PSYCHOSOCIAL PREDICTORS OF HEALTHY INFANT BIRTH OUTCOMES IN CHILDBEARING WOMEN

by

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DISSERTATION

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DEDICATION

I dedicate this work, and express my unbounded gratitude, to LaMon, the love of my life, whose confidence in me makes me able to be and do more than I ever dreamed! You were a wonderful sounding board and a great encouragement every step of the way!

Mike and James, it was always rewarding having you to commiserate with and to share triumphs. Thanks to you, Mom, for always being available to hear me laugh or cry about the long and difficult journey. My parents and siblings have ever been a source of encouragement.

My appreciation for the influence of Melvin Brass is profound, who taught his students that by God's grace and in His strength, nothing truly worthwhile is beyond their reach. Your motto, *lux lucet en tenebris,* has been an inspiration throughout my life and particularly in the pursuit of my doctorate.

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LIST OF ABBREVIATIONS

ACOG .....American Congress of Obstetricians and Gynecologists

CDC .....Centers for Disease Control and Prevention

CI.....Confidence Interval

CP.....Centering Pregnancy®

FOB.....Father of Baby

FFS.....Fragile Families and Child Wellbeing Study

HIBW.....Healthy Infant Birth Weight

IOM.....Institute of Medicine

LCBO.....Life Context Birth Outcomes Framework (adapted)

LIBW .....Low Infant Birth Weight

NCHC .....National Center for Health Statistics

OR.....Odds Ratio

PTB .....Preterm Birth

UNICEF .....United Nations International Children's Emergency Fund

U.S. .....United States

VIF .....Variance Inflation Factor

ABSTRACT

PSYCHOSOCIAL FACTORS PREDICTIVE OF HEALTHY INFANT BIRTH OUTCOMES IN CHILDBEARING WOMEN

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Low infant birth weight is a persistent problem in the United States. Psychosocial protective factors may confer benefits to vulnerable women, resulting in increased likelihood of healthy infant birth weight (HIBW). Few studies have examined predictors or correlates of healthy birth outcomes. The purpose of this study was to increase knowledge of protective factors and predictors of HIBW among childbearing women. A secondary analysis of the Fragile Families and Child Wellbeing Study public use baseline maternal surveys (1998 – 2000) was conducted (N = 4,759). Main predictors of HIBW were being married (adjusted odds ratio (OR) 2.38, 90% CI 1.12, 5.06) and (not) smoking (OR) 0.79 (90% CI 0.70, 0.89). Social support by FOB, self-rated health, and Hispanic and Other ethnicities were positively correlated with HIBW. Increasing relationship closeness with the FOB was associated with greater likelihood of HIBW. Black ethnicity, unmarried status, and increased church attendance negatively associated with HIBW (p=<.01). Nursing implications emphasize the importance of preconceptual and prenatal assessment and health promotion, including smoking cessation and reduction, and promoting social support from the FOB, particularly among Black, single women who smoke.

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Chapter 1

Psychosocial Factors Predictive of Healthy Infant Birth Outcomes in Childbearing Women

A healthy infant is the expected and joyful culmination of pregnancy; however, when an infant is born preterm or with low birth weight, the consequences can be devastating. The purpose of this secondary analysis was to examine which protective psychosocial factors are most predictive of healthy infant birth weight for childbearing women. The Life Context Birth Outcomes (LCBO) model provided the conceptual framework for this analysis of the Fragile Families and Child Wellbeing Study (FFS) public use dataset.

Significance and Magnitude

The March of Dimes (2015) has defined low infant birth weight (LIBW) as a weight of 2500 grams or less at birth. Preterm birth (PTB) is the primary cause of LIBW, with seven of ten infants born with low birth weight also being premature (March of Dimes, 2015). Preterm birth denotes a birth at less than 37 completed weeks of pregnancy. Worldwide, 15 million infants per year are born preterm (World Health Organization, 2014). Nearly two thirds of all PTB in developed countries have been found to have no biological explanation (Ferrero et al., 2016).

Unfortunately, the United States (U.S.) has one of the highest rates of LIBW and PTB in the industrialized world, despite spending more on health care than any other country (Blencowe et al., 2012). The prevalence of U.S. rates of LIBW increased between 1990 and 2013 from 6.97% to 8.02% (Martin, Hamilton, Osterman, Curtain, & Mathews, 2015). In 2014, the rate of LIBW dropped slightly to 8.00%, yet rose in 2015 to 8.07% (Hamilton , Martin, & Osterman, 2016). As the main contributing factor to LIBW, U.S. rates for PTB increased between 1992 and 2006 from 10.69% to 12.80%, declining slightly in 2013 to a rate of 11.39% (Martin et al., 2015). Illustrating the longstanding disparity between U.S. racial/ethnic groups (Linder &

Grove, 1947), prevalence rates for 2013 reported by race for LIBW were 7.0% for Whites, 7.1% for Hispanics, and 13.1% for Blacks. PTB rates stand at 10.2% for Whites, 11.3% for Hispanics and 16.3% for Blacks (Martin et al, 2015).

LIBW and PTB are the leading causes of infant mortality during the first month of life (March of Dimes, 2017), and even if an infant survives, the devastating sequelae may last a lifetime. Prematurity and LIBW have a direct association with neuromuscular debilities, such as cerebral palsy and cognitive disabilities, with the incidence and severity of these problems increasing as gestational age and weight at birth decrease (Marret et al., 2013; Saigal & Doyle, 2008).

Moreover, the costs of adverse birth outcomes in the United States are staggering, with 2007 estimates of PTB expenditures at $26 billion annually, or $51,600 for each infant born early (Institute of Medicine [IOM] Committee, 2007). Costs may exceed $100,000 for an infant weighing 1000 grams (2.2 lbs.) or less at birth (Almond, Chay, & Lee, 2004). Even among infants with a birth weight of 2,000 grams (4.4 lbs.), one extra pound of weight may mean a decrease of $10,000 in cost of care (dollar values from 2000; Almond et al., 2004). Clearly, any intervention that increases the length of gestation and birth weight by even a small margin may have the potential to increase quality of life for neonates with adverse birth outcomes and their parents, and may result in substantial savings to private and governmental sources of healthcare funding.

Factors that influence birth weight and length of gestation may include the mental and physical pre-gestational and prenatal health of the mother, as well as behavioral, social, and demographic factors. The influence of psychosocial factors on physiological processes in pregnancy is a very broad topic. Therefore, in the current study the focus was narrowed to

explore specific protective psychosocial factors among women at risk for LIBW due to social and demographic vulnerabilities.

Framework

Grounded in sociological research, the LCBO conceptual framework clearly depicts relationships between psychosocial factors and birth weight, making it a fit guide for the exploration of protective factor effects on infant birth weight. The LCBO (Figure 1) was adapted from the work of Culhane and Elo (2005). Their conceptual framework emerged after extensive investigation examining the effects of psychosocial predictors on birth outcomes. Figure 1 is an adaptation of the original framework, with modifications by the present author to support the current study objectives. The areas of adaptation consist of adding category labels at the top of the figure for clarity, modifying labels in the boxes to be consistent with study variables, and deleting various pathway arrows which were extraneous to the current study (appendix A).

The first column in the figure is entitled Life Context Stressors. The elements in this column represent circumstantial characteristics. Although some aspects of life context stressors may be volitional, items in this column represent segments of life which women may not be able to change substantially during the short time span of pregnancy, such as neighborhood context and socioeconomic/demographics (linked by pathway A, figure 1). Column two features areas over which individuals may have more immediate control. By making fundamental changes in these areas, downstream health outcomes may be modified. The characteristics of social support from various sources and health behaviors are found here. Pathways B and C indicate the interaction between each Life Context Stressor and the protective and risk factors. The arrows in the model depict direction of interaction; if substantial changes are made in elements of neighborhood context or in the moderators, the direction of influence may be strengthened or

weakened. Maternal Physiological Stress Reactions occupy column 3, which are affected by the stressors and moderators in the first two columns via pathway D. However, the FFS offers no biomarkers (e.g. cortisol values) as variables; therefore, this area of the framework was not tested in the current study. Pathway E represents effects of maternal stress upon the consequent variable, birth weight, which occupies the position in column 4 as a birth outcome. Birth weight was the consequent outcome variable available in FFS data for use in the current study. Despite the omission of gestational age as a variable in the FFS data, because PTB is the primary cause of LIBW (March of Dimes, 2015), it will be included in the discussion of adverse birth outcomes throughout the paper.

Background: Relationship between Psychosocial Factors and Birth Outcomes

The belief that psychosocial stressors can produce negative birth outcomes has been held by many cultures since the time of ancient Rome (French, 1986), and remains under investigation today. In a recent study of preterm birth in highly developed countries, researchers found no biological explanation for nearly two thirds of all cases (Ferrero et al., 2016), making the exploration of psychosocial factors and birth outcomes timely. In the following pages, a discussion of stressors in the life context will be presented, followed by moderating factors, and proceeding sequentially through the order in which they are given in the LCBO framework.

Figure 1 Life Context Birth Outcomes Conceptual framework

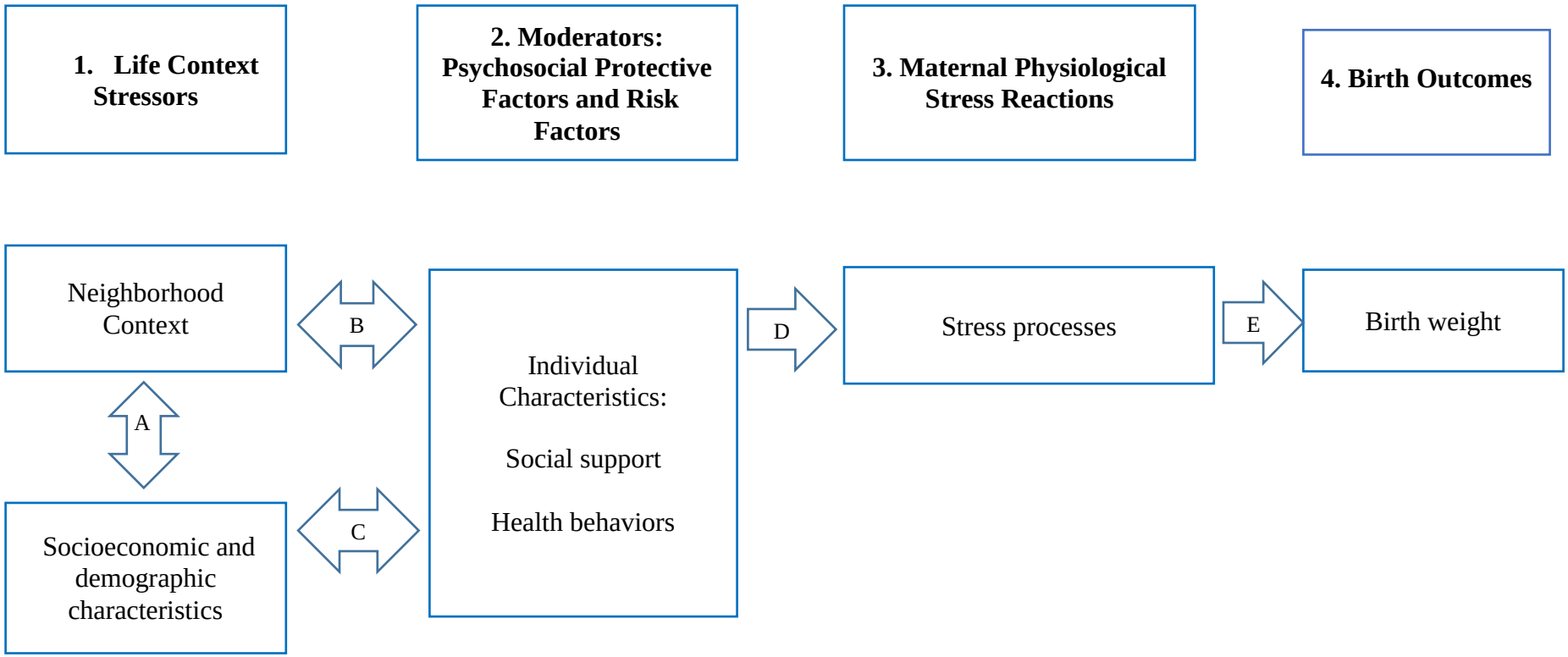


Figure 1 Life Context Birth Outcomes, adapted

Life Context Stressors

Known psychosocial influences acting as risk factors for adverse birth outcomes include maternal perceptions of stress, as well as the timing in which the stressor is experienced during pregnancy (Class, Lichtenstein, Langstrom, & D'Onofrio, 2011; Lilliecreutz, Larén, Sydsjö, & Josefsson, 2016; Loomans et al., 2013). The mechanisms through which stress directly and indirectly affects the weight of the fetus and timing of birth include the activation of biomarkers such as cortisol, corticotropin-releasing hormone, and immunity components, which have significant effects on the developing fetus, the processes of pregnancy, and initiation of labor (Ellman et al., 2008; Gravett, Rubens, Nunes, & GAPPS Review Group, 2010; Hobel, Dunkel-Schetter, Roesch, Castro, & Arora, 1999; Mancuso, Dunkel-Schetter, Rini, Roesch, & Hobel, 2004). Although the emphasis in this study was upon the sources and moderators of psychosocial stress, the role of complex physiological links between stress and birth outcomes is acknowledged. Within the LCBO framework (Figure 1), Life Context Stressors include the concepts of neighborhood context and socioeconomic/demographic characteristics.

Neighborhood context. According to Culhane and Elo (2005), the neighborhood context refers to three aspects of conditions: the social environment, service environment, and physical characteristics of the area. The social environment of the neighborhood includes socioeconomic composition, crime, and residential stability. Service environment is reflective of the availability of goods and services, such as access to health care, transportation, police protection, and availability of nutritious foods from grocery stores, rather than less nourishing options from convenience stores. Finally, the physical characteristics of neighborhoods include the quality of the housing, exposure to noise and air pollution, and availability of safe parks and recreational areas. Culhane and Elo (2005) noted that adverse neighborhood-level settings along

all three dimensions—social, service and physical—were reflective of socioeconomic disadvantage and have often been linked with LIBW.

Additional research has revealed that women from neighborhoods and census-tracts encompassing areas of high socioeconomic deprivation have higher rates of LIBW (Janevic et al., 2010). Nkansah-Amankra (2010) revealed that neighborhood deprivation was a mediator between maternal stress and LIBW. In a recent meta-analysis of 21 studies, researchers found that women from the poorest neighborhoods had a 27% greater risk of giving birth to a premature or low birth weight infant than other women (Ncube, Enquobahrie, Albert, Herrick, & Burke, 2016). The reasons for the poverty-LIBW link are not clear, but poverty appears to be a proxy for deprivation and the accompanying stress. Food insecurity and insufficient vegetable intake caused by living in poor service environments have been recognized as consequences of poverty (Meng, Thompson, & Hall, 2013).

Further, living in neighborhoods with high levels of crime increased risk of adverse birth outcomes: In low-violence areas of Raleigh, North Carolina, the LIBW rate was 4.9%, yet increased to 9.6% in highly violent areas (Messer, Kaufman, Dole, Herring, & Laraia, 2006). Vinikoor-Imler, Messer, Evenson, and Laraia (2011) found that women living in neighborhoods with widespread poor housing conditions, including over-crowding, visible litter and graffiti, had higher odds ratios (OR) for LIBW. Polluted physical environments are clearly associated with both LIBW and PTB, with multiple studies showing a link between lead and air pollution and adverse birth outcomes (Bloom et al., 2015; Stieb, Chen, Eshoul, & Judek, 2012). Unsafe neighborhoods tend to be those in poverty-stricken areas, and intuitively the two concepts of neighborhood context and socioeconomic resources are related in a bidirectional manner with

income and social ties being key to the selection of location of residence (Elo, Mykyta, Margolis, & Culhane, 2009; Giurgescu et al., 2012; Meng, Thompson, & Hall, 2013).

Living in a racially segregated neighborhood is an example of the union between neighborhood context and socioeconomic/demographic elements (noted by arrow A in the LCBO framework). Residential segregation by race/ethnicity leads to differences in exposure to both supportive and adverse conditions. Black women are significantly more likely to live in areas with high crime rates, poor housing, and fewer municipal services than White women resulting in racial health disparities, including LIBW and PTB (Laveist, 2003; Mason, Messer, Laraia, & Mendola, 2009; Walton, 2009). Conversely, living in ethnic enclaves may result in health advantages if the context is supportive. For instance, Morenoff (2000; 2003), a sociology researcher who explored neighborhood impacts on birth outcomes, discovered that infant birth weights were higher among Mexican women living in neighborhoods composed of other Mexican immigrants. This finding was not true of other cultures in the study, inviting further exploration of cultural influences on birth outcomes.

Socioeconomic and demographic characteristics. The circular nature of the bidirectional relationships between neighborhoods, sociodemographic characteristics, and health of the individuals within them, is well-illustrated in the LCBO framework (Figure 1, pathways A, B and C). Let the reader remember that the boxes and pathways in the framework are theoretical representations which appear to be distinct in the illustration, yet often merge and blur in the lived experience because of shared norms, cultural values, and individual interpretations or applications. Pathways A and B are characterized by neighborhood physiognomies which influence individual socioeconomic and demographic characteristics through such channels as access to schools, training, socialization, and employment opportunities. Neighborhoods in

which ethnic and cultural groups collect have both positive and negative effects on the women living within them, and have a far-reaching impact on the identities, opportunities, or marginalization they experience (Moore, 2005).

Parents with higher incomes are more likely to give birth to healthy infants than those with low incomes. In a recent international study, researchers found a clear graded relationship between parental income and the birth weight of children born in the United States, the association being less marked in the United Kingdom, Canada, and Australia (Martinson & Reichman, 2016). The authors of the study believed that the more generous social and health care programs for pregnant mothers in the latter three countries may have buffered the effects of poverty. Low income has been consistently linked with adverse birth outcomes, as revealed in a systematic review in which 93 of 106 studies supported an association between a lower socioeconomic measure and a poorer birth outcome (Blumenshine, Egerter, Barclay, Cubbin, & Braveman, 2010). Additionally, low income has been shown to be predictive of increased prenatal anxiety among some women (Gurung, Dunkel-Schetter, Collins, Rini, & Hobel, 2005), demonstrating that poverty may be an independent source of stress.

Socioecnomic and demographic characteristics are linked bidirectionaly through Pathway C to psychosocial factors and health status and behaviors. For example, smoking was found to be more significantly associated with poverty than any other factor, and had a strong effect on both birth weight and length of gestation (Nkansah-Amankra, 2010). Income and culture/ethnicity influence diet, daily activities, and education. Education has been shown to be weakly associated with birth weight in some studies (Rini, Dunkel-Schetter, Wadwha, & Sandman, 1999). The amount of education is usually closely associated with income (Rini et al., 1999) and has been found to vary by race (Pearl, Braveman, & Abrams, 2001).

Race is another demographic characteristic associated with birth weight. LIBW is significantly correlated with the self-identification of Black/African American, even after adjusting for income and education. Rates of LIBW have been found to be higher in Black women than White women at all ages, and surprisingly, the disparity between races as to adverse infant outcomes has been found to increase with maternal age (Geronimus, 1996). The full circle linking neighborhood, socioeconomics and demographics with individual characteristics (via pathways A, B, and C in Figure 1) is thus evident, and illustrates the interconnected nature of the variables.

The relationships between demographics and health are complex, and are complicated by a troubling problem in American society. A part of being a member of any demographic group is the reaction from others in society to that demographic category, for instance, the negative reaction of racism directed at minorities. Perceiving that racism is directed at oneself was rated as very stressful by those experiencing it, resulting in long-term health effects, including adverse birth outcomes (Carty et al., 2011; Krieger, 2010). Women's lifetime exposure to perceived racism, beginning in childhood, has been found to correlate strongly to the birth weight of their children, independently of other sociodemographic and medical variables (Dominguez, Dunkel-Schetter, Glynn, Hobel, & Sandman, 2008). The mechanism linking birth outcomes with perceived discrimination and social marginalization is consistent, yet poorly understood (Mustillo et al., 2004). Researchers discovered a physiological-psychological link in that blood pressure changes in pregancy correlated with lifetime exposure to racism, and were linked to decreased fetal growth and birth weight (Hilmert et al., 2014). This finding demonstrated a clear pathway between the psychological domain and birth outcomes. Yet, racism is an individual perception. In one study of multiracial pregnant women, foreign-born Blacks reported lower

perceived racism than American Blacks (Dominquez, Strong, Krieger, Gillman, & Rich-Edwards, 2009). The authors reflected that the foreign-born women possessed markedly different self-identities, having emigrated from countries in which they may not have originally been a part of a racial or ethnic minority.

Moderators: Psychosocial Protective Factors and Risk Factors

The discussion thus far has covered the contextual risk factors of neighborhood, socioeconomics and demographic features, and now will proceed along the framework sequence to individual characteristics. Moderators are variables which change the strength or direction of relationships between predictors and consequent variables (Rose, Holmbeck, Coakley, & Franks, 2004). For the current study, two types of moderators were considered: protective factors and risk factors. Protective factors are those that may have a tendency to ameliorate undesirable outcomes and contribute to healthy birth outcomes. In contrast, risk factors are those that may increase the chance of a negative birth outcome such as LIBW. Having an abundance of helpful protective factors enhances the probability of gestational well-being and healthy birth outcomes; having risk factors increases the odds of poor birth outcomes (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993; Dunkel-Schetter & Lobel, 2012; Feldman, Dunkel-Schetter, Sandman, & Wadwha, 2000; Hill, Pallitto, McCleary-Sills, & Garcia-Moreno, 2016; Kimbro, 2008)

The first of the moderators, psychosocial protective factors, refers to such diverse concepts in health-related literature as social support, attitudes, and behavior (Fava & Sonino, 2010). Factors that repeatedly emerge as predictors of desirable birth outcomes include various types of social support (Feldman et al., 2000), positive attitudes (Zambrana, Dunkel-Schetter, Collins, & Scrimshaw, 1999) and mastery (Rini et al., 1999). Although cumulative psychosocial stress was found to be a risk factor for late PTB (OR = 1.73, CI 1.07, 2.81), the risk was higher

for women with low levels of social support (OR = 2.09, CI 1.07, 4.07), illustrating a protective effect of support (McDonald, Kingston, Bayrampour, Dolan, & Tough, 2014). This is an example of the action of a moderator-- social support in this exemplar-- operating by changing the strenth of the assocation between the predictor varible of stress and the consequent birth outcome.

Individual Characteristic: Social Support

The mechanism through which social support influences the physiology of gestation and birth is complex and not well understood. The perception or appraisal of stress may somehow be less disruptive to women who experience certain types of support (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993). Psychosocial factors may buffer stress, or support a healthy response directly through emotional, cognitive/behavioral, or physiological pathways (Cohen & McKay, 1984; Dunkel-Schetter & Lobel, 2012; El-Mohandes, Kiely, Gantz, & El-Khorazaty, 2011).

Social support is a broad concept. Elo, Culhane, and colleagues operationalized assessment of support by querying the availability of tangible support, such as having someone to help with transportation to a doctor, to assist with chores and babysitting, or someone from whom to borrow money (Elo & Culhane, 2010; Elo, Mykyta, Margolis, & Culhane, 2009). Finally, they incorporated an element of emotional support by asking participants if they had someone with whom they could talk about personal problems (Elo et al., 2009). During the emotional period of pregnancy, this last aspect of support may be especially significant. The source for this type of support may be the father of the baby (FOB), family, or friends.

