi_cat_n	**Obese**	1	0	0	0
	Overweight	0	1	0	0
	Underweight	0	0	1	0
	Normal	0	0	0	1
MM_MD_n	**Yes**	1	0		
	No	0	1		
PRE_LB_n2	**Yes**	1	0		
	No	0	1		
MM_HBP_n	**Yes**	1	0		
	No	0	1		
MM_DIAB_n	**Yes**	1	0		
	No	0	1		
PREV_LBW_n2	**Yes**	1	0		
	No	0	1		
PREV_PRE_n2	**Yes**	1	0		
	No	0	1		
smoke_before_n	**Yes**	1	0		
	No	0	1		
smoke_during_n	**Yes**	1	0		
	No	0	1		
DRK6_3B_RAW_n	**Yes**	1	0		
	No	0	1		
DRK6_3L_RAW_n	**Yes**	1	0		

Continued

Class	Value	Design Variables			
	No	0	1		
EXERAPWK_n2	**3 or More Times per Week**	1	0		
	< 3 Times per Week	0	1		
VITAMIN_YN	**Yes**	1	0		
	No	0	1		
PABDHUS	**Yes**	1	0		
	No	0	1		
psych_abuse_any	**Yes**	1	0		
	No	0	1		
traumatic_stress_any_ai	**Yes**	1	0		
	No	0	1		
financial_stress_any_ai	**Yes**	1	0		
	No	0	1		
partner_stress_any_ai	**Yes**	1	0		
	No	0	1		
emotional_stress_any_ai	**Yes**	1	0		
	No	0	1		

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Table J.6: Model Fit Statistics.

Criterion	Intercept Only	Intercept and Covariates
AIC	221904.51	172322.29
SC	221914.53	172703.00
-2 Log L	221902.51	172246.29

R-Square 0.2588

Max-rescaled R-Square 0.3508

Table J.7: Testing Global Null Hypothesis: BETA=0.

Test	F Value	Num DF	Den DF	Pr > F
Likelihood Ratio	1342.19	36.9989	82914	<.0001
Score	6.53	37	2205	<.0001
Wald	4.46	37	2205	<.0001
Note: Second-order Rao-Scott design correction 0.0000 applied to the Likelihood Ratio test.				

Table J.8: Type 3 Analysis of Effects.

Effect	F Value	Num DF	Den DF	Pr > F
MAT_AGE_GROUP_n	0.13	1	2241	0.7173
maternal_race_n2r	0.54	1	2241	0.4638
mat_edu_yrs2	0.02	1	2241	0.8781
maritlstatus_n	3.61	1	2241	0.0577
rural_n	0.14	1	2241	0.7089
INCOME7n	0.89	3	2239	0.4448
PNC_1ST_n2	0.10	1	2241	0.7527
DDS_INS_n2	70.85	1	2241	<.0001
prenatal_ins_n3	1.34	2	2240	0.2609
DDS_PROB_n	1.56	1	2241	0.2116
PREG_TRY_n	0.31	1	2241	0.5792
DDS_CARE_n	11.23	1	2241	0.0008
mom_pre_bmi_cat_n	1.32	3	2239	0.2676
MM_MD_n	4.69	1	2241	0.0305
PRE_LB_n2	0.57	1	2241	0.4508
MM_HBP_n	0.25	1	2241	0.6162
MM_DIAB_n	0.05	1	2241	0.8308
PREV_LBW_n2	2.35	1	2241	0.1258
PREV_PRE_n2	1.29	1	2241	0.2559
BPG_DDS_n	9.93	1	2241	0.0016
smoke_before_n	0.09	1	2241	0.7632
smoke_during_n	1.98	1	2241	0.1595
DRK6_3B_RAW_n	0.57	1	2241	0.4488
DRK6_3L_RAW_n	0.12	1	2241	0.7277
EXERAPWK_n2	4.57	1	2241	0.0327
VITAMIN_YN	3.06	1	2241	0.0804
PABDHUS	1.45	1	2241	0.2284

Continued

Effect	F Value	Num DF	Den DF	Pr > F
psych_abuse_any	1.38	1	2241	0.2402
traumatic_stress_any	0.39	1	2241	0.5307
financial_stress_any	0.19	1	2241	0.6602
partner_stress_any_a	0.06	1	2241	0.8003
emotional_stress_any	2.18	1	2241	0.1396

Table J.9: Analysis of Maximum Likelihood Estimates.

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
Intercept		-0.9809	0.6487	-1.51	0.1307	0.375
MAT_AGE_GROUP_n	**35 Years or More**	0.0903	0.2493	0.36	0.7173	1.094
MAT_AGE_GROUP_n	**Below 35 Years**	0	.	.	.	.
maternal_race_n2r		-0.1715	0.2341	-0.73	0.4638	0.842
mat_edu_yrs2	**12 Years or More**	0.0454	0.2959	0.15	0.8781	1.046
mat_edu_yrs2	**Below 12 Years**	0	.	.	.	.
maritlstatus_n	**Married**	-0.4736	0.2494	-1.90	0.0577	0.623
maritlstatus_n	**Unmarried**	0	.	.	.	.
rural_n	**Yes**	0.1027	0.2751	0.37	0.7089	1.108
rural_n	**No**	0	.	.	.	.
INCOME7n	**$19,001 to $37,000**	0.0231	0.2374	0.10	0.9224	1.023
INCOME7n	**$37,001 to $67,000**	0.3388	0.3427	0.99	0.3230	1.403
INCOME7n	**$67,001 or More**	0.5482	0.3889	1.41	0.1588	1.730
INCOME7n	**$0 to $19,000**	0	.	.	.	.
PNC_1ST_n2	**Delayed (After 13 Weeks)**	-0.1172	0.3720	-0.32	0.7527	0.889
PNC_1ST_n2	**Timely (13 Weeks or Earlier)**	0	.	.	.	.
DDS_INS_n2	**Yes**	1.6713	0.1986	8.42	<.0001	5.319
DDS_INS_n2	**No**	0	.	.	.	.
prenatal_ins_n3	**Medicaid**	-0.5984	0.4842	-1.24	0.2167	0.550
prenatal_ins_n3	**Private Insurance/Military/Other**	-0.2435	0.5126	-0.47	0.6349	0.784
prenatal_ins_n3	**Uninsured**	0	.	.	.	.
DDS_PROB_n	**Yes**	0.2574	0.2060	1.25	0.2116	1.294
DDS_PROB_n	**No**	0	.	.	.	.

Continued

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
PREG_TRY_n	**Yes**	0.1121	0.2021	0.55	0.5792	1.119
PREG_TRY_n	**No**	0	.	.	.	.
DDS_CARE_n	**Yes**	1.0830	0.3232	3.35	0.0008	2.954
DDS_CARE_n	**No**	0	.	.	.	.
mom_pre_bmi_cat_n	**Obese**	-0.2377	0.2297	-1.03	0.3009	0.788
mom_pre_bmi_cat_n	**Overweight**	0.0804	0.2203	0.36	0.7152	1.084
mom_pre_bmi_cat_n	**Underweight**	0.4225	0.3413	1.24	0.2160	1.526
mom_pre_bmi_cat_n	**Normal**	0	.	.	.	.
MM_MD_n	**Yes**	-0.7239	0.3343	-2.17	0.0305	0.485
MM_MD_n	**No**	0	.	.	.	.
PRE_LB_n2	**Yes**	-0.1445	0.1917	-0.75	0.4508	0.865
PRE_LB_n2	**No**	0	.	.	.	.
MM_HBP_n	**Yes**	0.1948	0.3885	0.50	0.6162	1.215
MM_HBP_n	**No**	0	.	.	.	.
MM_DIAB_n	**Yes**	0.0905	0.4236	0.21	0.8308	1.095
MM_DIAB_n	**No**	0	.	.	.	.
PREV_LBW_n2	**Yes**	0.6691	0.4369	1.53	0.1258	1.952
PREV_LBW_n2	**No**	0	.	.	.	.
PREV_PRE_n2	**Yes**	-0.4455	0.3920	-1.14	0.2559	0.640
PREV_PRE_n2	**No**	0	.	.	.	.
BPG_DDS_n	**Yes**	1.6120	0.5115	3.15	0.0016	5.013
BPG_DDS_n	**No**	0	.	.	.	.
smoke_before_n	**Yes**	-0.0772	0.2563	-0.30	0.7632	0.926
smoke_before_n	**No**	0	.	.	.	.
smoke_during_n	**Yes**	-0.4972	0.3533	-1.41	0.1595	0.608
smoke_during_n	**No**	0	.	.	.	.
DRK6_3B_RAW_n	**Yes**	-0.1479	0.1953	-0.76	0.4488	0.862

Continued

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
DRK6_3B_RAW_n	**No**	0	.	.	.	.
DRK6_3L_RAW_n	**Yes**	-0.1156	0.3321	-0.35	0.7277	0.891
DRK6_3L_RAW_n	**No**	0	.	.	.	.
EXERAPWK_n2	**3 or More Times per Week**	0.4103	0.1920	2.14	0.0327	1.507
EXERAPWK_n2	**< 3 Times per Week**	0	.	.	.	.
VITAMIN_YN	**Yes**	0.3546	0.2027	1.75	0.0804	1.426
VITAMIN_YN	**No**	0	.	.	.	.
PABDHUS	**Yes**	-0.6557	0.5442	-1.20	0.2284	0.519
PABDHUS	**No**	0	.	.	.	.
psych_abuse_any	**Yes**	0.4981	0.4239	1.17	0.2402	1.646
psych_abuse_any	**No**	0	.	.	.	.
traumatic_stress_any	**Yes**	0.1602	0.2556	0.63	0.5307	1.174
traumatic_stress_any	**No**	0	.	.	.	.
financial_stress_any	**Yes**	-0.0872	0.1982	-0.44	0.6602	0.917
financial_stress_any	**No**	0	.	.	.	.
partner_stress_any_a	**Yes**	-0.0535	0.2116	-0.25	0.8003	0.948
partner_stress_any_a	**No**	0	.	.	.	.
emotional_stress_any	**Yes**	0.2807	0.1900	1.48	0.1396	1.324
emotional_stress_any	**No**	0	.	.	.	.
Note: The degrees of freedom for the t tests is 2241.						

Table J.10: Association of Predicted Probabilities and Observed Responses.

Percent Concordant	77.7	**Somers' D**	0.555
Percent Discordant	22.2	**Gamma**	0.556
Percent Tied	0.2	**Tau-a**	0.272
Pairs	1235514	**c**	0.777

Table J.11: Odds Ratio Estimates and t Confidence Intervals.

Effect	Unit	Estimate	95% Confidence Limits	
MAT_AGE_GROUP_n 35 Years or More versus Below 35 Years	1.0000	1.094	0.671	1.785
maternal_race_n2r	1.0000	0.842	0.532	1.333
mat_edu_yrs2 12 Years or More versus Below 12 Years	1.0000	1.046	0.586	1.870
maritlstatus_n Married versus Unmarried	1.0000	0.623	0.382	1.016
rural_n Yes versus No	1.0000	1.108	0.646	1.901
INCOME7n $19,001 to $37,000 versus $0 to $19,000	1.0000	1.023	0.643	1.630
INCOME7n $37,001 to $67,000 versus $0 to $19,000	1.0000	1.403	0.717	2.748
INCOME7n $67,001 or More versus $0 to $19,000	1.0000	1.730	0.807	3.709
PNC_1ST_n2 Delayed (After 13 Weeks) versus Timely (13 Weeks or Earlier)	1.0000	0.889	0.429	1.844
DDS_INS_n2 Yes versus No	1.0000	5.319	3.604	7.851
prenatal_ins_n3 Medicaid versus Uninsured	1.0000	0.550	0.213	1.421
prenatal_ins_n3 Private Insurance/Military/Other versus Uninsured	1.0000	0.784	0.287	2.142