Support from Father of the Baby. Relationship with the FOB is important to the mother-fetus/infant dyad during and after pregnancy, with adult and older teen mothers finding

FOB support most helpful. Demonstrating the protective action of moderators in this important area of research, Ghosh et al. (2010) found that among women with chronic stress, support from the FOB negated effects of stress to the extent that those with high levels of support showed no increased risk of PTB. Using a subsample of 2,174 mothers from seven cities included in the FFS dataset, researchers found statistically significant risks for LIBW of 12.0% in unmarried women who cohabited with a partner, 17.0% for those in a non-cohabiting relationship, and 8.0% for married women (Padilla & Reichman, 2001). A systematic review and meta-analysis of 21 studies revealed that unmarried women had significantly smaller babies and higher rates of PTB than married women (Shah, Zao, & Ali, 2011).

Partnering does not guarantee a protective effect, however. The relationship quality between the mother and FOB can also potentially influence infant outcomes. Marital discord is associated with immune system dysregulation (Jaremka, Glaser, Malarkey, & Kiecolt-Glaser, 2013), which may explain why women without caring partner support had more than double the rate of PTB than those with support (Raunchfuss & Maier, 2011). Intimate partner violence is strongly associated with LIBW and PTB (Bogat, Levendosky, Theran, von Eye, & Davidson, 2003; Hill, Pallitto, McCleary-Sills, & Garcia-Moreno, 2016; Rosen, Seng, Tolman, & Mallinger, 2007). In a case-control study, researchers found that among women having infants of low birth weight, the prevalence of domestic violence was more than double that of non-abused women giving birth to healthy infants (Shah & Shah, 2010).

Partner support in pregnant adolescents. Similar to their adult counterparts, pregnant adolescents can benefit from partner support. Using data from the National Survey of Family Growth (2006 to 2010), researchers discovered a connection between birth weight and social support, with an odds ratio of 0.64 for LIBW among teens with partner support (Shah, Gee, &

Theall, 2014). Other studies have shown similar findings (Alio, Mbah, Grunsten, & Salihu, 2011).

However, for adolescents, the partner is not always the best source of support. In one of the few qualitative studies of pregnant teens, researchers found that 13 to 14 year-old teens valued their parents input most, and received the most support from them (Logsdon, Gagne, Hughes, Patterson, & Rakestraw, 2005). The 15 to 16 year-olds felt the most ambivalence toward the FOB. The older teens, 17 to 19 year-olds, had more realistic expectations for social support, and often maintained emotional ties with the FOB (Logsdon et al., 2005). In most of the research on teen birth outcomes, results are not reported by age category and source of support, and adolescent health care providers are calling for more specific research in this vulnerable population (Logsdon, Birkimer, Ratterman, Cahill, & Cahill, 2002).

Among women in healthy partner relationships, better birth outcomes may be related to increased participation in health behaviors. Partner support has been associated with increased purposeful health behaviors such as attending prenatal care and smoking reduction (Cheng et al., 2016; Martin, McNamara, Milot, Halle, & Hair, 2007).

Support from Family. Support offered by family of origin has been associated with healthy birth outcomes. Feldman et al., (2000) found that social support from the family of origin was associated with higher birth weight ($r = .17$, $p < .01$) among pregnant women. Support offered by family has been found to be related to healthful behaviors during pregnancy (Schaffer & Lia-Hoagberg, 1997). Meager study in this area, however, suggests that a cultural connection to family and mutual support may be more important in some ethnic circles (Dunkel Schetter, 2011).

Campos et al. (2008) found that "familism," a cultural concept among Hispanics which involves identification with, obligation to, and support from the extended family of origin, was associated with higher infant birth weight among foreign-born women only. More acculturated American-born Hispanic mothers did not experience any significant birth weight benefit. Hispanic women scoring higher on acculturation measurements have been found to be more likely to assimilate unhealthful elements of the prevailing American culture, such as eating fast-food, and smoking than women scoring lower (Balcazar & Krull, 1999; Cobas, Balcazar, Benin, Keith, & Chong, 1996; Fox, Entringer, Buss, DeHaene, & Wadhwa, 2015). More research regarding the contribution of family and culture to the support of childbearing women is needed.

Support from other sourcess. Other sources of support may exist for childbearing women, such as support given during prenatal care and by pregnant peers. In an effort to increase social support for pregnant women, new group prenatal care models have been developed, with impressive reductions in PTB in some populations. These group care models are popular among adolescents and have been associated with beneficial infant outcomes. (Benediktsson, McDonald, Vekved, McNeil, & Dolan, 2013; Fiset, Hoffman, & Ehrenthal, 2016). Centering Pregnancy®, for instance, has incorporated perinatal education with purposefully developed social support by offering a prenatal clinic with group classes, in which static groups of 10 women attend together during the course of pregnancy (Centering Healthcare Institute®, Inc., 2016). Other models of group prenatal education exist, in which family members or spouses also participate (Collado, Saez, Favrod, & Hatem, 2014). However, not all women benefit equally from these models of care, and many do not find social support from group prenatal care attractive or feasible (Phillippi, 2011), relying on other social support resources during pregnancy. Hence, additional research is needed.

Spiritual support. Religious attendance and spiritually-oriented socialization may provide a type of social support for some individuals, functioning similarly to an extended family (Taylor & Chatters, 1988). Spiritual support and faith during pregnancy and throughout the lifespan are very important to some women (Jesse, Schoneboom, & Blanchard, 2007). In birth outcomes research, studies linking spirituality and religiosity with birth outcomes exist, but are inconsistent. Some researchers have found a positive connection between religious practice, operationalized as frequency of church attendance, and length of gestation (Najman, Williams, Keeping, Morrison, & Andersen, 1988). Yet, other studies examining spirituality and birth outcomes have failed to find an association between them (Dailey, 2009; Dole et al., 2004).

Intuitively, the concepts of spirituality and religiosity are distinct, and difficult to define and measure. Further, the constructs are operationalized differently from study-to-study, compounding the problem of disparate findings. More research is needed to develop a diversity of antenatal care options incorporating social support options for women. If psychosocial assets could be generated or augmented using social or faith-based resources from community sources women already trust, women and their infants might have healthier outcomes (Vonderheid, Norr, & Handler, 2007).

Individual Characteristics: Health Status and Behaviors

Maternal health status before pregnancy. Whether acting apart from or additive to protective psychosocial factors, the pre-pregnancy health status of women may increase or decrease chances of having a desirable birth outcome. For example, pre-pregnancy hypertension and diabetes have been found to signficantly increase the risk of LIBW and PTB, as well as resulting in large-for-gestational-age and small-for-gestational-age infants (Evers, de Valk, & Visser, 2004; Fang, Madhavan, & Alderman, 1999; Frey & Klebanoff, 2016).

Maternal health status during pregnancy. Medical conditions affecting the course of gestation may also be manifested after pregnancy has begun. Diagnoses of maternal pregnancy-related hypertension has been found to increased the risk of LIBW by at least double in Blacks, Whites, and Hispanics (Fang et al., 1999). Uncontrolled gestational diabetes often results in high maternal blood glucose levels during pregnancy, when insulin needs and absorption rates change. The developing fetus utilizes the glucose-rich blood, and gains weight too rapidly, becoming too large for the attained gestational age. If the infant of a diabetic mother is born preterm, birth weight may be normal, above 2500 grams, but despite the deceptive appearance of a healthy baby, the infant is premature with a full spectrum of health challenges, and may need in a neonatal intensive care unit (Östlund et al., 2003).

Conversely, an infant whose mother was hypertensive or used certain substances in pregnancy may receive fewer nutrients than required because of vasocontriction of the placental bed, and be born full term, yet be low birth weight—less than 2500 grams, and have the diagnosis, "small-for-gestational-age" (Allen, Joseph, Murphy, Magee, & Ohlsson, 2004; Gouin, Murphy, & Shah, 2010).

Maternal behaviors. Maternal smoking as well as the use of other substances such as alcohol, opiates and cocaine are related to LIBW and PTB (Bada et al., 2005; Bailey, McCook, Hodge, & McGrady, 2012; Ko et al., 2014). Although receiving prenatal care does not guarantee desirable birth outcomes, and has not been found to prevent LIBW and PTB, access to care is an important component of risk reduction (Behrman & Butler, 2007). Negative health behaviors can be assessed and addressed early, and interventions such as programs for smoking cessation and reduction can be discussed. Preconceptual and prenatal care clinic visits are also an appropriate time to initiate lifestyle teaching regarding such topics as a balanced pregnancy diet

and obtaining healthful amounts of exercise (Flower, Shawe, Stephenson, & Doyle, 2013; Ko et al., 2014; O'Campo et al., 2008; Thangaratinam, 2012; Weisman et al., 2011).

Maternal Stress Physiology

According to Culhane and Elo (2005), the stressful exposure to negative life state circumstances may be moderated by any protective factors possessed by pregnant mothers, and may proceed to act on the maternal-placental-fetal unit through pathway D. Direct stress activation of the neuro-endocrine systems and the immune/inflammatory cascade increase susceptibility to infection and proinflammatory responses, and may result in LIBW and PTB through pathway E. Maternal stress physiology was not the emphasis of the current study, yet recognizing that physiology mediates effects of psychosocial factors on birth outcomes is essential to understanding the larger perspective of protective factors.

Research Problem

An emphasis and orientation on outcomes of wellness is needed as a foundation for the development of effective goal-driven prenatal interventions. Available research tends to focus on biological and psychosocial risk factors for adverse outcomes rather than on the protective psychosocial factors which predict healthy births. A gap exists in the literature regarding which psychosocial factors are most helpful in protecting women from the effects of stress, and are predictive of healthy birth outcomes.

Fragile Families Study

The FFS, previously introduced, is an ongoing longitudinal birth cohort study of 4898 families, many of which have significant psychosocial risk factors. The baseline sample, collected between 1998 and 2000, contains data from 3,712 unwed couples and 1,188 married couples at 75 randomly selected hospitals, from 20 U.S. cities with populations over 200,000

(Reichman, Teitler, Garfinkel, & McLanahan, 2001). The interviewers collected data prior to hospital discharge from both parents shortly after the birth of their infant (Brendheim-Thomam Center for Research on Child Wellbeing, 2008). Data were obtained regarding relationships, health status, demographics, economic, and neighborhood characteristics, and infant birth weight. All survey questions are publicly available and accessible at the Fragile Families and Child Welfare Study website: www.fragilefamilies.princeton.edu/ (Brendheim-Thomam Center for Research on Child Wellbeing, 2008). The available selected FFS responses encompassing the risk and protective factors of interest to this researcher are enumerated below and in Table 1.

Life Context Stressors

The life context stressors in the current study included neighborhood context stressors and socioeconomic and demographic stressors, as discussed above with the LCBO framework (Figure 1). Variables included such factors as participant opinion about the safety of their neighborhood, race/ethnicity, age, income, education and marital status of participating parents (Table 1). Because of the increased risk of LIBW for Black women in the United States (Martin et al., 2015), this racial category was considered a social stressor and explored as an additional variable of interest.

Protective Factors

Support from the FOB was measured in the current study by the proxy of a survey question asking the woman if she and FOB had solved a problem together in the last month. Social support from family members was measured by survey questions regarding material support only--financial support if needed, offer of help with childcare, and if family members would provide the new mother a place to stay if needed. A question related to frequency of

church attendance functioned as a proxy for spiritual support. Other variables examined included smoking, attendance at prenatal clinic, and self-rated health status of mother.

Birth Outcomes

Birth weight in the FFS was obtained from restricted use medical records and added by FFS researchers to the public use data, except for a small number of women in which the birth weight was not included in the medical record (Reichman, Hamilton, Hummer, & Padilla, 2008). In these cases, researchers utilized the weight reported by the mother. The two sources of information had a .95 correlation rate. Birth weight of 5 lbs. 8oz (2500 grams) or more is designated as HIBW, and all weights below it are considered as LIBW, in accordance with March of Dimes guidelines (March of Dimes, 2015). Although a valuable indicator of infant and pregnancy health, information on infant gestational age at birth was not included by the orignial researchers in the FFS data.

Propositions of the Conceptual Model

The conceptual framework used for the current study supports the following propositions:

1. Social stressors are associated with LIBW.
2. Maternal preexisting and perinatal health challenges can result in LIBW.
3. Social support from the FOB, family of origin, and spiritual support may moderate the effects of stressors on birth weight.
4. Having certain psychosocial protective factors may predict healthy birth weights among women in high-risk categories by race/ethnicity, marital status, age, and income.

Utilizing data from the FFS, the purpose of this research study was to examine which protective psychosocial factors are most predictive of HIBW for childbearing women.

Table 1

Concepts and Variables Derived from FFS Survey Responses

LCBO Concepts	Variables derived from Questions of FFS Survey
Life Context Stressors	
• Neighborhood Context	1. Rating of safety of neighborhood. 2. Proxy for stability of residence: number of years living at current location.
• Socioeconomic and demographic characteristics	3. Race/ethnicity of mother 4. Age of mother 5. Education of mother 6. Income (yearly) 7. Formal relationship between mother and FOB
Moderators: Protective and Risk Factors	
• Individual characteristics (Protective and risk factors)	8. Proxies for social support by FOB: mothers' rating of willingness by fathers to compromise, expression of love/affection, and his encouragement of her interests. Item was rated as a protective factor, unless the relationship ended due to violence, in which case it was adjudged a risk factor. 9. The reverse of support: Intimate partner violence—physical and emotional abuse 10. Proxies for social support score from family—three questions asking if they would help her with money, childcare, and a place to stay if these were needed. 11. Proxy for spiritual support: Frequency of church attendance 12. Self-rated health status by mother. 13. Health behaviors: smoking as reported by mother. 14. Health behaviors: attending prenatal care
Maternal Stress Physiology	No indices of stress biomarkers are available in the baseline maternal FFS survey.
Birth Outcomes	
• Infant birth weight	15. Weight at birth, recorded as recalled by mother, and dichotomized into LIBW-- below 2500 grams and healthy birth weight—2500 grams and above.

Research Question

1. Among women considered vulnerable for having infants of low birth weight, which protective psychosocial factors are most predictive of healthy birth weight?

Assumptions

1. Women answered questions in the interviews truthfully.

2. Stressful circumstances, as well as psychosocial assets consisting of supportive relationships, are measurable and can be reported by women in terms of quantity and quality.
3. An array of physical and psychosocial factors contribute to birth outcomes. Thus, any one psychosocial factor is less central to HIBW, and will result in a small effect size.

Limitations

Limitations of the current study include features related to the use of retrospective self-reported data, as well as unique shortcomings of the FFS study design. Limitations include:

1. All variables of interest to the current researcher were not included in the dataset.
2. Further clarification or additional information from participants is not possible.
3. Birth weight was taken from the medical record, except for a small number of cases (16 among the non-marital sample) and is therefore subject to retrospective recall bias for those cases.
4. Gestational age is not included as a birth outcome; only data on birth weight was available.
5. Large-for-gestational-age preterm infants were unable to be screened out of the "healthy birth weight" category for purposes of analysis.
6. Few psychosocial factor scales are included in the FFS, such as emotional support items from friends, family, and FOB.
7. No spiritual support scales are included in the FFS, with only religious affiliation and frequency of attendance included as measurements.
8. No laboratory biomarkers, such as cortisol levels, were included in the study from time surrounding the birth.

9. Modified LCBO framework was used.
10. Psychometric scores of survey questions for the baseline maternal survey are not available.

Summary

LIBW rates remain persistently and disparately high between ethnic racial groups of women, and result in disability and continuing cost to families and society. Although stress increases the risk of PTB and LIBW, women with sufficient psychosocial protective assets may deliver healthy full-term infants. The purpose of this study was to determine which protective psychosocial factors are most predictive of HIBW for childbearing women, using the FFS dataset. The LCBO framework, adapted from the Culhane and Elo framework (2005), guided the study design and interpretation of findings.

Chapter 2 includes a comprehensive review of literature showing the progress that has been made in recent years in birth outcomes research as a result of the immense efforts on the part of the government and the private sector, encompassing both physical and psychosocial domains. Previous research reveals that in some populations, certain stressors, demographics, and lack of psychosocial support may predict LIBW, and that an abundance of support and favorable life context factors may contribute to healthy birth outcomes. Chapter 3 provides the details of the secondary analysis, including a description of the FFS dataset, the variables selected, and statistical analysis. Chapter 4 displays the results of the study, followed by commentary and discussion of findings in Chapter 5.

Chapter 2

This chapter includes a discussion of the prevalence, significance, and background of LIBW in the United States, followed by a review of literature concerning risk and protective factors of both LIBW and its primary contributor, prematurity. Although stress is predictive of LIBW and PTB, some psychosocial factors contribute to healthy birth outcomes, even in the presence of stress (Dunkel Schetter, 2011). While the preponderance of literature describes risk factors for adverse birth outcomes, the unique goal of this research study is to uncover psychosocial protective factors which are predictive of healthy birth outcomes in at-risk childbearing women.

Background

Birth Outcome Definitions

Birth weight. Normal birth weight for infants in the United States is described by the Centers for Disease Control and Prevention (CDC) as a weight between 5.5 pounds (2500 grams) and 8.8 pounds (4000 grams; CDC, 2009). Because of the difficulties in determining the precise gestational age of an infant when the mother has no trustworthy date of conception, LIBW status is often used as a proxy for prematurity (Institute of Medicine [IOM], 2007). Seven out of ten LIBW infants are premature, yet other conditions can also result in LIBW, meaning that researchers must use caution interpreting findings across studies (March of Dimes, 2015). LIBW may occur in full-term pregnancies, such as when the mother develops preeclampsia or hypertension, post-traumatic stress disorder or depression, or because of lifestyle choices such as smoking and drug use, and through poorly understood physiological processes in which the infant is subject to intrauterine growth restriction (Brittain et al., 2015; Cetin, Mandò, & Calabrese, 2013; Khashan et al., 2008). Conversely, an infant may be born preterm yet have

normal birth weight. The infant is then considered large for gestational age, a situation which occurs commonly in mothers with uncontrolled diabetes (Ferrero et al., 2016).

Prematurity. The factor most influencing birthweight is length of gestation: A premature infant has not had time to gain the weight additional gestational weeks would allow (Dunkel-Schetter & Lobel, 2012). Human pregnancy is generally considered as lasting 40 weeks from the last menstrual period, or 38 to 39 weeks from ovulation to birth (Jukik, Baird, Weinberg, McConnaughey, & Wilcox, 2013). The American Congress of Obstetricians and Gynecologists (ACOG) recently issued their opinion that a full-term pregnancy extends from conception to between 39 0/7 (meaning 39 weeks and 0 of 7 days into the following week) and 40 6/7 weeks of gestation (ACOG, 2013). An "early term" pregnancy lasts between 37 and 1/7 weeks and 38 and 6/7 weeks. Birth before 37 completed weeks of pregnancy (37 and 0/7 weeks) is considered preterm (ACOG, 2013).

Causes of LIBW and PTB are complex and multifactorial, some being clearly physical in nature, caused by anatomical and hormonal abnormalities; yet, others have a stress-related psychosocial etiology (Goldenberg, Culhane, Iams, & Romero, 2008), discussed in detail below. Physical and psychosocial domains continuously interact in the maternal-fetal unit, increasing risk for LIBW and PTB, while defying simplistic explanations (Wadhwa, Entringer, Buss, & Lu, 2011).

Prevalence

Low birthweight and prematurity pose persistent public health problems, which have not diminished in proportion to advances in technology and healthcare spending. In the United States, one in every twelve infants is born weighing less than 2,500 grams (March of Dimes, 2017). An infant with very low birth weight (1,500 grams or below) has a 22% chance of dying

within the first year of life, in contrast with a healthy infant, in whom the risk is 0.2% (Child Trends Databank, 2015). Infant mortality is a major indicator of the health and healthcare capabilities of a nation and thus is a public health and policy issue that reflects on U.S. society (Truman et al., 2011; United Nations International Emergency Children's Fund [UNICEF], 2007).

According to the U.S. National Center for Health Statistics between 1992 and 2006, the rate of PTB increased from 10.7% to 12.8%, declining slightly to a rate of 11.4% by 2013 (Martin, Hamilton, Osterman, Curtain, & Mathews, 2015). The March of Dimes 2016 Premature Birth Report Card shows a further decrease in the PTB rate to 9.6%, and has given the United States an overall grade of "C" for total rates (March of Dimes, 2016a). LIBW rates were 6.9% in 1990, and 8.1 % in 2015 (Hamilton , Martin, & Osterman, 2016; Martin et al., 2015). The recent change in calculation of extent of prematurity made by the National Center for Health Statistics may slightly inflate values, and subsequently, analyses using birthweight rather than gestational age are attractive to researchers studying birth outcomes (Martin, Osterman, Kirmeyer, & Gregory, 2015).

Cost of Adverse Birth Outcomes

Direct monetary costs. The cost of PTB has been estimated at $26.2 billion annually, or $51,600 per each infant born early (IOM, 2007). Health care costs for the birth of a typical term infant through the first year (2011 dollar values) were $5,085, but for the preterm infant health care expenditures averaged $55,393, a cost of over $12 billion annually to employers providing health care benefits (March of Dimes, 2014). Costs of neonatal intensive care and therapy increase with the amount of prematurity and can exceed $100,000 for an infant weighing 1000 grams (2.2 lbs.) or less at birth (Almond, Chay, & Lee, 2004).

Zupancic (2007) estimated that beyond the first year of life, annual costs of prematurity in the United States include more than $600 million for early intervention therapies up to age 3. Special education for school-age children having disabilities related to prematurity is estimated at $1.1 billion annually, and once adulthood is attained, the expense to taxpayers related to loss of wages and productivity may be as high as $5.7 billion annually (Zupancic, 2007). Health care costs for moderately preterm infants are less than for extremely preterm infants because in general, any lengthening of gestation toward full term is beneficial to the developing fetus, resulting in fewer complications and shorter lengths of stay. According to Zupancic (2007), relatively modest interventions targeting the prevention of moderate PTB may be as cost-saving as more elaborate and expensive methods of preventing extremely PTB because of the higher prevalence of moderate prematurity.

Other consequences of adverse birth outcomes. LIBW and PTB are the leading causes of death during the first month of life (March of Dimes, 2017). They are also directly associated with cognitive disabilities and neuromuscular disabilities such as cerebral palsy, with the incidence of these problems increasing as birth weight and gestational age at delivery decrease (Marret et al., 2013). In a longitudinal study of nearly 2,500 children who were followed for eight years, almost half of the children born between 24 and 26 weeks gestation showed moderate-to-severe cognitive disability, and 20% had moderate-to-severe cerebral palsy. When gestation lasted 31 to 32 weeks, rates of cognitive impairment and cerebral palsy were much lower, at 25% and 7% respectively (Marret et al., 2013). Continuing costs of adverse birth outcomes to parents in terms of lost work productivity and ongoing emotional stress as they attend to the care of their children are incalculable.