Continued

Effect	Unit	Estimate	95% Confidence Limits	
DDS_PROB_n Yes versus No	1.0000	1.294	0.864	1.937
PREG_TRY_n Yes versus No	1.0000	1.119	0.753	1.663
DDS_CARE_n Yes versus No	1.0000	2.954	1.567	5.567
mom_pre_bmi_cat_n Obese versus Normal	1.0000	0.788	0.502	1.237
mom_pre_bmi_cat_n Overweight versus Normal	1.0000	1.084	0.704	1.669
mom_pre_bmi_cat_n Underweight versus Normal	1.0000	1.526	0.781	2.980
MM_MD_n Yes versus No	1.0000	0.485	0.252	0.934
PRE_LB_n2 Yes versus No	1.0000	0.865	0.594	1.260
MM_HBP_n Yes versus No	1.0000	1.215	0.567	2.603
MM_DIAB_n Yes versus No	1.0000	1.095	0.477	2.512
PREV_LBW_n2 Yes versus No	1.0000	1.952	0.829	4.599
PREV_PRE_n2 Yes versus No	1.0000	0.640	0.297	1.382
BPG_DDS_n Yes versus No	1.0000	5.013	1.838	13.669
smoke_before_n Yes versus No	1.0000	0.926	0.560	1.530
smoke_during_n Yes versus No	1.0000	0.608	0.304	1.216
DRK6_3B_RAW_n Yes versus No	1.0000	0.862	0.588	1.265
DRK6_3L_RAW_n Yes versus No	1.0000	0.891	0.465	1.708
EXERAPWK_n2 3 or More Times per Week versus < 3 Times per Week	1.0000	1.507	1.034	2.197
VITAMIN_YN Yes versus No	1.0000	1.426	0.958	2.121
PABDHUS Yes versus No	1.0000	0.519	0.179	1.509
psych_abuse_any Yes versus No	1.0000	1.646	0.717	3.779
traumatic_stress_any Yes versus No	1.0000	1.174	0.711	1.938
financial_stress_any Yes versus No	1.0000	0.917	0.621	1.352
partner_stress_any_a Yes versus No	1.0000	0.948	0.626	1.435
emotional_stress_any Yes versus No	1.0000	1.324	0.912	1.922
Note: The degrees of freedom in computing the confidence limits is 2241.				

```
*--- Objective 3
*--- Dental cleaning is main exposure
*--- Manual Backward Model Building
*--- See steps recorded separately
*--- Without interaction selected model;
ods rtf file =
'F:\University of South Carolina\WILLIAMS, MONIQUE - Dissertation for Monique
Williams\Post Defense Outputs\
20200404_Objective_3a_wo_Interaction_Selected_Model_Binary_Logistic_Regression_
Outputs.rtf';
ods graphics on;
/*ods output ModelANOVA = type3table2;*/
proc surveylogistic data = prep_prams1215;
strata STRAT_YR_n;
weight WTANAL;
class
BD_DCLN(ref = '1 Neither before nor During')
/*--- Predisposing Factors*/
MAT_AGE_GROUP_n(ref = "Below 35 Years")
maternal_race_n2r(ref = "White and Other")
mat_edu_yrs2(ref = "Below 12 Years")
maritlstatus_n(ref = "Unmarried")
/*--- Enabling Factors*/
```

rural_n(ref = "No")

INCOME7n(ref = "$0 to $19,000")

PNC_1ST_n2(ref = "Delayed (After 13 Weeks)")

prenatal_ins_n3(ref = "Uninsured")

/*--- Need Factors*/

DDS_PROB_n(ref = "No")

PREG_TRY_n(ref = "No")

/*Biological Factors*/

mom_pre_bmi_cat_n(ref = "Normal")

MM_MD_n(ref = "Yes")

SEX_n(ref = "Male")

PRE_LB_n2(ref = "No")

NewWghtGain(ref = "Recommended")

MM_HBP_n(ref = "Yes")

BD_DIAB (ref = "Pre Diabetes")

PREV_LBW_n2(ref = "Yes")

PREV_PRE_n2(ref = "Yes")

/*Health Behaviors*/

BPG_DDS_n(ref = "No")

smoke_before_n(ref = "Yes")

smoke_during_n(ref = "Yes")

/*DRK_2YRS_n(ref = "No") */

DRK6_3B_RAW_n(ref = "Yes")

```
DRK6_3L_RAW_n(ref = "Yes")

EXERAPWK_n2(ref = "< 3 Times per Week")

VITAMIN_YN(ref = "No")

/*Psychobiological Factors*/

PABDHUS(ref = "Yes")

psych_abuse_any(ref = "Yes")

traumatic_stress_any_ai(ref = "Yes")

financial_stress_any_ai(ref = "Yes")

partner_stress_any_ai(ref = "Yes")

emotional_stress_any_ai(ref = "Yes")

/ param = glm;

model PTL (event = 'Yes') =

/*--- Predisposing Factors*/

MAT_AGE_GROUP_n maternal_race_n2r

/*--- Enabling Factors*/

/**/

/*--- Need Factors*/

/**/

/*--- Biological Factors*/

MM_MD_n PRE_LB_n2 NewWghtGain PREV_LBW_n2

/*--- Health Behaviors*/

BD_DCLN

/*-- Psychobiological factors*/
```

psych_abuse_any

traumatic_stress_any_ai

financial_stress_any_ai

/ expb clodds rsquare PARMLABEL;

/**/

title 'Objective 3a Binary Logistic Regression, wo interaction Selected Model';

run;

ods rtf close;

Table J.12: Model Information.

Data Set	WORK.PREP_PRAMS 1215	
Response Variable	PTL	Preterm Labor
Number of Response Levels	2	
Stratum Variable	STRAT_YR_n	
Number of Strata	4	
Weight Variable	WTANAL	BC WT: ANALYSIS WT
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Table J.13: Variance Estimation.

Method	Taylor Series
Variance Adjustment	Degrees of Freedom (DF)

Table J.14: Observations and Weights.

Number of Observations Read	2870
Number of Observations Used	2229
Sum of Weights Read	208452.5
Sum of Weights Used	164987.4

Table J.15: Response Profile.

Ordered Value	PTL	Total Frequency	Total Weight
1	No	988	150356.99
2	Yes	1241	14630.45

Probability modeled is PTL='Yes'

Note: 641 observations were deleted due to missing values for the response or explanatory variables

Table J.16: Class Level Information.

Class	Value	Design Variables			
BD_DCLN	**2 Before Only**	1	0	0	0
	3 During Only	0	1	0	0
	4 Both Before and During	0	0	1	0
	1 Neither Before nor During	0	0	0	1
MAT_AGE_GROUP_n	**35 Years or More**	1	0		
	Below 35 Years	0	1		
maternal_race_n2r	**Black**	1	0		
	White and Other	0	1		
MM_MD_n	**No**	1	0		
	Yes	0	1		
PRE_LB_n2	**Yes**	1	0		
	No	0	1		

Continued

Class	Value	Design Variables			
NewWghtGain	**Less than Recommended**	1	0	0	
	More than Recommended	0	1	0	
	Recommended	0	0	1	
PREV_LBW_n2	**No**	1	0		
	Yes	0	1		
psych_abuse_any	**No**	1	0		
	Yes	0	1		
traumatic_stress_any_ai	**No**	1	0		
	Yes	0	1		
financial_stress_any_ai	**No**	1	0		
	Yes	0	1		

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Table J.17: Model Fit Statistics.

Criterion	Intercept Only	Intercept and Covariates
AIC	98817.649	90465.037
SC	98827.663	90605.227
-2 Log L	98815.649	90437.037

R-Square 0.0495

Max-rescaled R-Square 0.1099

Table J.18: Testing Global Null Hypothesis: BETA=0.

Test	F Value	Num DF	Den DF	Pr > F
Likelihood Ratio	644.57	12.9999	34359	<.0001
Score	5.77	13	2631	<.0001
Wald	4.93	13	2631	<.0001
Note: Second-order Rao-Scott design correction 0.0000 applied to the Likelihood Ratio test.				

Table J.19: Type 3 Analysis of Effects.