Health consequences of LIBW and PTB extend into later life, with higher blood pressure found in adults who were born with very low birthweight (8.6 mmHg, CI 3.4, 13.9; Doyle, Faber, Callanan, & Morley, 2003). Other health sequelae include reductions in insulin sensitivity (Hofman et al., 2004), and decreased lung capacity (functional expiratory volume and flow rates) in adults born preterm (Vollsæter, Røksund, Eide, Markestad, & Halvorson, 2013). Women born with low birth weight are more likely than other women to have low birth weight infants (Collins, Rankin, & David, 2011). Clearly, decreasing the incidence of LIBW and PTB would have far-reaching health and economic effects.

Background

Psychosocial Stress Raises the Risk of Adverse Birth Outcomes

Stress exposures. Selye (1978) defined stress as the "the nonspecific response of the body to any demand" (p.1). Both acute and chronic stress exposures are associated with LIBW and PTB. For example, pregnant women who experienced acute stress from terrorist attacks, hurricanes, and economic collapse were found to have two to three times the rates of LIBW and PTB of other women (Bodalal et al., 2014; Eiríksdóttir et al., 2013; Xiong et al., 2008). In a study of 301 pregnant women who were directly exposed to personal risk during Hurricane Katrina, Xiong et al., (2008) found increased odds of delivering low birthweight infants (OR 2.4, CI 1.00, 6.10) and of delivering prematurely (OR 3.3, 95% CI 1.20, 8.98). In a study of 175 women affected by the 2011 flood in Thailand, researchers found that infants whose mothers were displaced during the flood had a mean birthweight of 173 grams less than those not displaced (n = 175; t =-2.38, p = .02; Sanguanklin et al., 2013). A systematic review of 49 articles by Harville, Xiong, and Beukins (2010) revealed that women who have experienced

various environmental disasters including major earthquakes, hurricanes, and floods, have increased rates of fetal growth restriction, which is a major precursor of LIBW.

Stressors of a chronic nature also take a toll on childbearing women and may lead to early birth. In a study of 3,149 women, chronic stressors and worry were responsible for 40% higher rates of both LIBW and PTB in low-income women, having more effect than poor health behaviors, such as tobacco use, no prenatal care, and lack of exercise (Neggers, Goldenberg, Cliver, & Hauth, 2006). In the Pregnancy in Nutrition study, conducted between 1996 and 2001 with 2,533 participants, Messer, Dole, Kaufamn and Savitz (2005) found that women reporting the highest quartile of perceived stress had a relative risk for PTB of 1.6 (CI 1.1 – 1.9).

The mother-fetus relationship is the most intimate of all human relationships, therefore, worry over the health of the baby, anxiety regarding impending childbirth, and feeling stressed by the future parental role, form a distinct syndrome (Huizink, Mulder, Robles de Medina, Visser, & Buitelaar, 2004). In three separate studies, women who reported excessive stress or anxiety related specifically to pregnancy were found to have significantly higher rates of both LIBW and PTB than other women (Kramer et al., 2009; Lobel et al., 2008; Orr, Reiter, Blazer, & James, 2007). Lobel et al. (2008) found that pregnancy-specific stress independently predicted birth outcomes, accounting for 9% ($p < .05$) of the variance in gestational age, and 32% ($p < .05$) of the variance in birth weight ($n = 279$). The pathway between stress and PTB/LIBW, however, was unclear because in the study by Lobel et al. (2008), the women with higher pregnancy-specific stress were more likely to smoke, consume caffeine, and eat unhealthfully, leading the researcher to consider whether the result was due to these confounders or to other dynamics. Such confounding factors may explain a part of the enigmatic “no association” results often

found in birth outcomes research which are undoubtedly related to the vast array of life context factors and their interactions.

In a small study of 27 mother-infant dyads, maternal pregnancy-specific stress measured early in gestation accounted for 25% of the variance in umbilical cord telomere length ($p = .04$) demonstrating a significant association between this category of maternal stress and infant physiology (Entringer et al., 2013). Undoubtedly, maternal stress affects the growing fetus, resulting in smaller size and decreased weight, although the explanatory physiological pathways for this are just beginning to be elucidated.

The timing of stress in pregnancy may be responsible for differences in birth outcomes, but researchers have yet to agree on which periods are most vulnerable. Roy-Matton, Moutquin, Brown, Carrier, and Bell (2011) identified the period of greatest vulnerability to be from 10 to 20 weeks of pregnancy, but Class, Lichtenstein, Langstrom, and D'Onofrio (2011) determined that it was from 5 to 6 months. The large sample size of the latter secondary analysis ($n = 2.6$ million) makes those findings particularly impressive.

Dunkel-Schetter (2011) concluded that major acute stressors and pregnancy-related anxiety seemed to be more closely associated with PTB, and that depression and generalized chronic distress were associated with LIBW. Continued research is needed to determine which social support and behavioral actions may have a protective function, mitigating the devastating effects of stress on birth outcomes. Life context factors that have been shown in the literature to affect birth outcomes will be discussed next.

Neighborhood Context Factors and Birth Outcomes

Health and illness outcomes are often linked to the broader social context of neighborhoods and other geographical divisions, and sociologists posit that explanations for this

lie in a public health perspective and that individual characteristics alone are insufficient to explain differentials (Culhane & Elo, 2005; Northridge, Sclar, & Biswas, 2003). The three categories suggested in the framework by Culhane and Elo (2005), which compose neighborhood context are: physical environment, social environment, and service environment. The physical environment includes such features as exposure to pollutants and quality of housing and public space. The social environment is reflected in neighborhood cohesion and stability, overall group socioeconomic and ethnic composition, and crime levels. Finally, the service environment refers to the accessibility of goods and services including quality health care, police and fire protection, and availability of supermarkets and recreational facilities (Culhane & Elo, 2005).

The three neighborhood contextual components are not discrete concepts but overlap considerably. For instance, the physical environment is the location in which the social and service environments function, providing very literal avenues and barriers; the service environment shapes the types of socialization possible, and adds or takes away value from the physical environment; finally, the social environment is an expression of the reactions of residents to the physical and service environment. Intuitively, income drives housing choices and is the determining factor guiding how much quality an individual can obtain. Socioeconomic deprivation is the common denominator for women living in less desirable neighborhood locations, and carries with it a host of risk factors for adverse birth outcomes (Janevic et al., 2010; Nkansah-Amankra, 2010).

Physical environment. Living in an undesirable neighborhood environment because of income limitations often means greater exposure to pollution and physical contaminants. Low income housing projects are more likely to have pollutants, such as lead paint, than median and

upper income housing (Jacobs et al., 2002; Krieger & Higgins, 2002). Such environmental toxins are directly linked to adverse birth outcomes (Bloom et al., 2015). For example, in a study of 14,000 women in the Bristol area of Great Britain, those having blood levels of lead below 5 micrograms/deciliter had a PTB rate of 5.3%; individuals with levels above 5 micrograms experienced a PTB rate of 8.8% (p = .001; Taylor, Golding, & Emond, 2015).

Urban living can involve routine exposure to environmental toxins. In Los Angeles, researchers found that risk for PTB increased by 16% to 47% as levels of carbon monoxide and particulate matter increased in the ambient air, the effect being most profound in those women who were exposed to the high levels during the first trimester of pregnancy (Ritz, Wilhelm, Hoggatt, & Ghosh, 2007). A meta-analysis of 62 studies of effects of air pollution on birth outcomes revealed that levels of carbon monoxide and particulate matter are consistently associated with LIBW, the risk increasing with increased levels of pollutants (Stieb, Chen, Eshoul, & Judek, 2012). Although the physical environment has an effect on birth outcomes, the social environment is also influential.

Social environment. The social environment is the outgrowth of the group/cohort reaction to the physical environment, and forms a part of the neighborhood context. The reaction may be of a positive or negative nature, and crafting neighborhood settings in a way that contributes to healthful outcomes is the goal of urban planners, public health officials, and policy makers as they build the larger milieu (Northridge, Sclar, & Biswas, 2003).

Living in a neighborhood with high levels of crime may cause chronic stress leading to adverse birth outcomes. In areas of Raleigh, North Carolina with low rates of neighborhood violence, the PTB rate was 6.8%, increasing to 10.4% in highly violent areas (Messer, Kaufman, Dole, Herring, & Laraia, 2006). Vinikoor-Imler et al., (2011) found that specific neighborhood

characteristics were associated with birth outcomes, namely neighborhood degradation to include physical incivilities (poor housing condition, litter, graffitti, and so on) and "walkability, " meaning some provision for walking in relative safety in the neighborhood. Living in a neighborhood with the highest quartile of physical incivilities resulted in odd ratios for LIBW of 1.78 (CI 1.06, 2.98) among White women, compared to 1.07 (CI .77, 1.49) for Black women. Walkability exhibited protective effects, with those at the highest quartiles having odds ratios of LIBW of 0.67 (CI .48, .93) for White women and .78 (CI .56, 1.09) for Black women. The authors noted that lack of statistical significance in the CIs for the odds ratios for LIBW among Black women in this study may represent increased risk from multiple simultaneous stressors to which Black women are exposed.

Service environment. The service environment relates to availabilty of goods and services, recreational facilities, police, fire protection, and access to health care. It is so closely linked to other environmental and socioeconomic components that few researchers have studied connections between birth outcomes and the service environment. In most cases, the service environment is recognized as a part of the general neighborhood context (Culhane & Elo, 2005). Because other chronic health conditions are associated with such aspects of the service environment as perceptions of neighborhood quality and amount of green space (Mitchell & Popham, 2008; Wen, Hawkley, & Cacioppo, 2006), it is possible that birth outcomes are also influenced through those variables. Social scientists concerned with LIBW have been clear and persistent in their calls for addressing the built environment through urban renewal and increases in services for at-risk families, with limited success (Lu et al., 2010; Northridge, Sclar, & Biswas, 2003).

Socioeconomic and Demographic Characteristics

Socioeconomic status. Exposure to poverty is a risk factor for adverse birth outcomes. Neighborhoods and census-tracts encompassing areas of high socioeconomic deprivation had higher rates of both LIBW (Janevic et al., 2010) and of PTB than others (O'Campo et al., 2008). This finding was supported via a systematic review showing 93 of 106 studies revealing an association between a socioeconomic measure and a birth outcome, including LIBW (Blumenshine, Egerter, Barclay, Cubbin, & Braveman, 2010).

Reasons for adverse birth outcomes among the poor are difficult to isolate, due to multifactorial causation and reflect the interrelationship between income and environment, discussed earlier. Among the many disadvantages conferred with low income is the problem of inadequate nutrition. Mothers with low income may not be able to purchase a sufficient quantity of food. More often, however, they purchase food of low nutritional value from convenience stores because of neighborhood distance to grocery stores, increasing the probability of obesity (Hilmers, Hilmers, & Dave, 2012). Obesity has been found to be associated with PTB (OR 1.53, CI 1.05, 2.20, $p < .05$, $n = 6{,}059$; Gaillard et al., 2013). Even in countries with significant health care spending, where medical needs are met through public insurance or other means, the poor consistently have more LIBW and PTB than those with more resources (Braveman et al., 2014; Glinianaia et al., 2013). Pregnant women who perceived their income to be inadequate, even if they had access to health care, had higher levels of corticotrophin-releasing factor (Latrendresse & Ruiz, 2010), a stress biomarker associated with PTB (Mancuso, Dunkel-Schetter, Rini, Roesch, & Hobel, 2004).

Ethnicity and SES. LIBW has been associated with self-identification of Black/African American, even after adjusting for income and education. In a study of over 36,000 women,

researchers compared birth weight among races in the context of SES. They divided census tracts into income tertiles, comparing those in the lowest tertile ($10,000 to 24,000) with those in the highest tertile ($41,000 to 150,000, 1990 monetary values). White women in low income areas had a LIBW incidence of 10.1%, compared to 5.1% for those in high income areas (Collins, Wambach, David, & Rankin, 2009). Black women also benefited from higher income status, though not as much, with those in low income areas having a LIBW incidence of 17.0% versus 11.7% for those in high income areas (Collins et al., 2009). Black women who began life in poverty and later attained higher income had a LIBW incidence of 12.8%, with the exception of women who had themselves been born with LIBW (Collins, Rankin, & David, 2011). Black women who had been born with low weight and had an increasing income had an aOR for giving birth to infants of low weight of 1.9 (95%CI 0.9, 3.3). However, Black women of normal birth weight with increasing income had an aOR for LIBW of 0.8 (95%CI 0.8, 1.0). This suggests a disadvantage conferred with poverty, and perhaps a fetal programming mechanism, whereby women with LIBW deliver infants with the same propensity (Lu et al., 2010).

Ethnicity, race, and culture. The racial disparity of birth outcomes in the United States is striking and persistent. In 2013, the National Center for Health Statistics reported that U.S. prevalence rates of LIBW were 7.0% for Whites, 7.1% for Hispanics, and 13.1% for Blacks, and rates of PTB were 10.5% for Whites, 11.3% for Hispanics and 16.3% for Blacks (Martin et al., 2015). Rates of LIBW among Asian/Pacific Islanders are similar to Whites and Hispanics, at 8.3%, and PTB rates at 10.2%; with American Indian/Alaskan Native LIBW of 7.5% and PTB rates being 13.1% (Martin et al., 2015). The inequality in birth outcomes between races has existed since the United States began keeping detailed birth records in 1915 (Linder & Grove, 1947). Although the incidence of adverse birth outcomes has recently decreased slightly across

races, the margin of discrepancy between Black women and White women remains essentially unchanged (Martin et al., 2015).

Rates of LIBW and PTB were found to be higher in Blacks than Whites at all ages, with the disparity between races increasing with maternal age (Holzman et al., 2009). Love, David, Rankin, and Collins (2010) studied 26,000 linked birth records from Cook County, Illinois, and found that Black women between the ages of 20 to 24 had a LIBW incidence of 12.3% compared to White woman of the same age at 5.0%, and by the ages of 30 to 35, the rates were 15.6% for Blacks and 4.5% for Whites. The unexpected finding that over time LIBW rates increased for Black women but not White women is consistent with results discovered by other researchers.

Geronimus (1992) first noted that White women had better birth outcomes between the ages of 20 to 30 than they did if they gave birth in their teens or after age 30. In contrast, Black women had better outcomes in their teens, with increasing rates of PTB/LIBW as they entered their 20s, followed by even higher rates in their 30s (Geronimus, 1996; 2001). Geronimus labeled this finding *weathering*, citing it as evidence that U.S. Blacks may physiologically age more rapidly than U.S. Whites, a discovery which has been corroborated using telomere measurement (Geronimus et al., 2010). Telomeres are "end caps" that protect chromosomes and become predictably shorter with age (Aubert & Lansdorp, 2008). Weathering and short telomere length are not well-understood but have been repeatedly associated with the stress of perceived racial discrimination (Chae et al., 2014; Dominguez, 2011; Giurgescu, McFarlin, Craddock, & Albrecht, 2011). Weathering was not found among foreign-born Blacks or among Hispanics, who have better outcomes in the mid-childbearing years, similar to Whites (Collins, Rankin, & Hedstrom, 2011; Deal, Bennet, Rankin, & Collins, 2014). Foreign-born Black women have better birth outcomes, perceive less racism, and may have stronger family and cultural ties than

U.S.-born Blacks (Deal et al., 2014; Dominquez, Strong, Krieger, Gillman, & Rich-Edwards, 2009).

Racism and weathering. Experiencing the injustice of racism has long-term effects on reproductive health. Evidence of this was found in a study examining women's lifetime exposure to perceived racism. Researchers administered questionaires to pregnant adults in the second trimester, assessing perceived racism from childhood through the time of survey. They found that scores for lifetime racism correlated with the birthweight of their children (r = -.26, p < .01, n = 124), independently of other sociodemographic and medical variables (Dominguez et al., 2008). Earnshaw et al. (2013) found corroborating evidence, noting that discriminatory treatment was associated with LIBW (OR 2.78, p = .05, n = 420). Blood pressure changes in pregancy have been associated with lifetime exposure to racism (r = -.30, p < .10, n = 39), even after adjustment for stressful life events, suggesting a mechanism for decreased fetal growth and birth weight (Hilmert et al., 2014). Rankin, David and Collins (2011) performed a case-control study of Black women, 163 of whom had PTB/LIBW versus 121 women having term infants. Women having high versus low/medium lifetime exposure to racism had an odds ratio of PTB of 1.5 (CI 0.9, 2.8), yet if the racism had occurred within the past year, rates of PTB were signficantly higher (OR 2.5. CI 1.2, 5.2).

Yet, no definitive explanation for the disparity in birth outcomes between Black women and White women exists. Culhane and Goldenberg (2011) postulate that experiencing generations of psychosocial stress from discrimination and marginalization may be the source of the racial LIBW/PTB discrepancy. Historically, populations that have experienced persecution, discrimination, and stigma over multiple social domains remain vulnerable to an array of pervasive health effects (Mohatt, Thompson, Thai, & Tebes, 2014). Krieger (2010) maintained

that consideration of the geographical location of studies in the United States is still relevant when evaluating research results, because of the continuing differences in social climate regarding race between the North and the South. A consensus seems to be building among some social scientists that racism, rather than the biology of race, may be at the root of many race-related health disparities in the United States, including the differences in birth outcomes (Brondolo, Gallo, & Myers, 2009; Collins & David, 2007; Gravlee, 2009; Krieger N. , 2010; Shonkoff, Boyce, & McEwen, 2009).

Hispanic paradox. In contrast, Hispanic women tend to have birth outcomes similar to White women (Campos et al., 2008). Noted in the literature for decades, the term "Hispanic Paradox" refers to the epidemiologic phenomenon that immigrant Hispanic women have healthier birth outcomes than other minority races and ethnicities, even at the lowest levels of income (Hummer, Powers, Pullum, Gossman, & Frisbie, 2007; Markides & Coreil, 1986). Hispanic women in the Fragile Families and Child Wellbeing study (FFS) had significantly better outcomes than either Black women or White women (Reichman, Hamilton, Hummer, & Padilla, 2008). Rates of LIBW in the three ethnicities were as follows: Hispanics: 5.8%, Blacks: 13.5%, Whites: 12.4% (Reichman et al., 2008). This suggests that stripped of their socioeconomic advantages, which confound nearly every study that includes multiple races of women, Whites may have no birth outcome advantages over Blacks, in contrast to family-oriented Hispanics (Campos et al., 2008).

Several researchers have discovered evidence supporting healthier birth outcomes among foreign-born Mexican immigrants, but results are inconsistent and degree of acculturation appears to also be a key element in the development of increasing risk factors (Acevedo-Garcia, Soobader, & Berkman, 2005; Wingate & Alexander, 2006). In an integrative review of 19

studies exploring several aspects acculturation and perinatal outcomes, Callister and Birkhead (2002) concluded that Mexican immigrants with higher acculturation to U.S. lifestyle and values had more risk of LIBW than less acculturated Mexican women. In one study with divergent findings (Hoggatt, Flores, Solorio, Wilhelm, & Ritz, 2012), foreign-born Latina immigrants between the ages 20 to 24 with a higher degree of acculturation had a lower risk for LIBW (OR .32, CI 0.07, 1.4) than those with "low acculturation" (OR 3.91, CI 1.69, 9.01; n = 700).

Individual Characteristics: Stressors and Protective Factors

Prenatal health care providers occupy a unique position, and are able to bring innovative interventions to patient groups in the health care setting which may bridge a gap between the larger public health context and the individual. An improved understanding concerning which individual protective factors have the most impact on healthy birth outcomes will guide the development of future interventions.

Social relationships as stressors. Social relationships may result in either nurturing or stressful bonds. Network resources, number of friends and family, support by the father of the baby, and satisfaction with support will be discussed as they relate to birth outcomes, with relationship risk factors being discussed first, and support as a protective factor covered afterward.

Zachariah (2009) studied birth outcomes from the perspective of a lack of support, and found that women suffering pregnancy complications had lower total functional social support scores in early pregnancy (14 to 22 weeks) than women without complications (t = 2.11, p = .038, n = 111). In the same study, women who experienced intrapartum complications had lower functional support than the others (t = 2.86, p = .007). Nylen, O'Hara and Engeldinger (2013) found that prenatally depressed women tended to have smaller support networks and rated their

satisfaction with the support lower (t = -2.61, p = .01, n = 235). Depressed women also had smaller babies than women with no history of depression (t = -2.37, p = .019).

Satisfaction with support is an important aspect of the social support concept, possibly reflective of the value it has to the pregnant women. Da Costa, Dritsa, LaRouche, and Brender (2009) found that low satisfaction-with-support scores had a weak but significant correlation with low birth weight (r = .21, p < .10, n = 80). Increasing the complexity of the issue, social support is measured variously as network support, received support, and perceived support. In the broader literature, the individual *perception* of received support is more closely associated with satisfaction than objective measurement of support received (Nylen et al., 2013). Effects of social support are likely to depend on the source, with the family of origin, friends, and FOB being important sources.

The effect of perceived support by the FOB upon birth outcomes is an area in which our understanding is inconclusive. Although some studies have found no association between FOB support or involvement and birth outcomes (Straughen, Caldwell, Young, Jr., & Misra, 2013), a number of studies have found significant relationships. In a study of nearly 200,000 women, teen mothers without involvement of the FOB had a higher risk of PTB (OR 1.21, CI 1.17, 1.25) and LIBW (OR = 1.19, CI 1.15, 1.23) than teens with FOB involvement (Alio et al., 2011). A systematic review and meta-analysis of 21 studies revealed that unmarried women had significantly smaller babies and higher rates of PTB than married women (Shah, Zao, & Ali, 2011).

Reasons for better outcomes among the partnered seem intuitive when social support is strong and caring. Unfortunately, partner involvement may not always be of a healthful and positive nature. In a meta-analysis of eight high-quality studies, researchers found that women

who were physically, emotionally, or sexually abused were more likely to give birth to infants with low birth weight (OR 1.4, CI 1.1, 1.8; Murphy, Schei, Myhr, & Du Mont, 2001). Other systematic reviews have uncovered similar results (Han & Stewart, 2014; Hill, Pallitto, McCleary-Sills, & Garcia-Moreno, 2016). Marital discord is associated with immune system dysregulation (Jaremka, Glaser, Malarkey, & Kiecolt-Glaser, 2013), which may offer one explanation for the poor outcomes.

Global rates of domestic violence in pregnancy are unknown, but range from estimates as high as 44% in some countries (Han & Stewart, 2014) to 78% in others (Hassan, Kashanian, Hassan, Roohi, & Yousefi, 2014), which implies that the impact on birth outcomes could be substantial. The highest rate in a U.S. study was 66%, in research by Shumway et al. (1999) which included verbal abuse by "someone close" to them (not necessarily a partner) as an abuse variable. The convenience sample consisted of a high proportion of disadvantaged women from a large metropolitan obstetric clinic, 62% having an annual income of less than $10,000, only 11% of whom were married, and 90% were Black. Women who reported experiencing verbal or physical abuse had significantly higher rates of preterm labor: 3.7% for women reporting no abuse exposure, 7.6% for those reporting verbal abuse, and 17.2 for those who reported severe physical abuse ($p = < .01$; Shumway et al., 1999). Researchers studying domestic violence during pregnancy admit that study results are difficult to compare due to differences in measurement, study design, and population sampled, with cultural norms and reliability of responses influenced by social desirability and willingness of women to divulge abuse (Jasinski, 2004). Such potentially confounding variables demonstrate the need for further research.