Effect	F Value	Num DF	Den DF	Pr > F
MAT_AGE_GROUP_n	3.71	1	2643	0.0542
maternal_race_n2r	9.67	1	2643	0.0019
MM_MD_n	14.27	1	2643	0.0002
PRE_LB_n2	11.02	1	2643	0.0009
NewWghtGain	4.03	2	2642	0.0178
PREV_LBW_n2	4.56	1	2643	0.0328
BD_DCLN	0.38	3	2641	0.7689
psych_abuse_any	6.84	1	2643	0.0090
traumatic_stress_any	3.01	1	2643	0.0830
financial_stress_any	4.02	1	2643	0.0451

Table J.20: Analysis of Maximum Likelihood Estimates.

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)	Label
Intercept		-0.0115	0.5628	-0.02	0.9837	0.989	Intercept: PTL=No
MAT_AGE_GROUP_n	**35 Years or More**	0.5362	0.2784	1.93	0.0542	1.710	Maternal Age Group 35 Years or More
MAT_AGE_GROUP_n	**Below 35 Years**	0	.	.	.	.	Maternal Age Group Below 35 Years
maternal_race_n2r	**Black**	0.6626	0.2131	3.11	0.0019	1.940	Maternal Race (2 Cat) Black
maternal_race_n2r	**White and Other**	0	.	.	.	.	Maternal Race (2 Cat) White and Other
MM_MD_n	**No**	-0.7920	0.2097	-3.78	0.0002	0.453	Medical Risk Factor No
MM_MD_n	**Yes**	0	.	.	.	.	Medical Risk Factor Yes
PRE_LB_n2	**Yes**	-0.7466	0.2249	-3.32	0.0009	0.474	Previous Live Births Yes
PRE_LB_n2	**No**	0	.	.	.	.	Previous Live Births No
NewWghtGain	**Less than Recommended**	0.4313	0.2519	1.71	0.0870	1.539	Maternal Weight Gain Less than Recommended
NewWghtGain	**More than Recommended**	-0.2438	0.2755	-0.88	0.3764	0.784	Maternal Weight Gain More Than Recommended
NewWghtGain	**Recommended**	0	.	.	.	.	Maternal Weight Gain Recommended
PREV_LBW_n2	**No**	-0.7531	0.3526	-2.14	0.0328	0.471	Previous Low Birth Weight No
PREV_LBW_n2	**Yes**	0	.	.	.	.	Previous Low Birth Weight Yes
BD_DCLN	**2 Before Only**	-0.0864	0.3022	-0.29	0.7749	0.917	Dental Cleaning Before-During Pregnancy 2 Before Only
BD_DCLN	**3 During Only**	-0.3735	0.5225	-0.71	0.4748	0.688	Dental Cleaning Before-During Pregnancy 3 During Only

Continued

Parameter		Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)	Label
BD_DCLN	**4 Both Before and During**	-0.2086	0.2347	-0.89	0.3742	0.812	Dental Cleaning Before-During Pregnancy 4 Both Before and During
BD_DCLN	**1 Neither Before nor During**	0	.	.	.	.	Dental Cleaning Before-During Pregnancy 1 Neither before nor During
psych_abuse_any	**No**	-1.1393	0.4357	-2.61	0.0090	0.320	Any Psychological Abuse During Pregnancy No
psych_abuse_any	**Yes**	0	.	.	.	.	Any Psychological Abuse During Pregnancy Yes
traumatic_stress_any	**No**	0.4847	0.2795	1.73	0.0830	1.624	Any Traumatic Stress No
traumatic_stress_any	**Yes**	0	.	.	.	.	Any Traumatic Stress Yes
financial_stress_any	**No**	-0.4085	0.2038	-2.00	0.0451	0.665	Any Financial Stress No
financial_stress_any	**Yes**	0	.	.	.	.	Any Financial Stress Yes
Note: The degrees of freedom for the t tests is 2643.							

Table J.21: Association of Predicted Probabilities and Observed Responses.

Percent Concordant	73.4	**Somers' D**	0.479
Percent Discordant	25.5	**Gamma**	0.484
Percent Tied	1.0	**Tau-a**	0.236
Pairs	1226108	**c**	0.739

Table J.22: Odds Ratio Estimates and t Confidence Intervals.

Effect	Unit	Estimate	95% Confidence Limits	
MAT_AGE_GROUP_n 35 Years or More versus Below 35 Years	1.0000	1.710	0.990	2.951
maternal_race_n2r Black versus White and Other	1.0000	1.940	1.277	2.946
MM_MD_n No versus Yes	1.0000	0.453	0.300	0.683
PRE_LB_n2 Yes versus No	1.0000	0.474	0.305	0.737
NewWghtGain Less than Recommended versus Recommended	1.0000	1.539	0.939	2.522
NewWghtGain More than Recommended versus Recommended	1.0000	0.784	0.457	1.345
PREV_LBW_n2 No versus Yes	1.0000	0.471	0.236	0.940
BD_DCLN 2 Before Only versus 1 Neither before nor During	1.0000	0.917	0.507	1.659
BD_DCLN 3 During Only versus 1 Neither before nor During	1.0000	0.688	0.247	1.918
BD_DCLN Both Beforeand During versus 1 Neither before nor During	1.0000	0.812	0.512	1.286
psych_abuse_any No versus Yes	1.0000	0.320	0.136	0.752
traumatic_stress_any No versus Yes	1.0000	1.624	0.939	2.809
financial_stress_any No versus Yes	1.0000	0.665	0.446	0.991
Note: The degrees of freedom in computing the confidence limits is 2643.				

APPENDIX K

ASSOCIATION OF DENTAL CLEANING WITH SMALL FOR GESTATIONAL AGE: USING DENTAL CLEANING AS A 4-CATEGORY VARIABLE (SAS INPUT AND OUTPUT WITH INTERACTIONS) FULL MODEL

```
*--- SGA
*--- Dental Cleaning is Main Exposure
*--- Multivariable Analyses;
*--- Binary Logistic Regression;
*--- Adjusted Associations between Dependent and Independent Variables;
*--- With All Selected Interaction Full Model;
ods rtf file =
'F:\University of South Carolina\WILLIAMS, MONIQUE - Dissertation for Monique
Williams\Post Defense Outputs\
20200427_SGA_Binary_Logistic_Regression_Full_Model_All_Selected_Interaction.rtf';
ods graphics on;
proc surveylogistic data = prep_prams1215;
strata STRAT_YR_n;
weight WTANAL;
class
```

BD_DCLN2(ref = 'No')

DRK6_3L_RAW_n(ref = "No")

/*--- Predisposing Factors*/

MAT_AGE_GROUP_n(ref = "Below 35 Years")

maternal_race_n3(ref = "White")

/*maternal_race_n2(ref = "White") */

maternal_race_n2r(ref = "White and Other")

mat_edu_yrs2(ref = "Below 12 Years")

mat_edu_yrs3(ref = "Below 12 Years")

maritlstatus_n(ref = "Unmarried")

/*--- Enabling Factors*/

rural_n(ref = "No")