The mediating role of supportive relationships on birth outcomes is not clearly understood (Dunkel-Schetter, 2011) and studies showing links between social support and

adverse birth outcomes exist. For instance, in one U.S. study with surprising findings, researchers found that women with lower support and fewer social ties had 32 to 39% lower odds of PTB, and decreased odds of LIBW (adjusted OR .69, CI 0.50, 0.96, *n* = 4,443; Almeida, Mulready-Ward, Bettegowda, & Ahluwalia, 2014). However, this study was done using a databank with very limited social support assessment measurements. The authors suggest that even supportive relationships imply an obligation for recipients to return social support, meaning that they may serve to increase stress at times. Gender roles often disproportionately burden women with social obligations and any resulting negative consequences of extensive family/social ties (Almeida et al., 2014).

Social relationships as protective factors. Women at high risk for adverse outcomes may benefit from interventions geared toward increasing exposure to protective factors. Yet, the action of protective factors on health outcomes such as birth weight remains to be explored. Given that stress exposure is impossible to avoid, some women with protective assets appraise or respond to stress in positive ways, leading to less physical and psychological harm and better birth outcomes.

In the seminal study of birth outcomes and social support by Nuckolls, Cassel, and Kaplan (1972), the researchers found no association between their measure of social support and healthy birth outcomes in women with low "life change" scores (representing a type of stress). However, in women with higher life change scores, those with high social support had only 33% of the birth outcome complications as those with low social support. The authors concluded that social support was associated with the ability of women to adapt to stress in a way that predicted healthy outcomes (Nuckolls, Cassel, & Kaplan, 1972). The finding has been corroborated in more recent birth outcomes research (Ghosh, Wilhelm, Dunkel-Schetter, Lombardi, & Ritz,

2010). Supporting the importance of a social network, Nkansah-Amankra, Jussey and Luchok (2010), found that women who reported that they had high levels of social support also had lower rates of PTB than women with less support (10.2% versus 14.2%, n = 5730). In the same study, women with high social support had a 8.5% rate of LIBW and those with low support had rates of 10.0% (Nkansah-Amankra et al., 2010). Raunchfuss and Maier (2011) found that adult women with caring partner support had less than half the rate of PTB than women without (p = .02, n = 589).

Conversely, in the Behavior in Pregnancy Study, Feldman (1993) found few significant links between any social support measure from FOB or family and friends and birth weight. Values attaining significance were small and negative in nature: More support resulted in lower birth weight (Feldman, 1993). Stress levels, however, were not taken into consideration, as in the study by Nuckolls and colleagues (1972), signifying the need for additional research.

Some studies describe a "buffering effect" of social support against stress on birth outcomes (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993). Yet, other studies draw a direct line between personal social resources and birth outcomes, and deny support for any buffering effect (Guardino & Dunkel-Schetter, 2014; Rini, Dunkel-Schetter, Wadwha, & Sandman, 1999). Cohen and McKay (1984) concluded over two decades ago that both the buffering and direct effect models have evidentiary support, demonstrating the complexity of the relationship between stressors, support, and birth outcomes. In the following paragraphs, research examining social support as a protective factor against adverse birth outcomes will be discussed. Most studies addressing effects of social support on birth outcomes do not differentiate between sources of support, grouping the sources into categories that in the lived

experience are, in fact, separate and distinct. In the discussion below, the sources of support will be covered separately.

Social support from family/friends. Having a greater number of family members and close friends, along with more network resources, have been associated with higher birthweight (r = .198, p < .05, n = 129; Collins et al., 1993). Raunchfuss and Maier (2011) found that women feeling a lack of acceptance from their female friends had higher odds of PTB than other women (OR 3.22, 95%, CI 1.23, 8.40, n = 589). Numerous other researchers have corroborated the stress-ameliorating nature of social support for pregnant women from family, friends and partners/father of the baby (Wado, Afework, & Hindin, 2014; Wakeel, Witt, Wisk, Lu, & Chao, 2014). Women identify support from their mothers as particularly important during the perinatal period (Darvill, Skirton, & Farrand, 2010; Warren, 2005). Research on maternal support for the period of labor and delivery reveals that women greatly value support from their mothers (Bruggemann, Parpinelli, Osis, Cecatt, & Neto, 2007); yet research on specific effects of maternal support during the timespan of pregnancy, as it relates infant birth weight, is lacking.

Social support from the FOB. Support by the partner or FOB may be of particular importance to pregnant women. A case-control study by Ghosh, Wilhelm, Dunkel Schetter, Lombardi and Ritz (2010) with 1,027 PTBs and 1,282 full-term infants, found that among women with moderate to high stress scores, those with partner support had lower rates of PTB than women without partner support, (OR 1.13, CI .94, 1.35 versus OR 2.15, CI .92, 5.03). These findings led the authors to suggest that this type of social support may act as a moderator or buffer of stress (Ghosh et al., 2010). Raunchfuss and Maier (2011) found that among women rating emotional support from their partners as ideal, only 1.8% had a preterm delivery, compared with 8.0% of those who had considered separation, or reported that their relationship

was “not that good.” Other researchers have found that pregnant women who reported higher levels of emotional closeness and intimacy with their partners had significantly less pregnancy anxiety (ß = -.35, z = -4.10, $p < .05$, n = 176) than women with low partner support (Rini et al., 2006).

Alternative Sources of Support. Interventions involving social support for pregnant women provided by various sources (nurses, social workers, and midwives) in an effort to improve birth outcomes began to appear in the literature over 20 years ago. Most studies showed mixed results, with Bryce, Stanley and Garner (1991) showing no significant differences between women receiving emotional support from midwives and controls without the added support. Villar et al. (1992) provided four to six home visits by nurses or social workers in addition to typical prenatal care, but also found no birth outcome benefits.

Women in one program, in which peers of similar social backgrounds were trained to give emotional and informational support to pregnant women, reported better birth outcomes than women in programs in which health care professionals attempted to give support. Another method, the Resource Mothers Program was implemented in various states in the southern part of the United States for mothers 19 years of age and under as a collaborative public and private initiative (Rogers, Peoples-Sheps, & Suchindran, 1996). In this model, trained lay workers of similar ethnicity as the subjects provided home visits for social, advocacy, and informational support. The program led to a 75% reduction (n = 354, $p \leq .05$) in PTB in South Carolina groups (Olds, Henderson, Tatelbaum, & Chamberlin, 1986). However, in Virginia the Resource Mother’s Program showed only a small, insignificant reduction in PTB between 29 control women receiving no prenatal care and 49 women receiving the intervention care ($p > 0.15$). Julnes and colleagues (1994) commented on the lack of statistical power for the Virginia study,

which may have hindered positive effects of the program (Julnes, Konefal, Pindur, & Kim, 1994).

Norbeck, Dejoseph and Smith (1996) conducted a seminal quasi-experimental study among 114 Black pregnant women. First, the researchers conducted focus groups designed to identify the type of support most needed. After a social support assessment was administered, women with low levels of support were randomized to control and intervention groups. The intervention consisted of four one-on-one support sessions with specific themes provided by nurses, and phone calls in the weeks between sessions. Rates of LIBW were 9.1% in the intervention group and 22.4% in the control group (n = 319). Unique strengths of the study by Norbeck and colleagues (1996) included pre-assessment of social support, so results from women with plenty of pre-existing support didn't confound results, and an intervention based on feedback from patients involved.

More recently, the Centering Pregnancy® (CP) model of enhanced prenatal care was developed which has effectively delivered a type of peer-group social support combined with prenatal care. In the intervention, pregnant women receiving CP care progress through the course of pregnancy with a consistent group of 8 to 12 women scheduled to deliver around the same time (Centering Healthcare Institute®, Inc., 2016). In this model, women are empowered to participate in their own care, weighing and charting their own weight, blood pressure, and urine tests. At each prenatal visit, they receive a short personal physical examination from the health care provider, and participate in interactive prenatal classes on a curriculum topic pertinent to their current period of pregnancy (Centering Healthcare Institute®, Inc., 2016). In two randomized controlled trials of over 1,000 women each, CP care resulted in a 33% reduction of PTB in one study ($p < .045$) (Ickovics et al., 2007), and a 34% reduction in the other ($p = .04$)

(Ickovics et al., 2016). Although many studies demonstrate better outcomes with CP, some show no differences (Klima, Norr, Vonderheid, & Handler, 2009; Robertson, Aycock, & Darnell, 2009). The studies showing no differences are consistently smaller and of less rigorous design, without randomization of the subjects; however, additional research is needed to explore the benefits and limitations of CP.

Despite the apparent effectiveness of the CP model and other group interventions, not all women felt that they benefitted, with some women disliking aspects of group care, and others finding it difficult to attend the meetings because of other family responsibilities (Kennedy et al., 2011; Shakespear, Waite, & Gast, 2010). In addition, medically high-risk women are typically encouraged to utilize individualized prenatal care rather than CP because of potential medical complications requiring specialized care (Picklesimer, Billings, Hale, Blackhurst, & Covington-Kolb, 2012). High-risk mothers could theoretically benefit from utilizing both models simultaneously, obtaining advantages from both medical and peer support. Further research related to best models of care in this vulnerable population is warranted.

More evidence of the value of social support provided by pregnant peers was found in a novel study by Field, Diego, Delgado, and Medina (2013). Efficacy of interpersonal psychotherapy on depressed pregnant women was compared to the control treatment of short social support sessions. In the study, women were randomized into either 12 one-hour group psychotherapy sessions or 12 control meetings. The control group meetings consisted of 20-minute sessions of unstructured discussion, with an untrained staff member present who remained silent. Both groups had reductions in anxiety, depression, and cortisol levels, but unexpectedly, the control group had a greater reduction in cortisol levels than the intervention group, despite having lower socioeconomic status and higher summary depression scores than

the intervention group (Field et al., 2013). There were no differences in birth outcomes. The authors suggested that peer support sessions may be a cost-effective method of treating antenatal depression.

A longitudinal randomized controlled trial of 184 couples in Spain and France, in which the women were at higher than normal risk of postpartum depression, involved an intervention which exposed them to higher spousal and pregnant-peer support. Collado, Saiz, Ravron and Hetem (2014) used a novel method of supplemental prenatal care involving 10 two-hour group sessions and a phone call between sessions, known as the Tournè psychosomatic approach. The method used "humanistic and cognitive techniques" (p. 5) involving reasoned connection of somatic sensation to emotions. Preterm birth rates were four times less in the experimental group (p = .003) and birth weight was higher by nearly 300 grams (p = .01).

Another recent innovation combined traditional individual prenatal care with group care, essentially adding three 2-hour group sessions (one per trimester of pregnancy) to the typical prenatal care schedule (Lathrop & Pritham, 2015). Known as the *Healthy Pregnancy, Healthy Childbirth, Healthy Parenting* model, the group sessions focused on discussion of health promotional education appropriate to the stage of pregnancy. A pilot study revealed increased maternal knowledge of health-related pregnancy issues, self-efficacy, and satisfaction with care. Birth outcomes have not been studied in relation to this prenatal care method, and the authors noted that the limited number of group sessions were not designed, and did not appear, to increase social support for the women (Lathrop & Pritham, 2015). Clearly, although group prenatal care may offer various advantages to women, intentional inclusion of activities fostering social support would be desirable.

The above studies indicate that protective assets may be existing (such as family or partner social support), or intentionally promoted, as demonstrated in the study by Collado et al. (2014). Understanding which assets and skills are most effective in improving birth outcomes is essential to the composition of interventions needed to address the needs of high-risk women.

Spiritual support/socialization. Coping using spirituality is a topic of current interest among researchers, but results tend to be mixed, partially due to differing methods of definition and measurement (Burdette, Weeks, Hill, & Eberstein, 2012; Dailey, 2009; Jesse & Alligood, 2010). A number of studies in various populations have explored facets of spirituality and religiosity on birth outcomes, without finding significant effects, yet are deserving of further study as new research is designed. For instance, Rankin et al. (2011) explored prayer as a means of dealing with effects of racism on PTB (OR 1.9, CI 0.9, 4.3). Another recent example includes a study of the effect of listening to the reading of the Quran on PTB (OR 0.3, CI 95%: 0.1, 1.2) by Mirghafourvand, Sehati, Mohammad-Alizadeh-Charandabi, and Jabbari (2016).

Other studies have identified significant links between a spiritual quality or activity and birth outcomes. In a study using several tools to assess religiosity and spirituality in a group of pregnant Hispanic women, Dalmida et al., (2010) found that spirituality, defined as women's ratings for frequency of church attendance and perceived importance of spiritual activities, explained 12.6% of the unique variance in birthweight (p = .003). Najman et al., (1988) found that frequency of church attendance was positively associated with length of gestation and birth weight in a study involving 6,566 women. After adjustment for income, marital status, age and number of pregnancies, the associations remained significant. Further, the association between frequency of church attendance and length of gestation (but not birth weight) remained significant (p = .02) even after adjusting for smoking and alcohol use. Conversely, in a smaller

yet still robust study (*n* =1898) Dole et al. (2004) found no association between PTB and frequency of church attendance. Confounding factors abound, however, and one explanation for improved birth outcomes in women reporting greater spirituality is the finding that such women are less likely to smoke and use drugs (Jesse & Reed, 2004; Mann, McKeown, Bacon, Vesselinov, & Bush, 2007).

Health status. Many health conditions affect the outcomes of pregnancy and birth, from pre-existing conditions serious enough to cause death to the woman and the fetus, to those with little impact. Pregnancy-related conditions such as gestational diabetes and hypertension may increase risk of PTB/LIBW up to ten-fold (Hammond et al., 2013). (Health status is not in the LCBO model but was assessed in the study so that it could be controlled for during analysis, as it may predispose women to experience particular outcomes.)

Health behaviors. Behaviors associated with adverse birth outcomes include several activities, with the most important being smoking. Smoking is strongly associated with PTB, (OR = 3.10, CI 1.37, 7.04, $p < .007$; Andrian & Hsien Wen, 2014), and LIBW (OR 2.04, CI 1.89, 2.19, $p < .0001$) with higher rates of smoking found among White women (Nkansah-Amankra, 2010). Smoking cessation is one of the five interventions selected by the World Health Organization as being most important in reducing preterm birth (Chang et al., 2013).

Few studies have been conducted that link cognitive and behavioral interventions to birth outcomes, but one group of researchers conducted a study in Washington, D.C., demonstrating efficacious results. In a randomized, controlled trial, El-Mohandes, Kiely, Gantz and El-Khorazaty (2011) tested a theory-based multifaceted therapy, targeting mood management, maintenance of positive social interactions, dealing with smoking, environmental smoke, and intimate partner violence. They found reductions in rates of PTB (OR .42, CI 0.19, 0 .93) in the

intervention group, when compared with the controls who received usual prenatal care (El-Mohandes et al., 2011).

Prenatal care for women in the United States is typically provided by a clinic-based health care provider, being sought by pregnant women with the intention of increasing the likelihood of a healthy pregnancy and birth. In general, evidence that prenatal care in the United States improves birth outcomes is mixed, with many studies comparing initiation of the month in pregnancy in which prenatal care began and the number of clinic visits to birth outcomes (Alexander & Kotelchuck, 2001; Alexander & Korenbrot, 1995). Studies showing strong effects in favor of prenatal care are often plagued with confounding factors, because women who do not seek prenatal care are most often from the demographic categories which are at highest risk for adverse birth outcomes (Behrman & Butler, 2007; Lu et al., 2010; Lu, Tache, Alexander, Kotelchuck, & Halfon, 2003; Partridge, Balayla, Holcroft, & Abenhaim, 2012). Some populations may receive greater benefits from prenatal care than others. Researchers in one large study involving adolescents found a seven-fold increase in PTB (adjusted OR 7.40, CI 5.7, 9.7) among those not receiving prenatal care, and a graded relationship between PTB and the number of prenatal visits (Debiec, Paul, Mitchell, & Hitti, 2010). A call has been issued for the content of prenatal care to change from risk reduction to improving health behaviors, with an emphasis on mental health promotion and stress management in minority women (Gennaro, Melnyk, O'Connor, Gibeau, & Nadel, 2016).

Maternal Stress Physiology

Biological responses to stress in pregnancy are well-studied. Physiological stress, psychological stress, and anxiety initiate a cascade of increased catecholemines, corticotropin-releasing hormone, and cortisol levels leading ultimately to labor initiation (Field, Diego,

Delgado, & Medina, 2013; Gravett et al., 2010; Juster, McEwen, & Lupien, 2010). The link between physiological and psychological stress, increased corticotropin-releasing hormone (CRH), and cortisol levels is clear although the mechanisms involved are very complex (Field & Diego, 2008; Selye, 1950). Because CRH and cortisol appear to play a vital role in the cascade of labor initiation, researchers have explored feedback loops and other connections between the biomarkers. One complicating problem is the multiple sources of CRH in pregnancy. The placenta, fetus, and mother's system all produce CRH (Gravett et al., 2010). In a meta-analysis of 15 studies, Giurgescu (2009) found that a majority of researchers, though not all (Voegtline et al., 2013), uncovered significant assocations between elevated cortisol and PTB, but the heterogeneity between studies (including the various sources of samples: saliva, blood, hair) makes comparison difficult. The levels of cortisol at certain times in pregnancy may correlate more closely with PTB than others. In a recent study, researchers found that perceived stress at 16 weeks was associated with increased cortisol (r = .28, p = .007, n = 90) and with PTB (r =-.30, p < .01; Hoffman, Mazzoni, Wagner, Laudenslager, & Ross, 2016). In addition to the cortisol-PTB link, Field et al. (2006) found that high levels of norepinephrine were associated with LIBW.

Although the cortisol-stress link to PTB is undoubtedly important, stress-related inflammatory processes may also be involved. In one study, 78 women were exposed to psychosocial stressors, followed by serum measurement of interleukin-6; Black women had 46% higher post-exposure increases than White women (p = .001). The authors concluded that stress-induced inflammatory reactions appeared more robust in Black women (Christian, Glaser, Porter, & Iams, 2013). Future studies are needed to determine if increased inflammatory responses are connected to the higher rates of LIBW in the Black population. Some studies show no link

between inflammatory markers and PTB, but because of the expense of biomarker research, sample sizes tend to be small and further research is needed (Giurgescu et al., 2009).

A recent study of 34 women explored the pathway between social support, stress, and physiologic responses, suggesting a rationale for better outcomes among those with more support. La Marca-Ghaemmaghami et al., (2013) traced the connection from preexisting perceived emotional support and acute stress to salivary steroid levels in the second trimester of pregnancy. The researchers found that emotional support mitigated some physiologic effects of stress by normalizing an enzyme-hormone interaction in the conversion of salivary cortisol to cortisone. Women with higher levels of emotional support had a healthier adaptive response than women with lower levels (r =.49, p = .03; La Marca-Ghaemmaghami et al., 2013).

Summary

Research findings regarding effects of psychosocial contextual factors on the birth outcomes of LIBW and PTB have been presented, in terms of risk and protective factors. Predictors of healthy birth outcomes, such as social relationships and health behaviors, were introduced and the possibility that they may offset detrimental effects of stress on birth outcomes has been discussed. The broad nature of the past and present birth outcomes research represents an impressive momentum in public health inquiry.

Little research has been done, however, addressing which of the various psychosocial assets are most predictive of HIBW. Secondary analyses of studies with psychosocial data and women at risk for adverse birth outcomes may be extremely helpful in identifying psychosocial factors likely to be associated with healthy birth outcomes. Such research is an essential step toward formulating new interventions that can be implemented to reduce LIBW and PTB in a broad array of women. Toward the goal of understanding which psychosocial assets serve in a

protective capacity in pregnant women at risk for LIBW, a secondary analysis of the FFS dataset was conducted. Study variables and analysis techniques will be described in Chapter 3.

Chapter 3

The FFS is an ongoing prospective cohort study which began in 1998, and was conducted under the auspices of Princeton and Colombia Universities, and funded by government and private donors, described below. A discussion of the research design, setting, and sample characteristics describing the original collection of data within the FFS and procedures for the current secondary analysis using available baseline data from the FFS follows. Further descriptions of the study variables are provided, along with the data analysis plan for the current study. The methodology discussion concludes with the limitations of the analysis and a final summary.

Design of the Original Fragile Families and Child Wellbeing Study

The FFS was funded by the National Institute of Child Health and Human Development (NIH Grant # R01-HD-36916; 5P30-HD-32030, R01HD-39135, and R01HD-40421), National Science Foundation, the U.S. Department of Health and Human Services and a coalition of 21 private foundations (Princeton University, 2016). This unique databank features survey responses covering demographic and psychosocial areas from a population of vulnerable mothers in the United States, allowing for descriptive and associational analyses.

The FFS began in 1998 as a longitudinal cohort study, with the goal of studying a single cohort of approximately 5,000 children from the time of their birth to adulthood and beyond, with administration of sociodemographic and psychosocial surveys to the parents, as well as occasional assessment of physical biomarkers. Data were collected at baseline (birth) and at years one, three, five, and nine, with year 15 data collection currently in progress. Three quarters of the families studied were non-marital, and thus considered “fragile” for the purposes of the original study (Princeton University, 2016). The baseline study data supplied information on

4,360 births as well as parental psychosocial and demographic information (Kimbro, 2008). There were 425 infants born with low birth weight, and 3,444 with normal birth weight (Clay & Andrade, 2015). The study files contain both restricted use data and public use data. The restricted use data includes medical records and geographical data, while the public use data have no geographic information and no medical information other than birth weight.

Sample

The sample selection procedure began with a stratified random sampling of all 77 U.S. cities with a population of 200,000 or more in 1998, the cities being stratified by the social policy categories of welfare generosity, child support provisions, and labor markets (Reichman, Teitler, Garfinkel, & McLanahan, 2001). After randomly selecting 16 of the 77 cities, and adding four others required by sponsors of the study (n = 20), the researchers then selected hospitals in each of the cities. Hospital selection varied from city-to-city because the number of birthing hospitals was a limiting factor. In two cities with a large number of birthing hospitals, hospitals were randomly selected. In five smaller cities, all the hospitals which served birthing women were selected. In the remaining cities, the hospitals were rank-ordered from those having most, to those having the least nonmarital births, with the larger sites being selected. A total of 75 hospitals served as the settings.

Further stratification by marital status among facilities led to a random sample of 3,712 unmarried women and a group of 1,188 married women for comparison. The final participant sample mirrored the U.S. population in age, but not race/ethnicity. An oversampling of Black women, in accordance with study goals, yielded an unweighted sample percentage of 47% versus 32% in U.S. population in 1998. (Note that the weighted sample values are different, see table 3). Less represented in the sample were Hispanics (27% versus the U.S. population of 24%) and

Whites (21% versus the U.S. population of 40%; Reichman et al., 2001). In an effort to obtain expanded data on unwed parents and others in whom the low infant birth weight (LIBW) prevalence was highest, e.g., Black women, the mirroring of general U.S. demographics was not a research goal (Reichman, Hamilton, Hummer, & Padilla, 2008). Such disproportionate sampling is a strategy for obtaining increased precision in a population of interest (Remler & Van Ryzin, 2011).

Procedures used in the FFS data collection

The current principal investigators for the FFS are Sara McLanahan from Princeton University, and Irv Garfinkel from Columbia University, with numerous co-investigators and research partners contributing to specific projects and aspects of the study across the United States (Brooks-Gunn, Garfinkel, McLanahan, & Paxson, 2011; Princeton University, 2016). The execution of data collection procedures to obtain the baseline data was a massive undertaking requiring coordination from multiple researchers at Princeton, in addition to a site principal investigator and staff at each of the participating hospitals (Brendheim-Thoman Center for Research on Childhood Wellbeing, 2008). The site principal investigator assisted with obtaining Institutional Review Board (IRB) approval at each hospital. Two reputable polling organizations, the National Opinion Research Center (www.norc.org), and Mathematica Policy Research, Inc., (https://mathmatica-mpr.com) were subcontracted to complete the baseline surveys, using experienced and fully trained field interviewers. Both parents were interviewed shortly after the birth of the infant, while they were still in the hospital. Data from the baseline interview of the infant's mother describe prenatal conditions, demographics, and relationships of interest reflecting study variables. The full baseline survey is public information, available at the FFS website: http://www.fragilefamilies.princeton.edu/documentation/baseline.

Study Protocols

Prior to beginning interviews at each site, the study managers ascertained the visiting hours, private locations for interviews, and procedures specific to each hospital for identifying eligible mothers and conducting interviews. The researchers randomly sampled marital and non-marital births in each hospital until predetermined quotas were reached, in accordance with the research goal of developing a greater understanding of "fragile" non-marital families. Because study data included information regarding the father of the baby (FOB), mothers who reported that the FOB was deceased were ineligible to participate in the study. Absent or unknown fathers did not exclude otherwise eligible women. Further exclusion criteria included those who planned to place their infants for adoption and an inability to speak English or Spanish, hospital discharge prior to screening, and age below 18 years if the hospital IRB had not permitted participation of minors.

Data Cleaning and Missing Data

The FFS data have been cleaned to a limited extent by the Brendheim-Thoman researchers and analysts associated with the databank. Birth weight was obtained from the medical record, and would normally not have been available in the public use files. The dichotomous variable "low birth weight birth" was released as a constructed variable for sample participants. Low birth weight is defined in the FFS dataset as a birth weight of less than 2500 grams (coded as "1"), and infants above 2500 grams are coded zero (0) (Brendheim-Thoman Center for Research on Childhood Wellbeing, 2008); therefore, continuous data for the outcome variable is not available. Many missing survey values were recovered for the public use data, by FFS researchers gleaning data from medical records (Burdette, Weeks, Hill, & Eberstein, 2012).

FFS Ethical Considerations Procedures

Princeton University FFS researchers working with clinicians at each of the 75 hospital sites obtained institutional review board (IRB) approval from each hospital board. None of the hospitals refused to participate in the study (Reichman et al., 2001). IRB approval from Princeton University is not mentioned in the Fragile Families materials. Each hospital site gave approval; however, institutional nuances disallowing specific research procedures were noted, such as participation of minors and monetary compensation, preventing the development of a standardized study protocol across all settings.

After determining participant eligibility, the interviewers explained the consent form, making certain each participant understood every provision in the agreement. Ample opportunity was allowed for questions before signing. If the mother was eligible and consented, the interviewer proceeded with the survey, administering it in a private and confidential setting. Interviews lasted an average of 42 minutes. In the hospitals in which the IRB allowed participants to receive compensation, the mother was given a check for $20 USD.

Research Design of Current Study

Purpose

The purpose of this research study was to examine which protective psychosocial factors are most predictive of Healthy infant birth weight (HIBW) for childbearing women. To date, no analysis has been conducted to explore the extent to which multiple protective psychosocial assets predict healthy birth outcomes in women with specific known risk factors for LIBW, enumerated below.

Variables were selected in accordance with the guiding framework for the study, the Life Context Birth Outcomes conceptual framework (LCBO), adapted from that of Culhane and Elo

(Culhane & Elo, 2005), presented as Figure 1 in Chapter 1. Risk factors, available in the dataset, that have been shown in previous research to predict adverse birth outcomes served as covariates including medical, neighborhood, and individual sociodemographic items. Protective factors in the domains of social support and health behaviors functioned as predictors.

Power Analysis

A power analysis was conducted using G*Power 3.1.9.2 for Windows (Faul, Erdfelder, Buechner, & Lang, 2009). G*Power estimated that 3,479 participants would be needed to attain a statistical power of .80 with a two-tailed alpha error probability of .05 on the basis of an odds ratio of 1.2 for spiritual support and birth weight by Clay and Andrade (2015). The power analysis was calculated from the variable of spiritual support because in other studies, it had smaller effect sizes than other psychosocial variables, and sensitivity was desired for the current study.

Current Study Ethical Considerations

Because the public use FFS data have been de-identified, the current study was deemed exempt from the need for IRB approval. A communication from the University of Texas at Arlington IRB and Regulatory Services Office indicated that according to the Department of Health and Human Services definition, the current study did meet the definition of human subjects research (Appendix B).

Measurements for Current Study

Because the FFS public use dataset contains numerous variables associated with birth weight, it was selected for this secondary analysis. Table 2 provides conceptual and operational definitions of the variables and measurement tools used to collect the resulting data. Although interviewers used established measurement instruments in some of the later surveys in the

development of the FFS dataset, only individual questions were used to obtain baseline data; therefore, psychometric data were not calculated by the original researchers and were not available for the current secondary analysis. For the current study, psychosocial and health behavior characteristics associated with healthy birth outcomes were considered predictors factors; medical, sociodemographic and individual risk factors associated with adverse birth outcomes composed the risk factors (Figure 1, in Chapter 1).

Risk factors for the current study included: neighborhood context items such as violence and income category, ethnicity of mother, age of mother, educational status, intimate partner violence, and smoking. Potentially protective predictors of healthy birth outcomes which were examined included the variables of social support by FOB, social support by family of origin, spiritual support, mother's self-rated health, and prenatal care visits. The birth outcomes were dichotomous: low birth weight and healthy birth weight (see tables defining each of the concepts, Table 1). Justification for the inclusion of selected variables can be found in the literature review in Chapter 2.

Table 2

Conceptual and Operational Definitions of Study Variables with Measurement Scales

Study Variable (Theoretical category from LCBO framework)	Conceptual Definition	Operational definition as taken from survey question (Princeton University , 2013)	Level of measure/ Measurement Scale as taken from survey responses (Princeton University , 2013)	Survey Item number
	Neighborhood Context (NC)			
a. NC1: Safety of neighborhood (Neighborhood context)	Neighborhood safety is a rating of the security felt in the neighborhood-level social environment. It is included in the concept of Life Context Stressors (Culhane & Elo, Neighborhood context and reproductive health, 2005).	Score from response to question: "How safe are the streets around your home at night?"	Ordinal/ Interview question Safety rating: 1 - Very safe 2 – Safe 3 – Unsafe 4 – Very unsafe (Dichotomized in Loggins, 2013, to safe or unsafe, as in current study.) 0 – Safe 1 - Unsafe	F5
b. NC2: Stability of residence (Neighborhood context)	Residential stability is a rating of permanency/constancy in the life of the individual respondent (Culhane & Elo, Neighborhood context and reproductive health, 2005), and thus, is reflective of individual permanency, serving as a proxy for general neighborhood stability.	Score from response to question: "How long have you lived in your neighborhood?"	Ratio/ Number of years___ Number of months ____	F1
	Demographic Characteristic (DC)			
c. DC1 : Ethnicity of mother (Demographic characteristic)	The social construct of membership in a group defined by culture, common heritage, or national origin; self-identification with such a group (Kaplan & Bennett, 2003)	Response from survey item, "Which of these categories best describes your race" and "Are you of Hispanic or Latino origin or descent.	Nominal/ 1 – White non-Hispanic 2 – Black non-Hispanic 3 – Hispanic 4 – Other	Constructed item available in codebook: CM1EthRace

Study Variable (Theoretical category from LCBO framework)	Conceptual Definition	Operational definition as taken from survey question (Princeton University , 2013)	Level of measure/ Measurement Scale as taken from survey responses (Princeton University , 2013)	Survey Item number
d. DC2: Age of mother (Demographic characteristic)	Maternal age at date of study infant's birth.	Mother's age in years from study demographic item cm1age (not asked in survey, but reported in record).	Ratio/ Age in years from demographic area of record.	Constructed item available in codebook: Cm1age mother
e. DC3: Education of mother (Demographic characteristic)	Amount of maternal education.	Response from survey item: "What is the highest grade or year of regular school that you have completed?"	Ordinal/ 1 – No formal schooling 2 – 8th grade or less 3 – Some high school 4 – High school diploma 5 - G.E.D. 6 – Some college /2-year degree 7 – Technical/trade school 8 – Bachelor's degree 9 – Graduate/professional school	I1

f. DC4: Household Income (Demographic characteristic)	Estimation of yearly income; low income is a risk factor for LIBW.	Response from survey question, what was your total household income before taxes in the past 12 months?	Ordinal/ 1 > $5,000 2 $5,000 - $9,999 3 $10,000 – $14,999 4 $15,000 - $19,999 5 $20,000 – $24,999 6 $25,000 - $34,999 7 $35,000 - $49,999 8 $50,000 - $74,999 9 < $75,000	J3
g. DC5: Formal relationship with FOB: Marital, cohabitation, or none (Demographic characteristics)	Marriage is evidence of a formal, legal relationship. Living with the father of the baby is a formal acknowledgement of the provision of obligation and interest; not living with the father of the baby is a risk factor because this formal acknowledgement is missing. (Reichman, Hamilton, Hummer, & Padilla, 2008)	Survey response to "Is respondent married to baby's father?" (If not, the following question was given:) Which of the following statements best describes your current relationship with baby's father?	Nominal (yes/no) Answer is selected from the following options: 1 – We are romantically involved on a steady basis 2 - We are involved in an on-again and off-again relationship. 3- We are just friends. 4 - We hardly ever talk to each other. 5- We never talk to each other.	Item A4 or B2, B3
	Risk Factors (RF)			
h. RF1: Intimate partner violence (Negative social support)	Physical abuse and emotional abuse by an intimate partner or former intimate partner are defined as behavior intended to cause harm, to coerce/control (World Health Organization, 2016)	(Asked separately to those in the not involved, romantically involved and marital relationships) Survey responses Thinking about your relationship with baby's father, how often would say that: He hits or slaps you when he is angry? He insults you or criticizes you or your ideas?	Ordinal/ Possible answers are: 1 - Often 2 - Sometimes 3 - Never. Dichotomized to yes/no--Nominal	In "not romantically involved" relationships: Items B7: B7B physical abuse B7D emotional abuse In "romantic or on-again, off-again" relationships:

			(The questions are identical in each of the relationship categories listed above in j. RF10.)		Items B13: B 13B: physical abuse B 13D: emotional abuse In married relationships: Items B25 B 25B physical abuse B 25D emotional abuse
i.	RF2: Maternal smoking (Health Behaviors)	Use of cigarettes.	Survey response: During your pregnancy, how many cigarettes did you smoke? Did you smoke…	Ordinal/ 1- 2 packs or more a day 2- 1 or more but less than 2 3- Less than 1 pack a day 4 – None	G4
	Protective Variables: Psychosocial Factors (PF) --Social Support and Health Behavior				
a.	PF1: Social Support by the Father of the baby (FOB) (Social support)	Social support is a mutual exchange of emotional, tangible/instrumental, and informational assistance (Dailey, 2009) and self-esteem/appraisal confirmation.	Survey responses: (Asked separately to those in the not involved, romantically involved and marital relationships) "I am going to read you some things couples often do together. Tell me which one you and [Baby's Father] did during the last month…" Helped each other solve a problem?"	Nominal/ Possible answers are: 1 - yes 0 – no	In "not romantically involved" relationships: B5D In "romantic or on-again, off-again relationships": B 11D In married relationships: B 22D

b. PF2: Social Support by Family of Origin (Social Support)	Tangible, instrumental, informational support provided by the parents, brothers, sisters or extended family of the woman (UCLA, n.d.).	Survey responses: During the next year, if you needed help, could you count on someone to in your family to: (1) Loan you $200? (2) Provide a place to live? (3) Help with babysitting or child care?	Nominal/ 1 - Yes 0 - No	Items E4: A, B, and C
c. PF3: Spiritual support (Social Support)	Frequency of attendance at religious services are used as a proxy for spiritual support (Dailey, 2009).	Survey response: About how often do you attend religious services?	Ordinal/ 1- Once a week or more 2 - Several times a month 3 -Several times a year 4 - Hardly ever 5 - Not at all	F6
d. PF4: Maternal self-rated health status	Maternal rating of health is a proxy for general health status.	Survey reponse: How I have some questions about your health. In general, how is your health?	Ordinal/ 1 – Excellent 2 – Very good 3 – Good 4 – Fair 5 – Poor	G1
e. PF5: Attendance at prenatal care (Health Behaviors)	Prenatal care attendance at a clinic	In which month of your pregnancy did you first see a doctor or other health care professional?	Ordinal/ Write in month (number, continuous value)	A 13A
		Birth Outcomes (O)		
a. O1: Healthy Birth Weight	Birth weight of less than 2500 grams (March of Dimes, 2015)	(Constructed variable in dataset from medical record or maternal recall--Low birth weight)	Nominal Low birth weight: 0 – No (Healthy weight) 1 – Yes	Constructed item available in codebook: cm1lbw

Data Analysis

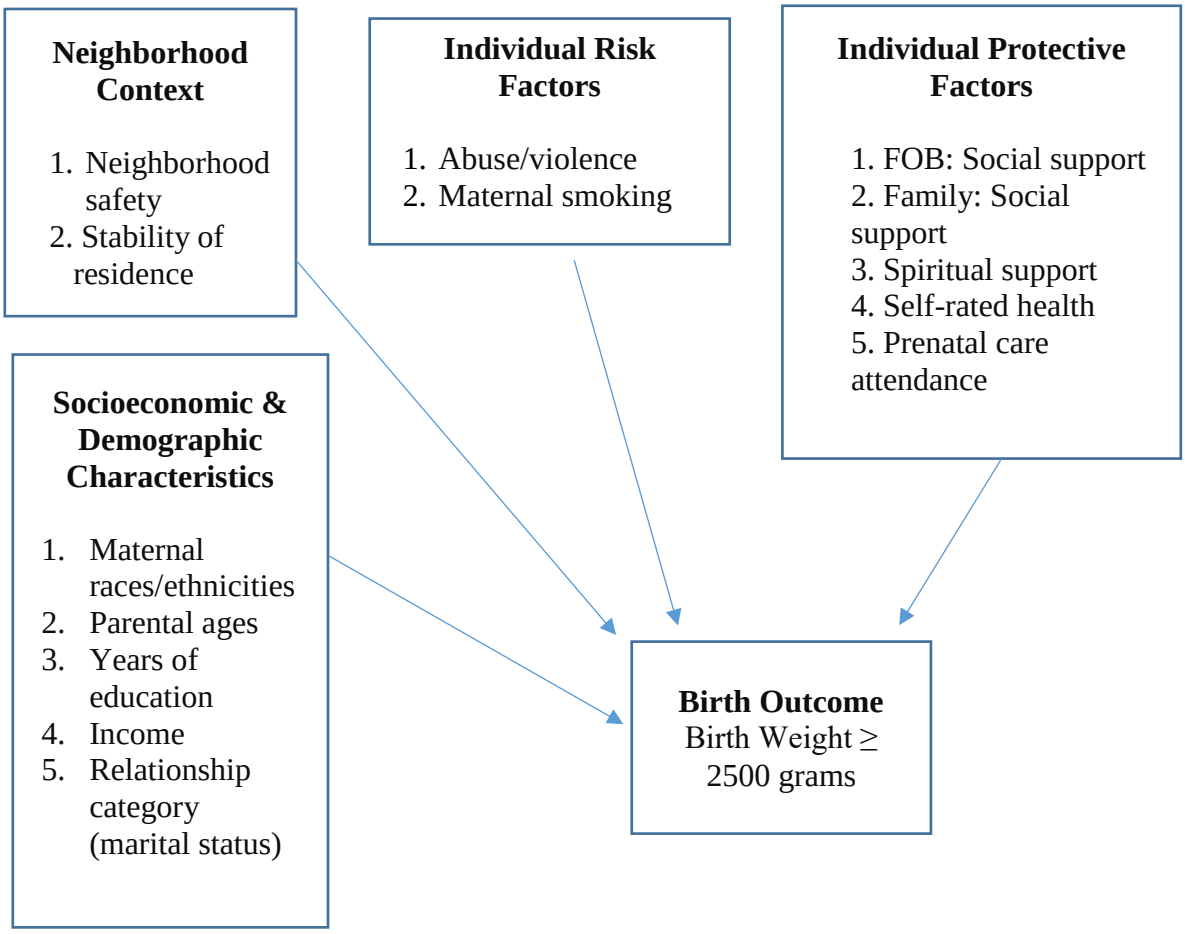
Statistical Analysis

The FFS public use data do not contain the geographic identifiers needed for construction of stratum and primary sampling unit variables used in the Taylor Series method of estimation of variance, but contain basic and replicate weights which are used instead. Therefore, survey data were analyzed using the replicate weights provided by the Brendheim-Thomam Center for Research and Child Wellbeing (2008), which served the purpose of masking participant location, while still allowing for estimations of variance. Using Stata Release 14 (StataCorp, 2015), the variance estimates were computed using the "svy" function (StataCorp LP, 2013), with "m1citywt" as the basic weight, and "m1citywt_rep1-m1citywt_10" serving as the replicate weight, to account for the complex sampling design.

In keeping with the exploratory nature of the study, an alpha of .1 was applied, with 90% confidence interval (CI) calculations. Sample data characteristics were extracted and analyzed with weighted descriptive values, such as means and frequencies. Multiple logistic regression analyses were performed to predict birth weight category from covariate risk factors and protective factors using odds ratios and CI. Predictor variables with the greatest impact on the full study population, and in the presence and absence of each covariate, were determined (Figure 2). Tables display data revealing sample demographics, numbers and proportions of women with predictors and outcomes, and associations between variables in Chapter 4.

Figure 2

Data Analysis Plan: Correlations, Hosmer-Lemeshow Variable Selection Procedure, and Logistic Regression



Variables for regression analysis originated from the pool of 15 variables described in Figure 2. An algorithm pioneered by Hosmer and Lemeshow (Bursac, Gauss, Williams, & Hosmer, 2008) was used, in which any variable having a significant univariate association at an alpha of .25 was selected for multivariate analysis with other significant predictors. In an iterative process of variable selection, covariates were removed if they were nonsignificant and non-confounders. In this protocol, the final iteration uses the retained variables, with level of significance being evaluated at the .10 alpha level, and variables considered as confounders if removal results in a greater than 20% change in any of the adjusted odds ratios in the model (Bursac et al., 2008). The Hosmer-Lemeshow variable selection method is useful because it retains variables that might not be significant by themselves but make an important contribution to the regression models in the presence of other variables. It is ultimately a more sensitive method for identifying predictors and confounders than simply eliminating variables that appear non-significant using other methods.

Missing Values

There were 4,898 respondents for the baseline survey. A total of 139 cases had missing values for the outcome variable of birth weight. These cases were excluded, as in the study by Burdette, Weeks, Hill and Eberstein (2012). In other FFS studies, researchers have imputed values using various methods (Moiduddin & Massey, 2006). In the current study, the researcher found that the volume of missing responses for study variables was below 5%, and for many variables was less than 1%; therefore, such missing values were coded as "system missing." This was deemed to yield more accurate computations than would be obtained using imputation methods. During computations of the variance inflation factor in IBM SPSS version 19 (SPSS), missing values were treated as described by Nunnally and Bernstein (1994), with pairwise

deletion. Because the survey data in FFS are weighted, the remaining calculations were completed in Stata. Stata tabulates descriptive statistics and regressions using only non-missing data, in a listwise deletion manner (UCLA: Statistical Consulting Group, 2016). Correlations with missing values are usually treated with pairwise deletion in Stata, but because weighted complex sample correlations with survey data must be computed via the method of the svy function of single x-on-y and y-on-x regression (using the higher *p*-value of the two) to find the beta statistic, listwise deletion was applied.

Assumptions for Logistic Regression

Logistic regression analysis is well suited to probability modeling and prediction of a dichotomous dependent variable; therefore, it was the analysis technique of choice in the current study. Fewer assumptions must be met when using logistic regression analysis, so this statistical test is ideal for studies in which there is a combination of linear and dichotomous predictors (Bewick, Cheek, & Ball, 2005). There are no assumptions regarding distribution; however, each observation must be independent, and a sample size of at least 400 is helpful (Bewick et al., 2009). In the FFS, each participant interview generated a private, individualized assessment, and thus was an independent observation.

Multicollinearity among variables can be problematic because it leads to variance inflation (Allison, 1999; Bewick et al., 2005). Multicollinearity does not bias the parameter estimate for the consequent variable (the adjusted odds ratio, in this study), but by enlarging the standard errors would obscure the statistical significance of each of the predictors. Therefore, variance inflation factors (VIF) and tolerance values were computed to identify the presence or absence of multicollinearity using SPSS, given Stata limitations. VIF calculated by SPSS for weighted data, as in FSS, may not represent actual values but may be helpful. A VIF cut-off

value of 5 flagged variables for consideration (Allison, 1999). If relatedness between predictors was evident, the associations between the predictors, and between predictors and consequent birth outcomes were examined, and items were explored for theoretical overlapping of conceptual meaning. In the current study, it was expected that some psychosocial factors would be related. Where necessary, multicollinearity was treated by removal of involved predictors in a theoretically appropriate manner. Because of the exploratory nature of the study, values of up to .80 were accepted, as theoretically appropriate (Grove & Cipher, 2017).

Limitations

Limitations Related to FFS Data

The study included only those variables which are supported by the FFS databank, though new risk factors and protective assets are identified regularly; therefore, the variables in this study do not represent an exhaustive list. In some respects, the FFS data contains broad rather than deep data. To keep the questionnaire length manageable, some topical areas had few survey questions. For instance, participants received only two questions regarding spiritual support. Other areas of limited measurement included dimensions of social support, such as emotional support from family and friends, which would have been of great interest to the current researcher.

Though FFS is ongoing, no further surveys have queried participants on the topic of birth outcomes. Because there was a single birth cohort, no new participants have been enrolled since 2000. In addition, the baseline survey questions have no psychometric evaluation data published.

Some FFS data were sampled non-randomly, as noted in the discussion concerning FFS protocols regarding hospital selection. A few hospitals did not allow minors under the age of 18

to participate, though others did, making the eligibility requirements differ by facility, potentially biasing data toward adult responses. Some hospitals did not allow participants to be compensated, a further inconsistency, disallowing full standardization of protocol.

The focus of this study was upon those associations between variables which attain statistical significance; yet due to the incompletely understood nature of the effects of psychological factors on physiology and birth processes, important areas might have been missed. Studies which explore associations between predictor and consequent variables help to establish evidentiary foundations, but should be followed by further research, which is essential for advancement of healthcare practice.

Validation of FFS use Despite Limitations

The data used for the FFS were collected over 15 years ago, which some may argue, is old for scientific research. However, LIBW and the risk factors examined in the current study remain compelling problems in the United States today, and reducing their incidence is among the Healthy People 2020 goals (Office of Disease Prevention and Health Promotion, 2016). Therefore, a better understanding of the predictors of LIBW of all varieties is as important now as ever. The value of the FFS is evident upon perusal of the study literature and the vast number of published studies using the FFS dataset. The highest standards of research were applied at every step of the study process and were outlined clearly in the research design paper published by the primary investigators (Reichman et al., 2001). The FFS dataset has had continuous use among researchers, generating a wealth of new knowledge regarding birth outcomes and many other topics (Burdette et al., 2012; Kimbro, 2008; Loggins, 2013; Reichman et al., 2008). At this time over 500 studies have been conducted and published in peer-reviewed journals using the FFS databank (Princeton University, 2016).