INCOME7n(ref = "$0 to $19,000")

INCOME7n2(ref = "$0 to $37,000")

PNC_1ST_n2(ref = "Timely (13 Weeks or Earlier)")

PNC_1ST_n(ref = "Timely (13 Weeks or Earlier)")

DDS_INS_n2(ref = "No")

DDS_INS_n(ref = "No")

prenatal_ins_n3(ref = "Uninsured")

prenatal_ins_n2(ref = "Medicaid and Anticipated Insurance (Non-insured)")

/*prenatal_ins_n2(ref = "Commercial Insurance")*/

/*--- Need Factors*/

DDS_PROB_n(ref = "No")

PREG_TRY_n(ref = "No")

DDS_CARE_n(ref = "No")

/*Biological Factors*/

mom_pre_bmi_cat_n(ref = "Normal")

mom_pre_bmi_cat_n2(ref = "Underweight/Normal")

MM_MD_n(ref = "No")

/*SEX_n(ref = "Male") */

PRE_LB_n(ref = "None")

PRE_LB_n2(ref = "No")

NewWghtGain(ref = "Recommended")

MM_HBP_n(ref = "No")

MM_DIAB_n(ref = "No")

BD_DIAB (ref = "Neither Pre nor During Diabetes")

PREV_LBW_n(ref = "No")

PREV_LBW_n2(ref = "No")

PREV_PRE_n2(ref = "No")

PREV_PRE_n(ref = "No")

/*Health Behaviors*/

PRE_DDS_n(ref = "No")

smoke_before_n(ref = "No")

smoke_during_n(ref = "No")

/*DRK_2YRS_n(ref = "No") */

DRK6_3B_RAW_n(ref = "No")

EXERAPWK_n4(ref = "0 Times per Week")

EXERAPWK_n2(ref = "< 3 Times per Week")

VITAMIN_n(ref = "Didn't Take Vitamin")

VITAMIN_n2(ref = "0-3 Times per Week")

VITAMIN_YN(ref = "No")

/*Psychobiological Factors*/

PAB6HUS_n(ref = "No")

PAD6HUS_n(ref = "No")

PABDHUS(ref = "No")

psych_abuse_any(ref = "No")

traumatic_stress_any_ai(ref = "No")

financial_stress_any_ai(ref = "No")

partner_stress_any_ai(ref = "No")

emotional_stress_any_ai(ref = "No")

STRS_any(ref = "No")

PTB(ref = "No")

/ param = glm;

model sfga (event = 'Yes') =

/*--- Predisposing Factors*/

MAT_AGE_GROUP_n maternal_race_n2r mat_edu_yrs2 maritlstatus_n

/*--- Enabling Factors*/

rural_n INCOME7n PNC_1ST_n2 prenatal_ins_n3

/*--- Need Factors*/

DDS_PROB_n PREG_TRY_n

/*--- Biological Factors*/

mom_pre_bmi_cat_n MM_MD_n PRE_LB_n MM_HBP_n BD_DIAB PREV_LBW_n2

PREV_PRE_n2

/*--- Health Behaviors*/

BD_DCLN2 smoke_before_n smoke_during_n DRK6_3B_RAW_n DRK6_3L_RAW_n

EXERAPWK_n2 VITAMIN_YN

/*-- Psychobiological factors*/

PABDHUS

psych_abuse_any

traumatic_stress_any_ai

financial_stress_any_ai

partner_stress_any_ai

emotional_stress_any_ai

/*--- Interactions*/

BD_DCLN2*smoke_during_n

/ expb clodds rsquare PARMLABEL;

title 'SGA: Binary Logistic Regression Full Model, Interaction Selected All';

run;

ods rtf close;

Table K.1: Model Information.

Data Set	WORK.PREP_PRAMS1215	
Response Variable	sfga	Small for Gestational Age
Number of Response Levels	2	
Stratum Variable	STRAT_YR_n	
Number of Strata	4	
Weight Variable	WTANAL	BC WT: ANALYSIS WT
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Table K.2: Variance Estimation.

Method	Taylor Series
Variance Adjustment	Degrees of Freedom (DF)

Table K.3: Observations and Weights.

Number of Observations Read	2870
Number of Observations Used	2152
Sum of Weights Read	208452.5
Sum of Weights Used	162604.6

Table K.4: Response Profile.

Ordered Value	sfga	Total Frequency	Total Weight
1	No	1576	143651.62
2	Yes	576	18952.95

Probability modeled is sfga='Yes'

Note: 718 observations were deleted due to missing values for the response or explanatory variables

Table K.5: Class Level Information.

Class	Value	Design Variables			
BD_DCLN2	**Yes**	1	0		
	No	0	1		
DRK6_3L_RAW_n	**Yes**	1	0		
	No	0	1		
MAT_AGE_GROUP_n	**35 Years or More**	1	0		
	Below 35 Years	0	1		
maternal_race_n2r	**Black**	1	0		
	White and Other	0	1		
mat_edu_yrs2	**12 Years or More**	1	0		
	Below 12 Years	0	1		
maritlstatus_n	**Married**	1	0		
	Unmarried	0	1		
rural_n	**Yes**	1	0		
	No	0	1		
INCOME7n	**$19,001 to $37,000**	1	0	0	0
	$37,001 to $67,000	0	1	0	0
	$67,001 or More	0	0	1	0
	$0 to $19,000	0	0	0	1
PNC_1ST_n2	**Delayed (After 13 Weeks)**	1	0		
	Timely (13 Weeks or Earlier)	0	1		
prenatal_ins_n3	**Medicaid**	1	0	0	

Continued

Class	Value	Design Variables			
	Private Insurance/Military/Other	0	1	0	
	Uninsured	0	0	1	
DDS_PROB_n	Yes	1	0		
	No	0	1		
PREG_TRY_n	Yes	1	0		
	No	0	1		
mom_pre_bmi_cat_n	Obese	1	0	0	0
	Overweight	0	1	0	0
	Underweight	0	0	1	0
	Normal	0	0	0	1
MM_MD_n	Yes	1	0		
	No	0	1		
PRE_LB_n	One	1	0	0	
	Two or More	0	1	0	
	None	0	0	1	
MM_HBP_n	Yes	1	0		
	No	0	1		
BD_DIAB	During Only	1	0	0	
	Pre Diabetes	0	1	0	
	Neither Pre nor During Diabetes	0	0	1	
PREV_LBW_n2	Yes	1	0		
	No	0	1		
PREV_PRE_n2	Yes	1	0		
	No	0	1		
smoke_before_n	Yes	1	0		
	No	0	1		
smoke_during_n	Yes	1	0		
	No	0	1		
DRK6_3B_RAW_n	Yes	1	0		
	No	0	1		
EXERAPWK_n2	3 or More Times per Week	1	0		
	< 3 Times per Week	0	1		
VITAMIN_YN	Yes	1	0		
	No	0	1		
PABDHUS	Yes	1	0		
	No	0	1		
psych_abuse_any	Yes	1	0		

Continued

Class	Value	Design Variables			
	No	0	1		
traumatic_stress_any_ai	**Yes**	1	0		
	No	0	1		
financial_stress_any_ai	**Yes**	1	0		
	No	0	1		
partner_stress_any_ai	**Yes**	1	0		
	No	0	1		
emotional_stress_any_ai	**Yes**	1	0		
	No	0	1		

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Table K.6: Model Fit Statistics.