Delimitations

The delimitations, or areas in which the scope of the study is defined and limited to ensure that the research question is answered, include the following areas:

1. Research problem: the researcher selected the area of psychosocial factors predictive of healthy birth because that area has not been explored extensively in the vast amount of birth outcomes literature available. Many physical and psychosocial factors contribute to infant birth weight, and though all need to be explored, support and health behaviors are two areas in which nursing/health care team interventions may be of use in increasing odds of favorable birth.

2. Data: the FFS was selected for use because the databank contains vast and accessible data of interest and a large unique sample population, warranting exploration of the research question.

3. Variables of interest: psychosocial variables, particularly support, were selected because that area is one of the most promising in light of recent research concerning the possibility of manipulating/engineering social support programs for the most vulnerable, as mentioned in the literature review in Chapter 2. Although other sophisticated interventions related to such diverse areas such as health care policy, pharmacology, and immunology have great potential regarding antenatal health, maximizing our understanding of resources currently available to women is vital.

4. Theoretical perspective: the LCBO conceptual framework demonstrates routes through which contextual aspects of women's milieus affect birth weight. The framework emphasizes the role of stressors on the health outcome of infant birth weight, mitigated by the impact of support and the effects and behaviors on birth outcomes. This is illustrative of the goal

of the study, which was to investigate the predictive power of social resources on women with stressors causing them to be at risk of poor birth outcomes.

A call for multidisciplinary approaches to women's health has been issued by the American Congress of Obstetricians and Gynecologists (ACOG), particularly with regard to patient education, and this study is an example of foundational research needed to accomplish this effectively (Hollier et al., 2015). The conceptual framework originates from the work of sociologists (Culhane & Elo, 2005). A sociologist and a social work/economics professor are the primary investigators on the FFS project, with many other disciplines represented on the FFS team (Princeton University, 2016); further, the current researcher is a member of the nursing profession. The contribution of the nursing profession to both nursing research and practice related to women's reproductive health is essential. Nurses are among those professionals taking a larger role in prenatal education and care, and their advocacy skills and care-centered perspectives are as essential today as ever.

Summary

The purpose of this study was to explore which protective psychosocial factors were predictive of HIBW in childbearing women, using the FFS data. This discussion of methodology included a presentation of the sample, setting, measurement tools, and procedural guidelines used to conduct the original FFS study. A description followed which explained the variables and analysis plan of the secondary analysis. An improved understanding of psychosocial protective factors which may promote healthy outcomes in women and fetuses at risk LIBW is needed so that clinicians can better instruct their patients, and targeted interventions can be developed for clinical implementation.

Chapter 4

Chapter 4 focuses upon the results of the current analysis using the Fragile Families and Child Wellbeing Study (FFS) data, in which the goal was to determine which psychosocial factors were most predictive of healthy infant birth weight (HIBW). In the discussion that follows, descriptive statistics are presented first, followed by the discussion of correlations. Multicollinearity data and variable selection tables are displayed. Finally, significant predictors of the outcome variable of HIBW are revealed, based upon the predictive ability of the risk and protective factor variables.

Results

Original FFS Sample Characteristics

The researchers planning the original baseline FFS utilized a complex sampling design, making analysis using sampling weights necessary in order to compute unbiased estimates, and to aid in generalizing the findings. The resulting dataset can be used to generate estimations corresponding to total population counts of births in large U.S. metropolitan areas in 1994, the year the study was designed. The baseline study data were collected from 1998 through 2000.

As expected, with an oversampling of selected variables, the largest single race/ethnicity demographic in the sample was Black, composing half of the total number of respondents, and representing 35% of the weighted study population. Age of childbearing women reflected the general population for large cities in 1994, when the study was designed (Reichman et al., 2001). Outcome data for infant birth weight was retrieved from medical records and recorded in public baseline data.

Current Study

The original FFS mother's baseline dataset was composed of responses from 4,898 childbearing women, but 139 cases had no birth outcome responses, so were eliminated from the current analysis, leaving a sample of 4,759 women. Using Stata Intercooled version 14.2 (StataCorp, 2015), listwise deletion resulted in the current analysis accessing data from 4,655 participants. The first phase of the current analysis was an exploration of the characteristics of the participants in terms of study variables based on 4,655 participants: 479 of low infant birth weight (LIBW) and 4,179 of HIBW. Using the "svy" function of Stata to analyze the data, final weighted analyses represented 333,135 births across the metropolitan United States.

In order to meet the study goal of discovering predictors of HIBW using logistic regression, some of the variables chosen for analysis on the basis of the study framework were eliminated in the processes of multicollinearity reduction and parsimonious regression model building through variable selection. Thus, the reader will notice that the study began with descriptors and correlations for 15 variables, but with the process of elimination, six variables remained for the computation of multiple logistic regression odds ratios.

Descriptive Statistics

Descriptive statistics, including population represented and frequencies of HIBW in relation to each variable, are presented in Table 3. In the table, the details for each of the 15 variables are shown, with the population represented for each variable (with a possible variable *N* of 333,135), and the percentage of the population given for each response category. The final two columns in the table show the composition of the sample population of the current study as it relates to infant birth weight. The final row in the table states the percentage of HIBW in the United States in the year the study was conducted, for the purpose of comparison with study

rates. The rest of the chapter will continue with a discussion of the correlational analysis (Table 4), variance inflation (Table 5), variable selection (Table 6), and finally, multiple logistic regression analysis (Table 7).

Neighborhood context categories. In the neighborhood context questions, women rated the safety of their current home localities, and specified the length of time they had lived in their present dwellings. The majority of participants (79.6%) came from neighborhoods which the participants had rated as safe (Table 3). Residential stability, or the number of years the participant had lived at her current location, was heavily weighted toward the lower spectrums of time. Twenty seven percent had lived in their homes for less than one year. No clear proportionate differences were evident between HIBW and LIBW in these categories.

Socioeconomic and demographic categories. Socioeconomic and demographic categories as listed in Table 3 include race, age, education, income, and maternal relationship status with the baby's father. Proportionately, Hispanic women had the best birth outcomes, followed by White, then other; Black women having the lowest rates of healthy infant birth weight (HIBW). Age range extended from 15 to 43 years of age. Prime childbearing years in the study were between 20 and 30 years of age, with highest proportions of HIBW evident among women of this age category. Educational levels of the mothers in the study were divided into four categories of increasing attainment. Education ranks were weighted toward those with lower attainments, with 34% of the women having less than a high school education. Mothers with a college education/grad school fared best proportionately for HIBW, followed by those with some college. Women having a high school diploma had the lowest rates (89.1%) of HIBW.

Table 3

Descriptive Statistics

Study Variable	Healthy Birth Weight % of n	Low birth weight % of n	Total population N = 4759 women representing a population of 333,135 Response percentages
Neighborhood Context (NC)			
a. NC1: Safety of neighborhood			Population (Pop): 332,971.7
Yes	79.6%	7.5%	87.08%
No	11.9%	1.0%	
b. NC2: Stability of residence (Length of time lived in current location)			Pop: 315,787.23
0 years	24.5%	2.0%	26.5%
1 year	15.1%	1.4%	16.5%
2 years	10.3%	0.6%	10.9%
3 years	9.8%	0.2%	10.0%
4 years	5.6%	1.0%	6.7%
5 years	4.7%	0.7%	5.4%
6–10 years	12.4%	1.4%	13.8%
11-40 years	9.0%	1.3%	10.3%
Demographic Characteristic (DC)			
c. DC1 : Ethnicity of mother			Pop: 334,135.62
Black	29.58%	5.24%	34.82%
Hispanic	27.07%	1.51%	28.58%
White	28.04%	1.60%	29.64%
Other	6.41%	0.31%	6.73%

Study Variable	Healthy Birth Weight % of n	Low birth weight % of n	Total population N = 4759 women representing a population of 333,135 Response percentages
d. DC2: Age of mother (Early teen proportions disaggregated to display effects) Ages/ranges in years			Pop: 333,516.81
15	0.23%	0.03%	.26%
16	0.64%	0.03%	.67%
17	0.57%	0.07%	1.64%
18 - 20	15.22%	2.31%	17.52%
21 - 25	23.69%	1.72%	25.41%
26 - 30	23.23%	1.47%	24.70%
31 - 35	18.3%	1.31%	19.61%
36 - 40	8.29%	1.44%	9.74%
41 - 43	1.31%	0.15%	1.46%
e. DC3: Education of mother Education categories			Pop: 333,298.84
Less than high school	31.18%	3.10%	34.28%
High school or equivalent	23.53%	2.87%	26.39
Some college, technical school	17.82%	1.68%	19.51%
College diploma or grad school	18.78%	1.04%	19.82%
f. DC4: Household Income (Reported as poverty categories)			Pop: 334,135.62
0 – 49%	11.83%	1.30%	13.13%
50 – 99%	12.08%	1.17%	13.25%
100 – 199%	23.50%	2.58%	26.08%
200 – 299%	12.46%	1.54%	14.00%
300+ %:	31.46%	2.08%	33.54%

Study Variable	Healthy Birth Weight % of n	Low birth weight % of n	Total population N = 4759 women representing a population of 333,135 Response percentages
g. DC5: Formal relationship with FOB Relationship category:			Pop: 332,727.46
Married	20.26%	3.50%	23.75%
Steady	46.12%	4.68%	50.8%
Not Steady	24.81%	0.53	25.34%
Risk Factors (RF)			
h. RF1a: Intimate partner violence: Physical abuse (Hits or slaps you when he is angry)			Pop: 320,865.62
Yes	2.77%	0.36%	3.13%
No	88.37%	8.49%	96.87%
i. RF1b: Intimate partner violence: Emotional abuse (Insults or criticizes you or your ideas)			Pop: 321,267.56
Yes	27.34%	3.19%	30.53%
No	63.83%	5.63%	69.47%
j. RF2: Maternal smoking			Pop: 333,352.94
Doesn't smoke	81.16%	6.24%	87.4%
Smokes < 1 pk/day	9.29%	2.18%	11.47%
1 or more pk	0.68%	0.24%	0.92%
2 or more pk	0.20%	0.01%	0.21%
Protective Psychosocial Factor Variables(PF)			
f. PF1: Social Support by the FOB			Pop: 331,101.48
Yes	78.40%	6.69%	
No	12.91%	1.99%	85.09

Study Variable	Healthy Birth Weight % of n	Low birth weight % of n	Total population N = 4759 women representing a population of 333,135 Response percentages
g. PF2: Social Support by Family of Origin			Pop: 332,658.34
Yes	77.58%	7.05%	
No	13.71%	1.65%	84.64%
h. PF3: Spiritual support (Frequency of church attendance.)			Pop: 333,876.25
Once/week or more	21.27%	1.33%	22.6%
Several times/month	16.26%	1.61%	17.87%
Several times/year	21.8%	2.29%	24.09%
Hardly ever	20.54%	2.40%	22.94%
Never	11.46%	1.03%	12.5%
i. PF4: Maternal self-rated health status			Pop: 333,536.7
Good/Excellent:	85.61%	6.85%	92.46%
Poor/Fair:	5.74%	1.81%	7.54%
j. PF5: Attendance at prenatal care (Month of pregnancy in which prenatal care was initiated.)			Pop: 324,444
Preconceptual	0	0.46	0.46%
Month 1	29.76%	2.36%	32.12%
Month 2	32.27%	2.80%	35.07%
Month 3	14.01%	1.53%	15.54%
Month 4	7.80%	0.57%	8.37%
Month 5	3.74%	0.61%	4.35%
Month 6	2.06%	0.08%	2.14%
Month 7	1.29%	0.53%	1.82%
Month 8	0.37%	0.01%	0.38%
Month 9	0.20%	0.01%	0.21%

Study Variable	Healthy Birth Weight % of n	Low birth weight % of n	Total population N = 4759 women representing a population of 333,135 Response percentages
Birth Outcomes (O)			
b. O: Healthy Birth Weight	-	-	Pop: 334,135.62 Yes: 91.33%
Comparison with national 1998 rates (Venture et. al, 2000)	-	-	HIBW: 92.31%

Income was analyzed using poverty categories. The poverty level determined by the Department of Health and Human Services in 1998 was $8,050 for one person, and $16,450 for a family of four (Shalala, 1998). The first poverty category contained 13% of the sample, and included women with no income, extending to those living at 49% of the poverty category. Little difference in birth outcomes was noted between poverty categories at the lower income levels, but women living at the benchmark of at least 300% or more of the poverty level (i.e., $24,150 annually) had greater frequency of HIBW.

Relationship status of women in the current study was categorized in one of three ways: as marital, steady (meaning the FOB had regular contact with the mother), or non-steady (no regular contact). Married women had the highest proportion of HIBW, followed by steady, and then non-steady.

Risk factors. Risk factors examined included experience with physical and emotional abuse by the FOB, and smoking. In the study sample, only about 3% of women reported physical abuse from the FOB, but nearly one-third indicated that they experienced emotional abuse, and those experiencing abuse of either type had slightly lower proportions of HIBW. The abuse variables, however, had the lowest response rate of any of the study variables, with about 200 fewer observations.

As for smoking, the majority of women responded to this question but several cells were small. The vast majority of women in the study, about 87%, did not smoke. Of the nearly 13% who disclosed smoking patterns, just over 11% of women smoked less than one pack daily, about 1% smoked between one and two packs per day, and even fewer smoked more than two packs per day. HIBW rates were found to decrease as volume of smoking increased.

Unexpectedly, women who smoked the most did not have a decreased risk of HIBW, but sample size for this group was small (n = 15).

Protective factors. The protective psychosocial factors examined included social support from the FOB and family of origin, health perception, and prenatal care. Most women, 85%, reported social support from the FOB, and these had slightly higher rates of HIBW than women without support. A similar number of the women indicated that their families would assist them with money, a place to stay, and babysitting help as needed, and these women showed a slightly higher rate of HIBW than women who lacked such family support.

An additional area of support, spiritual support, was measured by frequency of church attendance. Women's responses ranged from "Never" to "Once a Week or More," with only 12.5% responding "Never." Church attendance at each of the three attendance levels was more common than never attending. Those attending once per week or more had the highest proportion of HIBW, followed, unexpectedly, by the never-attenders.

A second protective factor explored in the study concerned the perceived health of participants. Over 90% of the women rated themselves as having good health. Women with poorer health ratings gave birth to proportionately smaller infants.

The final protective factor considered was prenatal care. Nearly 75% of the women initiated prenatal care sometime during the first 3 months of pregnancy. No obvious pattern of birth weight emerged for those receiving prenatal care either earlier or later than this time period.

Outcome variable: HIBW. Examination of data reflecting the outcome variable of infant birth weight showed the majority of women (91.33%) to give birth to infants of healthy weight health, comparing closely to the national rate at the same time. A minority (8.67%) of women gave birth to infants of LIBW.

Correlations

Correlations between HIBW and each of the study variables were computed (Table 4). All correlations were calculated by regressing x on y and y on x and accepting calculation with the larger of the two *p*-values for each variable. The resulting statistic, a standardized regression coefficient or ß, is equivalent to Pearson's *r* (McDonald, 2014). Because the study is exploratory in nature, *p*-values up to .10 were accepted as significant (Cohen, 1992).

Correlation effect sizes for all variables were small to medium in magnitude. The *r* values above .10 are characterized as representing a small effect size, those attaining values of .30 as medium, and .50 as the threshold for large effects (Cohen, 1988). Only two correlations had significant ß values corresponding to a medium effect size threshold of .30: marital status and maternal smoking, (Table 4). The remaining significant correlations were of small effect size.

Table 4

Weighted Correlations between HIBW and Study Variables

Variable Name	ß	*p*
Neighborhood Context (NC)		
a. NC1: Safety of neighborhood	-.006	.75
b. NC2: Stability of residence (Residential stability is a rating of permanency/constancy in the life of the individual respondent.)	-.003	.26
Demographic Characteristic (DC)		
c. DC1 : Ethnicity of mother of baby (MOB)		
Mutually exclusive categories		
MOB Hispanic	.047	.007
MOB Black	-.097	.003
MOB White	.047	.136
MOB Other	.034	.069
d. DC2: Age of mother	.036	.976

Variable Name	ß	*p*
e. DC3: Education of mother	.012	.211
f. DC4: Household Income: Poverty category	.008	.170
g. DC5: Formal relationship with FOB: Marital, Steady, or Not Steady		
Married	.302	.001
Steady	-.066	.018
Not Steady	-.119	.043
Risk Factors (RF)		
h. RF1a: Intimate partner violence-- Physical violence	-.028	.601
i. RF1b: Intimate partner violence-- Emotional Abuse	-.062	.460
j. RF2: Maternal smoking	-.491	<.001
Protective Psychosocial Variables (PF)		
k. PF1: Social Support by the Father of the baby (FOB) (The item asks about the frequency with which the mother and father of the baby collaborate to solve problems.)	.055	.071
l. PF2: Social Support by Family of Origin	.024	.479
m. PF3: Spiritual support	-.191	.079
n. PF4: Maternal self-rated health status	.146	.067
o. PF5: Attendance at prenatal care	-.302	.185

Multicollinearity Assessment

Prior to regression calculations, multicollinearity among variables was assessed. Multicollinearity in regression analysis is problematic because high correlations among independent variables obscures the extent to which each predictor influences the dependent variable, and variance estimates become inflated (Acock, 2014). Eliminating any redundancy is essential to calculating direct predictions (Han, Jiang, & Land, 2015). As anticipated, high multicollinearity was found among some of the study variables. Variance inflation scores for groups of variables were computed by subtracting a single variable and adding the others back in with each successive calculation. The target variance inflation factor (VIF) value was an upper

limit of 5 (Craney & Surles, 2002). A model was obtained using the maximum number of predictors, with the top VIF of 5.148 being deemed acceptable (Table 5). Eight items from six categories of variables were ultimately eliminated due to high VIFs: safety, the ethnicities of White and Other, maternal age, maternal education, income, steady relationship (meaning the survey respondent was not married but was in a close romantic relationship, such as cohabiting), and self-rated health status.

Table 5

Variance Inflation Factors Scores for the Remaining 12 variables

Study variables	Tolerance	VIF
RF2: Stability of residence	.679	1.473
RF3: Ethnicity of mother—Hispanic	.511	1.957
RF3: Ethnicity of mother—Black	.364	2.744
RF9: Formal relationship with FOB—married	.646	1.548
RF9: Formal relationship with FOB-- Unmarried, Not steady relationship	.630	1.588
RF10: Intimate partner violence-- Physical abuse	.884	1.131
RF10: Intimate partner violence-- Emotional abuse	.677	1.477
RF11: Smoking during pregnancy	.741	1.349
PF1: Social support by family	.196	5.098
PF2: Social support by FOB	.194	5.148
PF3: Spiritual support	.215	4.651
PF5: Attendance at prenatal care	.282	3.549

In the third step of this analysis, the variables were tested using the Hosmer-Lemeshow method of variable selection described in Chapter 3. Four additional variables from three

categories were eliminated due to bivariate *p*-values over the threshold of .25, when each variable was tested against HIBW (Table 6). Re-adding these variables back in individually resulted in no substantive changes to the parameter estimates of the remaining variables; therefore, stability of residence, physical abuse, emotional abuse, and social support by the family were eliminated from the final parsimonious model.

Table 6

Univariate Analysis for Hosmer-Lemeshow Variable Selection Process

Study variable	***p***
RF2: Stability of residence	.330
RF3: Ethnicity of mother—Hispanic	.012
RF3: Ethnicity of mother—Black	.001
RF9: Formal relationship with FOB—married	.003
RF9: Formal relationship with FOB-Steady	.003
RF9: Formal relationship with FOB-- Unmarried, Not steady relationship	.017
RF10a: Intimate partner violence-- Physical abuse	.583
RF10b: Intimate partner violence-- Emotional abuse	.455
RF11: Smoking during pregnancy	<.001
PF1: Social support by family	.443
PF2: Social support by FOB	.040
PF3: Spiritual support	.078
PF5: Attendance at prenatal care	.131

After identification of multicollinearity, logistic regression was used to determine the influence of the ten remaining variables on the outcome variable of HIBW, Table 7. Flagging *p*-

values of .10 and lower as significant determined only the variables married and smoking were significant. Smoking was noted as a significant risk factor, and married status was found to be a significant protective factor. The Hosmer-Lemeshow goodness-of-fit statistic was χ^2 7.30 (p = .126, df = 9).

Table 7

Multiple Logistic Regression Results

Variables	Adjusted Odds Ratio	*p*	90% confidence interval	
RF3: Ethnicity of mother-- Hispanic	1.30	.60	0.53	3.16
RF3: Ethnicity of mother-- Black	0.53	.22	0.23	1.27
RF9: Formal relationship with FOB-- married	2.38	.06	1.12	5.06
RF9: Formal relationship with FOB-- Unmarried, Not steady	0.97	.93	0.53	1.78
RF11: Smoking during pregnancy	0.79	.005	0.70	0.89
PF2: Social support by FOB	1.16	.60	0.70	1.95
PF3: Spiritual support	1.0	.96	0.90	1.10
PF5: Attendance at prenatal care	0.94	.60	0.78	1.14

Summary of Findings

The research question for the current study was: Among women considered vulnerable for having infants of low birth weight, which protective psychosocial factors are most predictive of healthy birth weight? An analysis of FFS data revealed that married status was the only psychosocial protective factor predictive of HIBW. Married women were 238% as likely to give birth to infants over 2500 grams in comparison to unmarried women.

Smoking was analyzed as a risk factor and was found to be predictive of significantly lower rates of HIBW; therefore, being a non-smoker is likely to be a protective factor and

predictive of HIBW. In the current study, smoking was measured incrementally, with four levels of smoking possible: none, less than 1 pack/day, 1 to 2 packs/day, and more than 2 packs/day. Table 7 reveals an adjusted odds ratio of 0.79, meaning that for every level of increase in the amount of smoking, mothers had a corresponding 19% decrease in the odds of giving birth to an infant with a healthy birth weight.

Summary

This chapter covered a description of the sample, and statistical findings of the analysis, which consisted of descriptive statistics, correlations, assessment of multicollinearity, variable selection, and finally, multiple logistic regression. Correlation analysis revealed several correlations which attained significance. Using multiple logistic regression, the relationship variable of being married and not smoking were found to significantly predict the outcome variable of HIBW.

Chapter 5: Discussion

The purpose of this secondary analysis was to determine which protective psychosocial factors were predictive of healthy infant birth weight (HIBW) for childbearing women participating in the Fragile Families and Child Wellbeing Study (FFS). This final chapter provides a discussion of the results of the study in the context of the Life Context Birth Outcomes framework (LCBO), with a comparison of findings of previous studies, and acknowledgement of the study limitations. The chapter will conclude with implications for nursing practice and recommendations for further research.

Comparison of Major Study Findings with Previous Studies

The research question was: Among women considered vulnerable for having infants of low birth weight, which protective psychosocial factors are most predictive of healthy birth weight? The current study examines the desired birth outcome of HIBW as the outcome variable; however, the primary focus by the majority of researchers has been to examine unhealthy outcomes, such as low infant birth weight (LIBW) and preterm birth (PTB). Therefore, the following discussion is based on the available literature describing predictors of unhealthy birth outcomes. Research geared toward furthering the understanding of causes of unhealthy birth outcomes is important, but even more important is increased knowledge of processes and potential protective factors that lead to healthy outcomes. The current study has confirmed the findings of others as relates to correlates and predictors of desirable birth outcomes, and expanded knowledge relating to protective factors that may contribute to HIBW.

Marital status. Being married is a psychosocial asset that has been associated with various health benefits in the literature, including better birth outcomes (Barrington, 2010; Gollop, 2016; Koball, Moiduddin, Henderson, Goesling, & Besculides, 2010). In the current

study, multiple logistic regression analysis identified the protective factor of being married as the strongest predictor of HIBW. Further, correlation analysis showed a graded response between relational closeness of the parents of the infant and HIBW. In other words, the women in closer relationships, such as married women, had the highest likelihood of HIBW, followed by unmarried women in romantic relationships, and then by unmarried women with no steady relationship to the FOB. These findings are congruent with those of other studies identified in the literature. A meta-analysis of 21 studies, representing a composite total of 1.3 million births, revealed that when compared with "married" as the reference category, being single and cohabiting were predictive of LIBW in a graded response, similar to the current study (Shah, Zao, & Ali, 2011).

In the current study, 96% of married women had HIBW, compared with 87% of unmarried women in a steady romantic relationship. Single women without a steady romantic relationship had the lowest rates of HIBW, at 84%. These results show similarities to those in a study of the 1995 National Survey of Family Growth (Bird, Chandra, Bennett, & Harvey, 2000). Using a sample size of 2,578, Bird and colleagues reported that 96% of married women--the same percentage as in the current study--had infants which were not of low birth weight. Yet, 94% of non-marital cohabiting women, and 94% of single non-cohabiting women had infants of healthy weight. The unmarried women in the study by Bird and colleagues had better infant birth outcomes than unmarried women in the current study; however, the demographic composition between the two studies was markedly different, with the FFS having more women in the categories of higher vulnerability.

The sample of Bird et al. (2000) was representative of relationships of childbearing women ages 15 to 44 in the United States (U.S.) at the time, with 69% being married, 12%

cohabiting, and 19% single. In contrast, the women in the FFS represented a much more "fragile" or vulnerable sample, with (after weighting) 51% being in steady romantic non-marital relationships, 25% were single and not in steady relationships, and 24% were married. Having more non-marital women may have contributed to poorer outcomes in FFS women, but additional vulnerabilities may have compounded their risk.

Although Bird and colleagues reported oversampling Black and Hispanic women, the racial/ethnic composition of their study sample was 13% Black, 16% Hispanic, and 72% White. In contrast, in the current study the race/ethnicity sample included (after weighting) 35% Black, 29% Hispanic, 30% White, and 7% other (mainly Asian, Pacific Islander, Native American and unspecified ethnicity). Differences between the study populations of the current research and that by Bird et al. (2000) are illustrative of the lack of truly comparable databanks and large studies with samples of the most vulnerable, or fragile, of women. The ambitious magnitude of FFS, having a complex sample design and unique large-volume sample population, has immense value for birth outcomes research, providing data from women with the multiple risk factors, such as being both Black and single, along with other vulnerabilities.

Equally high rates of HIBW among the married women in both studies, contrasting with lower rates of HIBW in the more vulnerable FFS women, could suggest that married status plays a bigger protective role in healthy birth outcomes in fragile than in non-fragile women, though this needs further study. However, with non-marital women having lower rates of HIBW as compared to other studies, other factors evidently influence the birth outcomes of these vulnerable women. Clearly, more research concerning protective factors among women with multiple risk factors for LIBW is needed.

Overall, most studies have shown a birth outcome advantage to infants who are born to married women. Suggestive, however, that marital status alone does not guarantee HIBW, a study in Israel found no significant differences in birth weight between infants of married versus unmarried women. The study was a retrospective matched cohort study of 304 married and 304 unmarried women (Lurie, Zalmanovitch, Golan, & Sadan, 2010). Thirty-eight unmarried women (12.5%) and 27 of married women (8.8%) had infants of low birth weight. Although all the women were ethnic Israelis, no information on other racial demographics was provided. The researchers noted that all women had access to "free" health care before, during, and after pregnancy through the national insurance plan, and they posited that the equal access to health care contributed to the equivalent birth outcomes between the married and unmarried women. The homogenous demographic sample may also contributed to the lack of differences in birth weight between groups. The factors of equal healthcare access and homogenous population were not characteristics of the FFS sample, suggesting a possible contributory attribution of these variables to birth outcomes in the Israeli study.

Social support by the father of the baby. Social support is described by social scientists as consisting of several facets of support, including emotional support, instrumental support (which includes tangible, material support, such as money, transportation and assistance with tasks), informational support, and companion support (Cohen & McKay, 1984; Langford, Bowsher, Maloney, & Lillis, 1997; Willis & Ainette, 2012). Social support by the FOB in the current study may reflect several of those domains. This variable was operationalized through the FFS survey item which asked the mother if she and the FOB had helped each other solve a problem in the last month. In the current study, a significant correlation was identified ($p = .04$) between HIBW and social support given by the FOB.

Social support from the FOB is more likely in relationships formalized by a marriage than in uncommitted relationships (McNamara, Orav, Wilkins-Haug, & Chang, 2006), which may partially explain why married women have higher rates of HIBW than non-married women. The action of social support as a contributor to healthy birth outcomes is supported by improved rates of HIBW which were seen with increased closeness of relationship in the current study, e.g. through marriage, and steady versus non-steady relationship status. A beneficial effect of FOB social support has been revealed in several studies examining social support-birth outcome links. For instance, in a retrospective case-control study of a convenience sample of 2,300 women, Ghosh et al. (2010) found that among women with chronic stress, positive support from the FOB moderated the effects of maternal stress on birth outcomes. Women with high levels of support showed no increased risk of PTB, though women with low levels of support had significantly higher risk ($p < .05$). Ghosh et al. (2010) reported using validated, but unspecified, social support measures.

A prospective study with mixed results was conducted by Zambrana, Dunkel-Schetter, Collins, and Scrimshaw (1999) using a convenience sample of 1,071 Hispanic and Black women. A small but significant positive correlation was found between FOB support and infant birth weight ($p < .05$), but there was no effect for PTB. Zambrana and colleagues used a 6-item FOB survey with a stated Cronbach's α of .91. Similarly, a longitudinal investigation conducted in the Boston area among 2,600 prenatal women recruited from two differing non-random samples found no significant association between antenatal partner support and birth weight (Cheng et al., 2016). Their support instrument, the Turner Support Scale, has had much use and a Chronbach's α of .94 has been noted with past studies of childbearing American women (Turner, Grindstaff, & Phillips, 1990).

The relationships between physical health indicators and psychosocial factors, such as social support, formal partner relationship, and emotional closeness, are complex. High satisfaction with social and emotional support has been found, in several studies, to be more common in married than in unmarried partners, being associated with positive health biomarkers (Glazier, Elgar, Goel, & Holzapfel, 2004; Kiecolt-Glaser & Newton, 2001; Sarason, Sarason, & Gurung, 1997). In one study, participants rating their marriages as happy and of high quality had positive blood pressure and mental health effects, in sharp contrast to participants in stressful and low-quality marriages (Holt-Lunstad, Bimingham & Jones, 2008). Holt and colleagues (2008) reported that the health benefits were not conferred by formal marital status, but by the support and emotional satisfaction found in the healthy relationships. This suggests that the physical effects of relational closeness between partners may be a result of, or mediated by, social support exchanged between them. Evidence of a similar complex dynamic are seen in the current study: Married status, social support by the FOB, and increasing closeness of relationship, were associated with increased likelihood of HIBW. FOB support may explain or mediate the associations between partner relationships and birth outcomes; however, further study is required to substantiate and explore these conceptual links.

On the other hand, stressful maternal-FOB relationships such as found among women living with intimate partner violence (IPV) may reflect a different outcome. This conclusion was reflected in a systematic review and meta-analysis of 50 studies with a combined sample of over 5 million women (Donovan, Spracklen, Schweizer, Ryckman, & Saftlas, 2016). Donovan et al. (2016) found that women experiencing physical abuse during pregnancy had an odds ratio (OR) for LIBW of 1.80 (95% confidence interval [CI] 1.36, 2.37), and those having emotional abuse during pregnancy had OR of 1.61 (95% CI 1.19, 2.27). In the current study, lower rates of

HIBW were expected among the women reporting IPV. Although the correlations were in the expected direction, with a negative relationship between HIBW and the variables of physical and emotional abuse, they did not attain statistical significance (p = .6 and .4 respectively).

Not finding the link between IPV and HIBW in the current study may indicate that abuse was overshadowed by other variables significant to birth outcomes for vulnerable women. Also findings may be due to such factors as the operational definitions (including address of only one measurement of infant outcome, HIBW) and the small number of respondents in the cells as related to poor disclosure of abuse by women. Only 3% of women in the study reported experiencing physical abuse (FOB "hits or slaps you when he is angry" [table 3]), which created a small cell of women with resulting potential of increased bias. A substantial 30% of women reported emotional abuse (FOB "insults or criticizes you or your ideas" [table 3]); yet, the variable definition of emotional abuse in the current study is not very specific, with differences existing between the verbs of insults and criticizes, as well as between the objects: the women, or her ideas. This FFS survey question may have led to some ambiguity in responses from participants, and may partially explain the high prevalence of emotional abuse in the current study sample, as well as the statistical insignificance.

Abused women are often reluctant to disclose IPV for a variety of reasons, making validity of prevalence rates difficult to determine accurately (Petersen, Moracco, Goldstein, & Clark, 2004), even though effects may be significant. For example, in a convenience sample of 16,000 women delivering at Parkland Hospital in Dallas, Texas, researchers defined emotional abuse in their study survey as various types of verbal mistreatment. They found that rates of LIBW were 7.6% in the verbally abused, and 5.1% in women reporting no abuse (p =.002; Yost, Bloom, McIntire, & Leveno, 2005). Interestingly, in women who declined to be interviewed

regarding abuse, the rate of LIBW was 12.8 ($p < .001$). Yost et al. (2005) concluded from this finding that risks for adverse birth outcomes were highest in women who were powerless—which they defined as unwilling or unable--to change their abusive circumstances. More research is needed among IPV victims, but as noted, studying this population can be challenging.

Combined sources of support: FOB and family. Although support from the FOB was correlated with HIBW in the current study, support by family was not statistically significant ($p = .5$). This finding is similar to one large prospective Australian study ($N = 901$) examining support by family, friends, and partners, which showed no link between social support and birth outcomes (Webster et al., 2000). The study used a convenience sample of women attending a large public prenatal clinic. The 6-question survey examined support by family, friends and partner; however, information regarding reliability and validity was not provided. A later prospective study by different researchers using the same survey in Ethiopian childbearing women (N=627) found fairly weak internal consistency among instrument items, stating a Chronbach's α of .74 (Dibaba, Fantahun, & Hindin, 2013). Webster and colleagues stated that their instrument may not have differentiated adequately between mixed conflict and support, and between sources of support, which they felt may have contributed to the lack of significance for social support.

One contrasting study showing a small effect of combined sources of support was conducted using a convenience sample of 247 women attending a California prenatal clinic. Feldman et al. (2000) found that a latent social support variable was correlated with birth weight, ($r = 0.17$, $p < .01$). The latent variable consisted of a combination of social support from FOB, family, and general functional support. Instruments used to assess support had adequate internal consistency, with Cronbach's α ranging from .79 to .95.

Reasons for differing associations between social support and health outcomes in studies are due not only to differing measurement surveys and the vast variety of types and sources of support, but also to the subjective nature of the concept and personal interpretations by respondents (Uchino, Bowen, Carlisle, & Birmingham, 2012). A key factor is also the multidimensionality of human social interactions. Evidence of this may explain why some studies have even shown support to be non-beneficial. For example, a secondary analysis using a stratified random sample of women in New York City revealed that women with four or more social support ties (FOB, friends, in-laws, and various family relationships) were more likely to have LIBW than women with zero to one social support tie (Almeida, Mulready-Ward, Bettegowda, & Ahluwalia, 2014). With an OR 0.69 (CI 0.50, 0.96), this study was conducted using a weighted sample of 4,443 particpants representing a population of 369,825 women. Social support was operationalized from a survey of three items, with two of the questions reflecting instrumental support, and one of emotional support (Almeida et al., 2014). Internal consistency among their three social support measurements reflected a Cronbach's α of .77. The researchers attributed the lack of positive effects of social support to the quantitative nature of their measurements, which failed to capture quality of relationships, and to the socially stressful obligations of having a greater number of ties.

Recent interest in the multidimensionality of social support is illustrated by the development of new theories which take into account the dual nature of relationships as sources of both support and adversity, and the resulting impact on health (Afifi, Merrill, & Davis, 2016; Feeney & Collins, 2014; Uchino, Carlisle, Birmingham, & Vaughn, 2011). Further study is needed to determine which types of social support are most valuable in terms of promoting healthy birth outcomes, and how perceptions of support given by FOB, friends, and family relate

to perception of support received. Although FOB support is important, many new fathers do not understand how to fulfil their role of support provider (Doity, Johnson, & Ingram, 2008) Future research should explore prenatal methods of teaching them about role and effective techniques for providing support.

The majority of published prospective and cross-sectional studies examining support among pregnant women have not used a random sampling plan. The limited amount of time that women are pregnant and the practice of using participants attending specific clinics may limit the possibility of simple random selection, and sample demographics. Studies using random sample selection or randomization, however, have a reduced risk of bias. A strength of the FFS is that the design included random selection of hospitals and individual births until study thresholds were reached (Reichman, Teitler, Garfinkel, & McLanahan, 2001).

Smoking. Another important variable contributing to infant birth weight and outcome is smoking. Studies dating from as far back as the 1950s have agreed that smoking is associated with poor birth outcomes (Lowe, 1959). Exposure to second-hand smoke even when the mother is a non-smoker has been associated with LIBW (Ward, Lewis, & Coleman, 2007). As a well-known variable affecting infant birth weight, the rationale for including smoking as a risk factor in the current study was to account for the effects of smoking in logistic regression, and to provide an index when viewing comparative work. Findings of the current study coincided with the preponderance of research in this area, with a strong negative statistical relationship between smoking and HIBW. As the number of cigarettes smoked per day increased, the likelihood of HIBW decreased in a graded manner. Unexpectedly, the category of women reporting smoking two or more packs of cigarettes per day was not found to illustrate further decreased likelihood

of HIBW; however, this finding may simply reflect the small number of women in this category (n=15).

Other studies have also linked the amount of daily smoking with LIBW. Using a stratified random sample of 24,200 Taiwanese women, Ko et al., (2014) found increasing ORs for LIBW with an increasing volume of cigarette smoking. Mothers who smoked had from two to five times the risk of LIBW, the highest value being for those smoking more than 20 cigarettes (1 pack) daily in the third trimester. Further, using a stratified random sample of 40,441 women, Garn et al., (2014) compared Canadian and U.S. women and found that smoking increased the risk for PTB to a similar degree in both countries (relative risk 1.5, 95% CI 1.1, 2.1), illustrating a consistent link between smoking and adverse birth outcomes.

The effects of smoking in North American women are similar. In a prospective convenience sample (N = 279), Lobel and colleagues (2008) found a correlation between smoking and LIBW (p <.01). In a secondary analysis using a stratified random sample of 8,000 women in the South Carolina Pregnancy Risk Assessment and Monitoring System dataset, Nkansah-Amankra (2010) found that mothers who smoked had double the risk of LIBW when compared with non-smokers. Yet, former smokers showed little increase in rates of adverse birth outcomes over non-smokers (Nkansah-Amankra, 2010). Additional research on smoking cessation has revealed that women quitting before or in early pregnancy often have no higher risk for adverse birth outcomes than never-smokers (Brooke, Anderson, Bland, Peacock, & Stewart, 1989; Ghosh, Wilhelm, Dunkel-Schetter, Lombardi, & Ritz, 2010; Nkansah-Amankra, 2010). These finding are of interest because smoking, as an addiction, is difficult to stop regardless of pregnancy. Research regarding effective strategies for cessation and reduction among prenatal and preconceptual women is needed.

Tobacco toxins cross the utero-placental barrier and are associated with increased apoptosis in the placenta, adversely affecting maternal and fetal mitochondria, directly reducing fetal weight (Garrabou et al., 2016). Research-sponsoring governmental agencies concur that overwhelming evidence supports the existence of a direct causal link between smoking and suboptimal birth outcomes (Curtain & Mathews, 2016), to the extent that infants of active smokers can weigh 200 to 300 grams less than those of non-smokers (U.S. Department of Health and Human Services, 2014). Therefore, although not all infants born to smokers have LIBW, birth weight is more likely to be reduced.

Other Significant Findings

Correlation analysis between the independent variables and HIBW revealed significant relationships between five additional facets of three variables. Although not attaining significance in the more robust regression analysis, the following independent variables did reach statistical significance in bivariate correlational analysis: race/ethnicity categories (Black, Hispanic and Other), spiritual support, and maternal self-rated health status.

Race and ethnicity. Race and ethnicity have long been recognized as having an impact on birth outcomes (Linder & Grove, 1947). The current study supports this documented fact and revealed that women of Black race/ethnicity were the most vulnerable for experiencing LIBW.

Three large studies conducted over several years offer additional evidence of racial vulnerability. The Coronary Artery Risk Development in Young Adults (CARDIA) study is an ongoing, prospective cohort study which begun in 1985, using stratified random sampling (n = 352) from four metropolitan U.S. cities. Black women were found to be at the highest risk for PTB with an OR of 2.54 (CI 1.33, 4.85) in comparison to White women (Mustillo et al., 2004).

A secondary analysis, using a stratified random sample of 4,443 women from New York City, revealed that Black woman had an OR for LIBW of 2.98 (CI 2.39, 3.90; Almeida et al., 2014).

Black women have been consistently cited as being the most vulnerable of U.S. women for adverse birth outcomes (Martin et al., 2015), and the search for reasons behind the racial difference continues. Rather than simply being a result of variation in genetics, answers from the social domain recognizing U.S. cultural mores have been suggested to better explain the differences, given that foreign-born Black women have rates of adverse birth outcomes comparable to White women (Collins & David, 1997). In a prospective U.S. study of 51 Black women and 73 White women, which explored detailed measurements of perceived stress and racial discrimination, Dominguez and colleagues (2008) found that each unit increase in lifetime perceived racial discrimination resulted in a 40 gram decrease in birth weight ($p <$. 05, psychometric data for racism measurements not provided). Similarly, in a prospective study of 1,898 U.S. women, researchers found that women reporting high levels of perceived racial discrimination had a relative risk for PTB of 1.8 (CI 1.1, 2.9) when compared with women reporting no discrimination (Dole et al., 2004). A meta-analysis of ten studies with a combined total of 10,000 women demonstrated a clear link between racism measures and adverse birth outcomes (Giurgescu, McFarlin, Craddock, & Albrecht, 2011).

In contrast to the increased rates of adverse birth outcomes in Black women, numerous studies have reported healthy infant outcomes of Hispanics, often similar to the health outcomes of White woman (Collins, Rankin, & Hedstrom, 2011; Martin, Hamilton, Osterman, Curtain, & Mathews, 2015). The current study results supported this premise, finding HIBW was correlated more closely to Hispanic ethnicity than the other racial/ethnic categories (p = .007). Findings such as these reflect what has been called the Hispanic Paradox, in which immigrant Hispanic

mothers have good birth outcomes, despite economic disadvantage (Markides & Coreil, 1986; Pearl, Braveman, & Abrams, 2001). The phenomenon of the Hispanic Paradox has been investigated by numerous researchers over several decades and many theories as to why it exists have been posited.

One reason suggested for the improved outcomes in Hispanic immigrant women may be the high degree of familial support (Campos et al., 2008). Campos, Dunkel-Schetter, and Abdou (2008) analyzed Hispanic familial ties, finding them to be richly multifaceted and different from ties in White and Asian families, with a higher number of positive interactive connections among extended family. Campos and colleagues (2008) labeled this tie *familialism,* and found that it was associated with lower rates of LIBW, and that women having high familialism scores felt less stressed, less anxious about their pregnancies, and more supported than women without familialism. Using linked birth/death records from 2000 (estimated to represent 99% of all births in the United States for the year), researchers found that having higher population rates of Hispanics resulted in birth outcome improvements among not only Hispanics, but Blacks and Whites as well (Shaw & Pickett, 2013). Shaw and Pickett (2013) offered no conclusive explanation for the improved outcomes among all racial/ethnic groups, but cited cultural Hispanic support for pregnant women as a possible contributing factor, as well as dilution of any negative aspects of U.S. culture.

The Hispanic Paradox, however, is not illustrated in all studies of Hispanic women, and may be influenced by such factors as degree of acculturation, and changes in traditional Hispanic values, beliefs, and lifestyles (Cobas, Balcazar, Benin, Keith, & Chong, 1996; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005). For example, Almeida et al. (2014) found no

evidence of the Hispanic Paradox, with Hispanic mothers having adjusted OR for LIBW of 1.35 in comparison to White mothers (CI 1.02, 1.78; Almeida et al., 2014).

Reasons for racial/ethnic differences in birth outcomes for the current study are not clear, with the literature identifying a myriad of possible explanations, none of which have been shown to be conclusive, as discussed in Chapter 2. Recently immigrated Hispanics have been found to have some of the best birth outcomes among American women (Campos, et al., 2008; Callister & Birkhead, 2002), a finding coinciding with HIBW racial/ethnic differences in the current study. Familialism among pregnant Hispanic women is associated with healthier lifestyles, including decreased smoking and alcohol consumption, a diet with sufficient key nutrients, lower stress/anxiety among childbearing women, and a widespread positive cultural attitude toward pregnancy (Campos et al, 2008). Clearly, these advantages are significant and are often missing or present to a lesser degree in other populations. Just as poor birth outcomes are more common in Black women due to cultural disadvantages conferred with weathering, many Hispanic women have a cultural advantage, conferred by familialism (Callister & Birkhead, 2002). Birth outcomes, however, are not the result of one variable. While White women, have greater socioeconomic advantages and tend to have good birth outcomes in most U.S. demographic studies (Hamilton et al., 2015), they have neither the disadvantages of weathering, nor the advantages of Hispanic familialism. In the current study, White women did not show an advantage, and this may be related to higher rates of smoking among them, relative to Black or Hispanic women (Vinikoor-Imler, Messer, Evenson, & Laraia, 2011) and the overall vulnerabilty of them as a “fragile” family due to other factors.

Spiritual Support

Spiritual support may offer additional social support for some women, and has received a fair amount of research attention. Relationships between birth outcomes and spiritual support, however, have been inconsistent. In the FFS, spiritual support was only operationalized via one measure, frequency of church attendance, ranging from once a week or more to never. The use of five levels of attendance addressed the habitual nature and time commitment involved and provided objective quantification of the extent to which religious attendance is a part of participants' lives. Attendance levels among the women were unevenly distributed across the five categories of attendance, ranging from the smallest cell with 605 women (the "never category), to the largest cell, with 1,063, which was the "hardly ever" category (representing weighted totals of 38,000 and 73,000 women respectively).

The current study found that spiritual support, measured through frequency of church attendance, showed an inverse bivariate correlation with HIBW, with more frequent church attendance correlating with lower rates of HIBW ($p = .08$). The correlation, however, was not a clear graduated relationship as was evident with marital status and HIBW, but irregular in nature: Women attending church several times/year had the highest proportion of HIBW, followed closely by those attending once/week, then the "hardly ever" attenders. Women attending several times/month, and the "never-attenders," had the lowest rate of HIBW.