Criterion	Intercept Only	Intercept and Covariates
AIC	117081.05	105710.08
SC	117091.04	106100.05
-2 Log L	117079.05	105632.08

R-Square 0.0680

Max-rescaled R-Square 0.1324

Table K.7: Testing Global Null Hypothesis: BETA=0.

Testing Global Null Hypothesis: BETA=0				
Test	**F Value**	**Num DF**	**Den DF**	**Pr > F**
Likelihood Ratio	301.19	37.9991	82838	<.0001
Score	2.67	38	2143	<.0001
Wald	2.00	38	2143	0.0003
Note: Second-order Rao-Scott design correction 0.0000 applied to the Likelihood Ratio test.				

Table K.8: Type 3 Analysis of Effects.

Effect	F Value	Num DF	Den DF	Pr > F
MAT_AGE_GROUP_n	0.22	1	2180	0.6422
maternal_race_n2r	6.87	1	2180	0.0088
mat_edu_yrs2	2.29	1	2180	0.1302
maritlstatus_n	1.84	1	2180	0.1755
rural_n	0.34	1	2180	0.5576
INCOME7n	0.60	3	2178	0.6141
PNC_1ST_n2	0.10	1	2180	0.7546
prenatal_ins_n3	1.84	2	2179	0.1584
DDS_PROB_n	0.45	1	2180	0.5037
PREG_TRY_n	0.31	1	2180	0.5786
mom_pre_bmi_cat_n	0.71	3	2178	0.5448
MM_MD_n	0.40	1	2180	0.5247
PRE_LB_n	0.63	2	2179	0.5317
MM_HBP_n	0.46	1	2180	0.4976
BD_DIAB	2.19	2	2179	0.1120
PREV_LBW_n2	4.33	1	2180	0.0375
PREV_PRE_n2	0.41	1	2180	0.5211
BD_DCLN2	4.47	1	2180	0.0346
smoke_before_n	2.04	1	2180	0.1532
smoke_during_n	0.27	1	2180	0.6018
DRK6_3B_RAW_n	0.25	1	2180	0.6185
DRK6_3L_RAW_n	0.77	1	2180	0.3789
EXERAPWK_n2	1.33	1	2180	0.2488
VITAMIN_YN	3.82	1	2180	0.0508

Continued

Effect	F Value	Num DF	Den DF	Pr > F
PABDHUS	1.33	1	2180	0.2495
psych_abuse_any	0.04	1	2180	0.8328
traumatic_stress_any	0.03	1	2180	0.8671
financial_stress_any	2.44	1	2180	0.1186
partner_stress_any_a	0.69	1	2180	0.4065
emotional_stress_any	5.92	1	2180	0.0151
BD_DCLN2*smoke_duri n	3.42	1	2180	0.0645

Table K.9: Analysis of Maximum Likelihood Estimates.

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
Intercept			-2.3715	0.5432	-4.37	<.0001	0.093
MAT_AGE_GROUP_n	35 Years or More		0.1587	0.3415	0.46	0.6422	1.172
MAT_AGE_GROUP_n	Below 35 Years		0	.	.	.	.
maternal_race_n2r	Black		0.7245	0.2765	2.62	0.0088	2.064
maternal_race_n2r	White and Other		0	.	.	.	.
mat_edu_yrs2	12 Years or More		-0.5033	0.3325	-1.51	0.1302	0.605
mat_edu_yrs2	Below 12 Years		0	.	.	.	.
maritlstatus_n	Married		-0.3981	0.2937	-1.36	0.1755	0.672
maritlstatus_n	Unmarried		0	.	.	.	.
rural_n	Yes		0.1705	0.2907	0.59	0.5576	1.186
rural_n	No		0	.	.	.	.
INCOME7n	$19,001 to $37,000		-0.3022	0.2886	-1.05	0.2952	0.739
INCOME7n	$37,001 to $67,000		0.0471	0.5045	0.09	0.9257	1.048
INCOME7n	$67,001 or More		-0.2256	0.6064	-0.37	0.7099	0.798
INCOME7n	$0 to $19,000		0	.	.	.	.
PNC_1ST_n2	Delayed (After 13 Weeks)		-0.1453	0.4648	-0.31	0.7546	0.865
PNC_1ST_n2	Timely (13 Weeks or Earlier)		0	.	.	.	.
prenatal_ins_n3	Medicaid		0.8316	0.4574	1.82	0.0692	2.297
prenatal_ins_n3	Private Insurance/Military/Other		0.9262	0.5374	1.72	0.0849	2.525
prenatal_ins_n3	Uninsured		0	.	.	.	.
DDS_PROB_n	Yes		-0.1916	0.2866	-0.67	0.5037	0.826
DDS_PROB_n	No		0	.	.	.	.
PREG_TRY_n	Yes		-0.1458	0.2624	-0.56	0.5786	0.864

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
PREG_TRY_n	**No**		0	.	.	.	.
mom_pre_bmi_cat_n	**Obese**		-0.3967	0.2752	-1.44	0.1495	0.673
mom_pre_bmi_cat_n	**Overweight**		-0.1347	0.2887	-0.47	0.6408	0.874
mom_pre_bmi_cat_n	**Underweight**		-0.0148	0.4306	-0.03	0.9726	0.985
mom_pre_bmi_cat_n	**Normal**		0	.	.	.	.
MM_MD_n	**Yes**		0.2270	0.3568	0.64	0.5247	1.255
MM_MD_n	**No**		0	.	.	.	.
PRE_LB_n	**One**		-0.1588	0.2767	-0.57	0.5661	0.853
PRE_LB_n	**Two or More**		-0.3574	0.3182	-1.12	0.2615	0.700
PRE_LB_n	**None**		0	.	.	.	.
MM_HBP_n	**Yes**		0.2840	0.4187	0.68	0.4976	1.328
MM_HBP_n	**No**		0	.	.	.	.
BD_DIAB	**During Only**		-0.8392	0.4358	-1.93	0.0543	0.432
BD_DIAB	**Pre Diabetes**		-0.8456	0.7840	-1.08	0.2809	0.429
BD_DIAB	**Neither Pre nor During Diabetes**		0	.	.	.	.
PREV_LBW_n2	**Yes**		0.9795	0.4705	2.08	0.0375	2.663
PREV_LBW_n2	**No**		0	.	.	.	.
PREV_PRE_n2	**Yes**		-0.2801	0.4364	-0.64	0.5211	0.756
PREV_PRE_n2	**No**		0	.	.	.	.
BD_DCLN2	**Yes**		-0.0810	0.2426	-0.33	0.7385	0.922
BD_DCLN2	**No**		0	.	.	.	.
smoke_before_n	**Yes**		0.4837	0.3385	1.43	0.1532	1.622
smoke_before_n	**No**		0	.	.	.	.
smoke_during_n	**Yes**		0.8499	0.4657	1.82	0.0682	2.339
smoke_during_n	**No**		0	.	.	.	.
DRK6_3B_RAW_n	**Yes**		-0.1311	0.2633	-0.50	0.6185	0.877

Continued

Parameter			Estimate	Standard Error	t Value	Pr > |t|	Exp(Est)
DRK6_3B_RAW_n	**No**		0	.	.	.	.
DRK6_3L_RAW_n	**Yes**		-0.4724	0.5367	-0.88	0.3789	0.624
DRK6_3L_RAW_n	**No**		0	.	.	.	.
EXERAPWK_n2	**3 or More Times per Week**		0.2687	0.2329	1.15	0.2488	1.308
EXERAPWK_n2	**< 3 Times per Week**		0	.	.	.	.
VITAMIN_YN	**Yes**		0.4782	0.2447	1.95	0.0508	1.613
VITAMIN_YN	**No**		0	.	.	.	.
PABDHUS	**Yes**		-0.7050	0.6120	-1.15	0.2495	0.494
PABDHUS	**No**		0	.	.	.	.
psych_abuse_any	**Yes**		0.0999	0.4732	0.21	0.8328	1.105
psych_abuse_any	**No**		0	.	.	.	.
traumatic_stress_any	**Yes**		0.0589	0.3521	0.17	0.8671	1.061
traumatic_stress_any	**No**		0	.	.	.	.
financial_stress_any	**Yes**		0.3882	0.2487	1.56	0.1186	1.474
financial_stress_any	**No**		0	.	.	.	.
partner_stress_any_a	**Yes**		-0.2129	0.2565	-0.83	0.4065	0.808
partner_stress_any_a	**No**		0	.	.	.	.
emotional_stress_any	**Yes**		-0.5746	0.2362	-2.43	0.0151	0.563
emotional_stress_any	**No**		0	.	.	.	.
BD_DCLN2*smoke_durin	**Yes**	**Yes**	-1.2679	0.6854	-1.85	0.0645	0.281
BD_DCLN2*smoke_durin	**Yes**	**No**	0	.	.	.	.
BD_DCLN2*smoke_durin	**No**	**Yes**	0	.	.	.	.
BD_DCLN2*smoke_durin	**No**	**No**	0	.	.	.	.

Note: The degrees of freedom for the t tests is 2180.

Table K.10: Analysis of Maximum Likelihood Estimates.

Parameter			Label
Intercept			Intercept: sfga=No
MAT_AGE_GROUP_n	**35 Years or More**		Maternal Age Group 35 Years or More
MAT_AGE_GROUP_n	**Below 35 Years**		Maternal Age Group Below 35 Years
maternal_race_n2r	**Black**		Maternal Race (2 Cat) Black
maternal_race_n2r	**White and Other**		Maternal Race (2 Cat) White and Other
mat_edu_yrs2	**12 Years or More**		Maternal Education (2 Cat) 12 Years or More
mat_edu_yrs2	**Below 12 Years**		Maternal Education (2 Cat) Below 12 Years
maritlstatus_n	**Married**		Marital Status Married
maritlstatus_n	**Unmarried**		Marital Status Unmarried
rural_n	**Yes**		Rurality Yes
rural_n	**No**		Rurality No
INCOME7n	**$19,001 to $37,000**		Household Income Categories $19,001 to $37,000
INCOME7n	**$37,001 to $67,000**		Household Income Categories $37,001 to $67,000
INCOME7n	**$67,001 or More**		Household Income Categories $67,001 or More
INCOME7n	**$0 to $19,000**		Household Income Categories $0 to $19,000
PNC_1ST_n2	**Delayed (After 13 Weeks)**		Prenatal Care Initiation Delayed (After 13 Weeks)
PNC_1ST_n2	**Timely (13 Weeks or Earlier)**		Prenatal Care Initiation Timely (13 Weeks or Earlier)
prenatal_ins_n3	**Medicaid**		Medicaid Insurance (Poverty Proxy) 3 Cat Medicaid
prenatal_ins_n3	**Private Insurance/Military/Other**		Medicaid Insurance (Poverty Proxy) 3 Cat Private Insurance/Military/Other
prenatal_ins_n3	**Uninsured**		Medicaid Insurance (Poverty Proxy) 3 Cat Uninsured
DDS_PROB_n	**Yes**		Dental Problem During Pregnancy Yes
DDS_PROB_n	**No**		Dental Problem During Pregnancy No
PREG_TRY_n	**Yes**		Were Trying to Get Pregnant Yes
PREG_TRY_n	**No**		Were Trying to Get Pregnant No
mom_pre_bmi_cat_n	**Obese**		Prepregnancy BMI Obese

Continued

Parameter			Label
mom_pre_bmi_cat_n	**Overweight**		Prepregnancy BMI Overweight
mom_pre_bmi_cat_n	**Underweight**		Prepregnancy BMI Underweight
mom_pre_bmi_cat_n	**Normal**		Prepregnancy BMI Normal
MM_MD_n	**Yes**		Medical Risk Factor Yes
MM_MD_n	**No**		Medical Risk Factor No
PRE_LB_n	**One**		Previous Live Births One
PRE_LB_n	**Two or More**		Previous Live Births Two or More
PRE_LB_n	**None**		Previous Live Births None
MM_HBP_n	**Yes**		Hypertension During Pregnancy Yes
MM_HBP_n	**No**		Hypertension During Pregnancy No
BD_DIAB	**During Only**		Pre-During Diabetes During Only
BD_DIAB	**Pre Diabetes**		Pre-During Diabetes Pre Diabetes
BD_DIAB	**Neither Pre nor During Diabetes**		Pre-During Diabetes Neither Pre nor During Diabetes
PREV_LBW_n2	**Yes**		Previous Low Birth Weight Yes
PREV_LBW_n2	**No**		Previous Low Birth Weight No
PREV_PRE_n2	**Yes**		Previous Preterm Birth Yes
PREV_PRE_n2	**No**		Previous Preterm Birth No
BD_DCLN2	**Yes**		Dental Cleaning Before/During Pregnancy Yes
BD_DCLN2	**No**		Dental Cleaning Before/During Pregnancy No
smoke_before_n	**Yes**		Mom Smoked 3 Months Before Pregnancy Yes
smoke_before_n	**No**		Mom Smoked 3 Months Before Pregnancy No
smoke_during_n	**Yes**		Mom Smoked During Pregnancy Yes
smoke_during_n	**No**		Mom Smoked During Pregnancy No
DRK6_3B_RAW_n	**Yes**		Alcoholic Drinks 3 Months Before Pregnancy Yes
DRK6_3B_RAW_n	**No**		Alcoholic Drinks 3 Months Before Pregnancy No
DRK6_3L_RAW_n	**Yes**		Alcoholic Drinks in Last 3 Months of Pregnancy Yes
DRK6_3L_RAW_n	**No**		Alcoholic Drinks in Last 3 Months of Pregnancy No