Further, two separate studies using subsets of FFS data found the reverse of the current study, with increased frequency of church attendance being linked with decreased odds of LIBW (Burdette, Weeks, Hill, & Eberstein, 2012; Reichman, Hamilton, Hummer, & Padilla, 2008). Differences between the current study and the others using the FFS may be due to sampling and methodological differences. Burdette et al. (2012) analyzed the restricted-use FFS data, which

included confidential information from the medical records, and had about 1,000 fewer participants: n = 3,583, versus 4,655 in the current study (p <.01). Further, they reported that cigarette usage partially explained the association between frequency of attendance and LIBW, with less frequent attendees smoking more.

Reichman and colleagues (2008), also using FFS data, found that never attending religious services increased odds for LIBW as compared with attending at least once per week (OR 1.52; CI 1.04, 2.20). Again, methodological differences can be seen. Reichman et al. (2008) used only a portion of the data (n = 2,412) studying only non-marital births, and restricted their analysis to only Black, White, and Hispanic race/ethnicities, eliminating the category of Other. Furthermore, they collapsed frequency of church attendance to three levels: never, less than once/week, and at least once/week, rather than using the original five levels in the dataset. They did not offer suggestions as to how their sample selection might have affected frequency of attendance (Reichman et al., 2008).

An Australian study using a convenience sample of 6,566 women attending two obstetric clinics in Brisbane originally found a correlation between church attendance and birth weight, revealing that mean birthweight was found to be about 100 grams higher in frequent attenders and sect members than in those attending less often (Najman, Williams, Keeping, Morrison, & Andersen, 1988). However, after researchers adjusted for the more frequent rates of smoking in those attending less, the differences between the groups disappeared, suggesting that the rate of smoking, rather than religious or spiritual factors, was responsible for differences between groups (Najman et al., 1988). Smoking as a significant variable for adverse birth outcomes in the current study may also have influenced findings in this area. Associations between spiritual support and smoking clearly need further study.

Dole et al. (2004) reported results similar to the current research findings. Using a convenience sample of 1,898 women from a prenatal clinic, a relative risk for PTB was found to be higher in those who attended church more frequently. Using weekly attendance as reference with OR of 1.0 for PTB in Black women and White women separately, comparison showed OR of 0.7 for Black never-attenders (95% CI 0.4, 1.30) and 0.9 in White never attenders (95% CI 0.6, 1.50). Although results did not attain the significance levels set by the researchers, they were in the same direction as those of the current study.

Using a different measure for spiritual support, Dailey (2009) used a survey measuring personal spirituality. The Spiritual Perspective Scale (Cronbach's α of .91) assesses the extent to which spiritual beliefs are considered important, and guidance-seeking spiritual behaviors are utilized. Using a convenience sample of 119 women, the researcher found no association between spirituality and birth weight (Dailey, 2009).

Different operational definitions and conceptualizations of spirituality and religiosity, as well as differing birth outcomes such as PTB, LIBW and HIBW, make comparisons between studies difficult. The utility of using a single, easily measured index of spiritual support, such as church attendance, had the advantage of simplicity, with little risk of participant misunderstanding or scoring method variations, but is limited. Reflecting only one dimension of a complex concept does not easily differentiate between possible motives for attendance. In addition, frequency measurements addressed only how often participants availed themselves of an opportunity for support, revealing nothing about what was actually received. Social desirability has often influenced responses to survey questions regarding religious topics (Crown & Marlowe, 1960). With church attendance being considered a moral measurement by some, there may be a propensity to respond positively when surveyed. In addition, variables which are

single-question measurements are more likely to suffer from high random measurement error, resulting in low reliability (Waltz, Strickland, & Lenz, 2010).

Defining and measuring adequately the concepts of spirituality and religiosity is difficult and fraught with philosophical pitfalls. Health behaviors of religious adherents often differ among styles and traditions of faith, and across ethnic cultures (Cyphers, 2015; Mann, Mannan, Quinones, Palmer, & Torres, 2010; Mann, McKeown, Bacon, Vesselinov, & Bush, 2007). The felt need of spiritual support because of stressful life and health challenges may drive some to attend church more frequently as a coping mechanism, thus obscuring the association between health, illness, and spirituality (Lee & Newberg, 2005). Healthy lifestyle elements are often found to a greater degree in people attending church more frequently, or who consider themselves more spiritual (Powell, Shahabi, & Thoresen, 2003). In their review of evidence covering 11 studies, Powell and colleagues (2003) found that health habits in those with higher indices of religiosity and spirituality explained the differences in health status. In the current study, the negative association between frequency of church attendance and HIBW may be related more to smoking than any other factor, which would be consistent with the comments made by Burdette et al. (2012), as they discussed their study findings. Cultural and ethnic differences also may influence church attendance as commented upon by Burdette and colleagues (2012), who found that Black women attended church more frequently than either Hispanics or White women in the restricted use FFS. However, other disadvantages experienced by vulnerable Black women confound clear associations. A further multivariate analysis of spiritual support was beyond the scope of this study. Clearly, this is an area requiring exploration in greater depth, with the variables of spirituality and religiosity operationalized using multidimensional and well-validated measurements.

Maternal self-rated health status. The final statistically significant finding in the current study was the link between maternal self-rated health status and HIBW. Self-rated health has been found to be closely associated with objective measures of health and mortality, yielding a useful index of participant health for research (Miilunpalo, Vuori, Oja, Pasanen, & Urponen, 1997; Stenholm et al., 2014). Preexisting health has an impact on pregnancy health and birth outcomes (Hammond et al., 2013). As a potentially confounding variable, self-rated health status was included among the variables of interest primarily so that poor pre-existing health would be less likely to obscure psychosocial effects. It served as an index to confirm the direction of analysis, and as expected, higher self-ratings of health had a positive correlation with HIBW.

Few studies have focused on the variable of good pre-pregnancy health in relation to HIBW, probably because of its self-evident nature. Self-rated health has been found to be reliably linked to objective measures of health, so is a useful index of individual health status (Idler & Benyamini , 1997). The variable of poor maternal health has often been linked to LIBW and is well documented in the literature. For example, in a secondary analysis of state-required reporting forms in West Virginia (a non-random sample), women (N = 14, 298) who reported lower self-rated health were significantly more likely to give birth to infants of low birth weight (< 2500 grams) than women with good self-rated health ($p < .001$; Teoli, Zullig, & Hendryx, 2015). Similar findings have been discovered in a smaller, cross-sectional study of 540 women, randomly selected from among women giving birth at two comparable hospitals. According to Janjua et al. (2009), women who rated their health as poor had double the prevalence of LIBW compared to women giving birth to infants of HIBW ($p < .05$).

In contrast, researchers conducting a secondary analysis using a convenience sample of 4,811 women living in the Czech Republic between 1991 and 1995 found no significant association between maternal self-rated health and birth weight. However, the non-significant link between variables was in the expected direction, with better self-rated health predicting lower rates of LIBW (OR 0.85; CI 0.68, 1.06). Study limitations included a small number of adverse birth outcomes, with LIBW occurring in only 4.8% of the cases. No demographic data were provided (Stepanikova, Kukla, & Svancara, 2016).

Importance of Non-Significant Findings

Although some variables in the current study were not found to be significantly associated with HIBW, they were all statistically linked to birth outcomes in at least one previous study, as discussed in Chapter 2. In the current study, nine of the original 15 variables of interest did not show significant predictive or correlational links with HIBW, most likely suggesting differences existing between the FFS oversampled minority population and other study populations, as well as differences in operationalization of variables across studies. However, the lack of significance for these previously determined influential variables noted as risk factors for LIBW, may mean a true lack of importance to HIBW. The lack of association may also be the result of unknown confounding factors obscuring relationships between variables. Ultimately, additional research is needed. The non-significant variables included the neighborhood context variables of safety and stability of residence, maternal age, income, education, and prenatal care. As discussed earlier in this chapter, social support by family of origin and IPV, in both physical and emotional domains, were statistically unrelated to HIBW in the current study, signifying the need for further research.

Limitations

Overall, the findings of the current study were consistent with published research. However, there are limitations, such as the inability to generalize to populations differing from the study population. In the FFS sample, births were randomly selected from hospitals, with sample selection continuing until predetermined thresholds were attained. Hospitals were randomly selected from U.S. cities with populations of over 200,000 people. Because study subjects were recruited from among women in large cities, results may not apply to women in rural areas or small towns. Women choosing to give birth in out-of-hospital sites, such as birthing centers or homes, could compose a different population of women and study results may not be applicable to them. Furthermore, participants were selected as an initiative to study "fragile" families (or populations who had shown increased incidence of adverse birth outcomes), thus use of a disproportionate sampling plan resulted in a planned sample bias of approximately 75% unmarried women and 50% Black women, which is non-representative of the United States' childbearing population. Although this also serves as a strength of the study and clearly aligns with the study's goal to provide additional information regarding vulnerable women, it also limits the generalizability of the results.

A second limitation is the definition of the outcome variable of HIBW, which was considered as a birth weight of 2500 grams and above. Lacking an upper ceiling of birthweight, infants weighing more than 5000 grams were included in the HIBW category. As with infants of low birth weight, large for gestational age infants have been found to have significant health challenges in comparison with infants of normal birth weight (Zilko, Rehkopf, & Adams, 2010). Because gestational age was not available in the data, preterm infants who weighed more than

2500 grams were also included among the healthy, having attained the minimum weight threshold.

Another limitation of the study is that the FFS data were collected between 1998 and 2000, a time frame nearly two decades removed from this analysis. One could debate that subsequent societal shifts may not be represented in this study; however, changes in birth outcome statistics from 2000 to the present time are miniscule, with the very same risk and protective factors under investigation. Recently published articles reveal that current research is focused on similar psychosocial variables as those included in the current study (Mutambudzi, Meyer, Reisine, & Warren, 2017; Rao, Ramya, Batchu, & Reddy, 2017).

Conclusions

The current study has confirmed that several variables are predictors or correlates of HIBW among "fragile families." Among the women in the study, with their increased vulnerabilities, those who were married, and non-smokers, were found to be the most likely to have infants of healthy weight. Having the support from the baby's father also correlated with healthy birth outcomes and may have contributed to the increased rates of healthy birth weight among married partners. Although women in unmarried, yet steady romantic relationships were less likely to have HIBW than married women, they were more likely to have healthy infants than single women, stressing the importance of this source of support. Non-Black women also reported healthy infants. Hispanic women and those rating their health as good were more likely to give birth to HIBW infants, supporting the Hispanic paradox and weathering phenomena. Unexpectedly, spiritual support did not contribute to HIBW and coincides with the inconsistencies within the literature in this area of research. Additional research is required to address the additional variables not found in the current study for their contribution to HIBW as

well as continued exploration of the complex nature of all identified variables of interest and their interlocking influence on birth outcomes.

Implications for Nursing Practice

Conclusions of the study lead to several implications for nurses. The importance of marital status or involvement in a steady relationship upon HIBW, illuminates the need for increased urgency in designing holistic preconceptual and prenatal care models which take social support of the FOB into consideration. While preconceptual counseling is minimally taken advantage of by couples, with nearly 50% of pregnancies unplanned, nurses can advocate for this across women's health care and gynecology clinics. Therefore, interventions directed at a health birth outcome could begin with encouraging preconceptual counseling of couples. Further involvement of the FOB in prenatal care visits can foster a mutual goal of developing and maintaining healthy maternal behaviors, such as smoking cessation, and strong support ties. Fathers-to-be are often unaware of their role during pregnancy, and what support may be expected and desired by their partners (Zvara, Schoppe-Sullivan, & Dush, 2013). Targeted educational and emotional support directed at FOBs could help them to understand more fully their importance in promoting healthy maternal and infant outcomes, as well as teaching them how to best support their partners (Alio, Lewis, Scarborough, Harris, & Fiscella, 2013).

Holistic models of preconceptual and prenatal care have long been called for (Alexander & Korenbrot, 1995); innovations in nursing care of women and their partners in the United States are needed and are just beginning to be developed (Thompson et al., 2017). Advocates for men have called for greater inclusion of men in preconceptual and prenatal care (Bond, 2010). One of the challenges to including men in prenatal care education has been their availability constraints related to employment, with leave for prenatal visits not typically allowed for men. A small but

successful pilot study was conducted by researchers who developed a novel way of making prenatal care accessible to men (Mackert, Guadagno, Donovan, & Whitten, 2015). A prenatal teaching "app" available on smart phones and tablet computers was tested and found to be popular among U.S. men from various ethnicities; however, expansion of the project is needed so more men may benefit. Effects of this technology on maternal and birth outcomes have not yet been studied (Mackett et al., 2015)

The current study findings also adds urgency to the initiatives of governmental agencies calling for more effective protocols for smoking reduction and cessation in preconceptual and pregnant women (TobaccoFreeKids.org, 2017; U.S. Department of Health and Human Services, 2014). The National Center for Health Statistics reported that about 10% of U.S. women smoked in 2014; once they attained pregnancy, 24% of them managed to stop smoking (Curtain & Mathews, 2016). The Healthy People 2010 goal of 30% smoking cessation during pregnancy has not been met and was renewed in the Healthy People 2020 goals (HealthyPeople.gov, 2017). Although understanding the effects of smoking while pregnant is important and recognized by most women, it is evident that total cessation can be a challenge. While some women may quit, others may need additional intervention in breaking a possible nicotine addiction. Assisting women in improving their health through smoking cessation, or reduction, should be seen as a vital nursing function and an area of assessment preconceptually and prenatally. In a qualitative study of 39 patients interested in smoking cessation, participants stated that a non-judgmental attitude by health care providers, and a working knowledge of the latest evidence-based methods for cessation and reduction of smoking had a large impact on their motivation (Roddy, Antoniak, Britton, Molyneux, & Lewis, 2006). Partner support for smoking reduction and cessation (Coppotelli & Orleans, 1985) and positive encouragement and praise by nurses (Lumley, et al.,

2009) have been associated with increased success, and all such avenues of assistance should be leveraged by nurses as they work to improve maternal health.

Nurses should be informed about and make preconceptual and prenatal referrals to such initiatives as Women.smokefree.gov and BecomeAnEx.org, which have excellent free materials available. A 12-step program such as Nicotine Anonymous may be helpful for women seeking group support. Programs targeting specific populations have been developed, such as the "Butt out for Baby" campaign in Australia, which addresses cessation in pregnant teenage mothers (Child and Youth Health, 2003). Intentional employment of a variety of smoking cessation programs should be added to prenatal clinic protocols, so nurses can assist women in finding methods that would be most suitable for them in their unique positions. An example of a resource for health care providers is Pregnets.org, a Canadian initiative, which provides an abundance of information and a toolkit for helping patients with cessation.

When women find cessation impossible, unrealistic, or overwhelming, nurses must understand how to support them in successful smoking reduction. In a random sample of 2,306 women in Great Britain, researchers found that women who were unable to quit, but who significantly curtailed smoking to less than ten cigarettes per day in the first trimester of pregnancy had infants with higher birth weight than women who did not reduce smoking (Yan & Groothuis, 2015). This study provides a reduction goal which nurses may use to assist women unable to break the addiction during pregnancy. Policy makers and entities funding prenatal care can serve their constituencies in a cost-effective manner by requiring clinicians to address smoking cessation and reduction before and during the vulnerable time of pregnancy, for the mutual benefit of two generations.

Although they are less likely to smoke than White women (Geronimus, 1996), Black women are more vulnerable for adverse birth outcomes, and were found to have the lowest rates of HIBW in the current study. Additional factors create high risk circumstances for the pregnant Black women. High-risk women need opportunities to leverage all available support resources and should be encouraged to access preconceptual counseling and receive the minimum number of prenatal care visits, perhaps by utilizing resources like Centering Pregnancy® and other group care models led by nurses, which incorporate social support and group classes into prenatal care. The group care models address the needs of women in new ways, including an increased focus on developmental age and social needs, and use of empowering techniques to help women engage in their own care (Benediktsson, McDonald, Vekved, McNeil, & Dolan, 2013). Evidence that these new methods are effective is compelling, with a consistent show of improved rates of LIBW and PTB in some vulnerable populations (Ickovics, Reed, Magriples, Westdahl, & Rising, 2011; Lathrop, 2013). This evidence suggests that more models addressing specific vulnerable populations of women should be developed. Expanding prenatal care options and educational foci, such as the importance of FOB support and smoking reduction/cessation, would add value to women's health care in terms of better birth outcomes, empowered and healthier mothers, and in dollars saved by prevention of LIBW and PTB.

In the future, new models of individualized prenatal care might facilitate the selection of a support team of friends and family by pregnant women, to assist them to set mutually healthy behavior goals together. Such holistic models, using a team approach, have been used in other public health initiatives, with positive results (Leahey et al., 2014). Using a model of prenatal care with a self-selected team might appeal to older childbearing women and multigravidas, who have sometimes expressed a lesser appreciation for the Centering Pregnancy model than teens, to

whom peer support is often a key developmental incentive (Kennedy et al., 2011; Shakespear, Waite, & Gast, 2010). Another model for well-women's health care now under development is the Maternity Care Home concept introduced by the Centers for Medicare and Medicaid Innovation. This model is derived from the Patient-Centered Medical Home, and similarly has potential for transforming preconceptual, prenatal, and postpartum care into a smooth continuum, with inclusion of holistic evidence-based care (Romano, 2017). In this model, women have primary care providers that care for them across the span of preconceptual care, prenatal, intrapartum, postpartum, and well-woman gynecology care, beginning the process again when the woman desires another pregnancy. Although some proactive women already follow such a plan, this provision formalizes an extended relationship between health care provider and patient, and encourages the use of preconceptual care as a standard practice. Nurses need to act as advocates for preconceptual care, working to bring it to the forefront of policy, with the goal of having it covered by payer sources.

Recommendations for Further Research

The majority of nursing implications identified above include a component of education- either to be delivered preconceptually or prenatally. While prenatal care was not found to be a significant predictor or correlate of HIBW in the current study it could offer a resource for pregnant women which can strengthen partnerships, improve maternal health behaviors, and ultimately yield a healthy infant. The promising new models of prenatal care need further research, especially those geared toward identification of methods to benefit women with intersecting vulnerabilities, such as single, Black, smokers. Past prenatal care models in the United States have often been static and given in a "one-size-fits-all" model (Moos, 2006), which may explain the ineffectual nature of the variable of prenatal care in the current study. Differing

vulnerabilities and needs of childbearing women accentuate the need for new, individualized methods of prenatal care; continued research is needed to determine which elements are most critical for all women, and to test effectiveness in regard to both maternal and infant outcomes.

The success of the Centering Pregnancy® method of prenatal care may be related to its emphasis on the development of social support; however, this model is one of the few with an emphasis on peer support (Centering Healthcare Institute, Inc., 2016). Comparative research exploring effects of social support by type (i.e., emotional, informational, functional) and source (relationship to pregnant woman) is needed. There is an urgent need to examine which aspects of FOB social support best explain the marital birth outcome advantage, differentiating between ethnic-racial groups. In the absence of FOB support, other types of support may bring birth outcomes of single mothers into alignment with those of married women, as some studies have suggested (Collado, Saez, Favrod, & Hatem, 2014; Field, Diego, Delgado, & Medina, 2013), but continued research is needed here.

Experimental research testing various interventions for smoking cessation and addiction management in pregnant populations is needed, so that the methods which are most effective in particular age groups and settings can be implemented. Special groups need smoking cessation strategies targeted to their specific race, age, educational level, and perhaps even workplace. More research linking birth outcomes with modification/reduction of smoking (or alcohol) is also needed.

The effects of spirituality and religious practices on birth outcomes are not clear, yet are an important aspect of life for women in many cultures. Future work should include the goal of consistent use and focus on improved operationalization of concepts, with multidimensional surveys developed to capture the meanings and lived experiences of how religiosity and

spirituality fit into the lives of women. Additional research should explore the various aspects of religiosity and spirituality as another avenue of social support among childbearing women in diverse cultures.

Utility of the Life Context Birth Outcomes model

Not every independent variable described in the adapted LCBO framework was found to relate to the outcome variable in the current study. However, one or more variables, present in each domain of the LCBO, were statistically linked to HIBW, suggesting that the framework was useful in explaining relationships between the variables in this study.

Summary

The research question was: Among women considered vulnerable for having infants of low birth weight, which protective psychosocial factors are most predictive of healthy birth weight? The current study has revealed valuable information. Married women and non-smokers were found to be more likely to have infants of healthy birth weight. Additional advantages were seen among Hispanic women, in women reporting support by the FOB, and in those with preexisting good health. The study has generated results that will be helpful to nurses in their role as patient advocates, and in their ongoing efforts to educate and empower women and their partners in the pursuit of wellness. Continued research is needed to expand the knowledge of protective factors and their effects on birth outcomes, and for development of evidence-based interventions fostering social support, healthy maternal behaviors, and involvement of the FOB during preconceptual planning and prenatal care.

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Appendix A

(Conceptual Framework from 2005 AJOG Publication)

Furr, Deana J
Wed 6/8/2016 11:11 AM

To:popelo@pop.upenn.edu;

Dear Dr. Elo,
I am a doctoral nursing student from Texas, and am working on my dissertation proposal. I am planning to do a secondary analysis of the Fragile Families databank. I would like to use the conceptual framework which you and Dr. Culhane presented in the 2005 as the guide for my work, which is on the topic of psychosocial predictors of healthy birth outcomes in high-risk women. I would be adapting it slightly to accommodate the focus of my research questions and the variables available to me. I would like to have the consent of your and Dr. Culhane to use the framework, and will apply to the Copyright Clearance Center for permission to use the graphic, as well. (I have emailed Dr. Culhane about this too.)

I greatly admire the work you have done and hope to continue reading your publications for a long time to come!

Deana Furr, RN, MSN….

Elo, Irma T <popelo@pop.upenn.edu> Thu 6/9/2016 3:17 AM
To: Furr, Deana J;
Cc: jennifer culhane <CULHANEJ@email.chop.edu>;

Hi:
Thanks for your note. I am assuming you are referring to our AJOG paper. I am glad you find the framework informative.
As long as you cite the paper I don't see any reason why you could not use the framework, but you would probably need some copyright clearance for the use of the figure, which you seem to be pursuing.

Good luck with your research. Best – Irma

Irma T. Elo
Director, Population Aging Research Center
Research Associate, Population Studies Center
Professor of Sociology
University of Pennsylvania
3718 Locust Walk
Philadelphia, PA 19104

Appendix B

HSR decision chart

Lybrand, Mary Colette
Tue 9/6/2016 4:34 PM
To:
Furr, Deana J;
Cc:
Anderson, Cheryl;
Suggested Meetings

Hi Deana,

Thanks for the phone call today! If you are not interacting or intervening with the subjects, and if the data you collect is completely de-identified, then this would not be human subject research per the definition from OHRP: http://www.hhs.gov/ohrp/regulations-and-policy/decision-trees/index.html#c1.

Please let me know if you have any follow up questions.

Thanks,

Mary-Colette

Mary-Colette Lybrand, MS, CCRP

Regulatory Services Manager, Research Administration

The University of Texas at Arlington

Center for Innovation, Suite 300

Office: (817) 272-9329

Marycolette.lybrand@uta.edu