Continued

Parameter			Label
EXERAPWK_n2	**3 or More Times per Week**		Exercise (Times per Week) After Finding Pregnancy 3 or More Times per Week
EXERAPWK_n2	**< 3 Times per Week**		Exercise (Times per Week) After Finding Pregnancy < 3 Times per Week
VITAMIN_YN	**Yes**		Multivitamin Consumption During Month Before Pregnancy (Y/N) Yes
VITAMIN_YN	**No**		Multivitamin Consumption During Month Before Pregnancy (Y/N) No
PABDHUS	**Yes**		Physical Abuse Before or During Pregnancy Yes
PABDHUS	**No**		Physical Abuse Before or During Pregnancy No
psych_abuse_any	**Yes**		Any Psychological Abuse During Pregnancy Yes
psych_abuse_any	**No**		Any Psychological Abuse During Pregnancy No
traumatic_stress_any	**Yes**		Any Traumatic Stress Yes
traumatic_stress_any	**No**		Any Traumatic Stress No
financial_stress_any	**Yes**		Any Financial Stress Yes
financial_stress_any	**No**		Any Financial Stress No
partner_stress_any_a	**Yes**		Any Partner Related Stress Yes
partner_stress_any_a	**No**		Any Partner Related Stress No
emotional_stress_any	**Yes**		Any Emotional Stress Yes
emotional_stress_any	**No**		Any Emotional Stress No
BD_DCLN2*smoke_durin	**Yes**	**Yes**	Dental Cleaning Before/During Pregnancy Yes * Mom Smoked During Pregnancy Yes
BD_DCLN2*smoke_durin	**Yes**	**No**	Dental Cleaning Before/During Pregnancy Yes * Mom Smoked During Pregnancy No
BD_DCLN2*smoke_durin	**No**	**Yes**	Dental Cleaning Before/During Pregnancy No * Mom Smoked During Pregnancy Yes

Continued

Parameter			Label
BD_DCLN2*smoke_durin	**No**	**No**	Dental Cleaning Before/During Pregnancy No * Mom Smoked During Pregnancy No
Note: The degrees of freedom for the t tests is 2180.			

Table K.11: Association of Predicted Probabilities and Observed Responses.

Percent Concordant	59.7	**Somers' D**	0.201
Percent Discordant	39.6	**Gamma**	0.202
Percent Tied	0.7	**Tau-a**	0.079
Pairs	907776	**c**	0.600

Table K.12: Odds Ratio Estimates and t Confidence Intervals.

Effect	Unit	Estimate	95% Confidence Limits	
MAT_AGE_GROUP_n 35 Years or More versus Below 35 Years	1.0000	1.172	0.600	2.290
maternal_race_n2r Black versus White and Other	1.0000	2.064	1.200	3.549
mat_edu_yrs2 12 Years or More versus Below 12 Years	1.0000	0.605	0.315	1.160
maritlstatus_n Married versus Unmarried	1.0000	0.672	0.378	1.195
rural_n Yes versus No	1.0000	1.186	0.671	2.097
INCOME7n $19,001 to $37,000 versus $0 to $19,000	1.0000	0.739	0.420	1.302
INCOME7n $37,001 to $67,000 versus $0 to $19,000	1.0000	1.048	0.390	2.819

Continued

Effect	Unit	Estimate	95% Confidence Limits	
INCOME7n $67,001 or More versus $0 to $19,000	1.0000	0.798	0.243	2.621
PNC_1ST_n2 Delayed (After 13 Weeks) versus Timely (13 Weeks or Earlier)	1.0000	0.865	0.348	2.152
prenatal_ins_n3 Medicaid versus Uninsured	1.0000	2.297	0.937	5.633
prenatal_ins_n3 Private Insurance/Military/Other versus Uninsured	1.0000	2.525	0.880	7.243
DDS_PROB_n Yes versus No	1.0000	0.826	0.471	1.448
PREG_TRY_n Yes versus No	1.0000	0.864	0.517	1.446
mom_pre_bmi_cat_n Obese versus Normal	1.0000	0.673	0.392	1.154
mom_pre_bmi_cat_n Overweight versus Normal	1.0000	0.874	0.496	1.540
mom_pre_bmi_cat_n Underweight versus Normal	1.0000	0.985	0.423	2.293
MM_MD_n Yes versus No	1.0000	1.255	0.623	2.526
PRE_LB_n One versus None	1.0000	0.853	0.496	1.468
PRE_LB_n Two or More versus None	1.0000	0.700	0.375	1.305
MM_HBP_n Yes versus No	1.0000	1.328	0.585	3.019
BD_DIAB During Only versus Neither Pre nor During Diabetes	1.0000	0.432	0.184	1.016
BD_DIAB Pre Diabetes versus Neither Pre nor During Diabetes	1.0000	0.429	0.092	1.998
PREV_LBW_n2 Yes versus No	1.0000	2.663	1.058	6.701
PREV_PRE_n2 Yes versus No	1.0000	0.756	0.321	1.778
smoke_before_n Yes versus No	1.0000	1.622	0.835	3.151
DRK6_3B_RAW_n Yes versus No	1.0000	0.877	0.523	1.470
DRK6_3L_RAW_n Yes versus No	1.0000	0.624	0.218	1.786
EXERAPWK_n2 3 or More Times per Week versus < 3 Times per Week	1.0000	1.308	0.829	2.066
VITAMIN_YN Yes versus No	1.0000	1.613	0.998	2.607
PABDHUS Yes versus No	1.0000	0.494	0.149	1.641
psych_abuse_any Yes versus No	1.0000	1.105	0.437	2.795

Continued

Effect	Unit	Estimate	95% Confidence Limits	
traumatic_stress_any Yes versus No	1.0000	1.061	0.532	2.116
financial_stress_any Yes versus No	1.0000	1.474	0.905	2.401
partner_stress_any_a Yes versus No	1.0000	0.808	0.489	1.336
emotional_stress_any Yes versus No	1.0000	0.563	0.354	0.895
Note: The degrees of freedom in computing the confidence limits is 2180.				