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ABSTRACT

AN ANALYSIS OF PRENATAL CARE IN GEORGIA

By

JONCEL L STEPHENS

1 MAY 2018

OBJECTIVE: The present study characterizes the population of women residing in the state of Georgia who did not receive prenatal care before giving birth to a live infant between 2015-2016. In addition, the association between mother's place of residence (rural/non-rural) and pre-term delivery was also examined.

METHODS: Natality data were obtained from Georgia Department of Public Health and included a total of 7,062 women who did not receive prenatal care and gave live birth in Georgia from 2015-2016. Descriptive analyses used to characterize mothers not receiving prenatal care included: mother's age, race, ethnicity, education level, county of residence in Georgia, parity, funding source for her birth. Multivariable logistic regression examined the association between place of residence in Georgia with pre-term delivery, controlling for sociodemographic variables.

RESULTS: 2.91% of all births in Georgia from 2015 to 2016 were from mothers who received no prenatal care. For the infants of these births, 21.53% were born preterm, 12.12% born low birth weight and 5.34% born very low birth weight. Most of the mothers were African American, had less than 2 previous pregnancies, had a high school diploma or GED, and used Medicaid as the funding source for the delivery of their infant. Although rates of preterm birth were the same for rural and non-rural mothers who did not receive prenatal care (OR = 1.163, 0.985-1.372, p=.0754), five significant predictors for preterm birth were identified and included.

CONCLUSION: Continued monitoring of women not receiving prenatal care is needed. The findings from this study can assist the state of Georgia to tailor healthcare outreach efforts and formulate population-specific intervention strategies that aim to improve access and allocation of prenatal care resources throughout the state of Georgia.

AN ANALYSIS OF PRENATAL CARE IN GEORGIA

by

JONCEL STEPHENS

B.S., GEORGIA INSTITUTE OF TECHNOLOGY

A Thesis Submitted to the Graduate Faculty
of Georgia State University in Partial Fulfillment
of the
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30303

APPROVAL PAGE

AN ANALYSIS OF PRENATAL CARE IN GEORGIA

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Author's Statement Page

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CHAPTER I.

INTRODUCTION

Prenatal care is not only an important aspect of healthcare for the infant being born, but is also important for the mother. Prenatal care can serve as a vital gateway into ongoing healthcare for some women as it provides an opportunity for them to receive family planning counseling, parenting education, and linkage with community resources, including nutrition and social service programs (Fiscella, 1995). For example, many women, particularly adolescents, minorities, and low-income women, may receive their first comprehensive health assessment during prenatal care (Fiscella, 1995). Many studies have pointed to the beneficial effect that prenatal care has on birth outcomes. Prenatal care is important because it encompasses the detection, treatment, or prevention of adverse maternal, fetal, and infant outcomes as well as interventions to address psychosocial stress, detrimental health behaviors such as substance abuse, and adverse socioeconomic conditions (Alexander & Kotelchuck, 2001).

Prenatal care has been thoroughly studied as a health intervention, but the study of its effectiveness has proven difficult as the fundamental necessity in determining effectiveness of a treatment or intervention is randomization. Randomizing women to prenatal care and no prenatal care groups can be considered unethical thus randomized clinical trials have not been conducted to demonstrate the efficacy of the components of prenatal care (Alexander & Kotelchuck, 2001). Most studies conducted on prenatal care focus on the adequacy in which a woman utilizes care. The adequacy of prenatal care utilization in relation to certain birth outcomes has been used as a proxy for effectiveness of care (Alexander & Kotelchuck, 2001).

Many studies that have examined these birth outcome proxies in women who receive prenatal care and those who do not have been conducted. Taylor and colleagues discovered that for the birth outcomes of: very low birth weight, low birth weight, very pre-term birth, preterm birth, small for gestational age, infant mortality rate, neonatal mortality rate, and post-neonatal mortality rate, women with no prenatal care were two to four times worse for every measure compared to outcomes for the total population (C. R. Taylor, Alexander, & Hepworth, 2005). Vintzileos and colleagues also discovered that the absence of prenatal care increased the relative risk for preterm birth 2.8-fold in both African American and White women (Vintzileos, Ananth, Smulian, Scorza, & Knuppel).

Investigating the adequacy of prenatal care utilization came to a head in the United States during the 1980s after pregnancy Medicaid was expanded to include more low-income individuals. Many individuals who were once ineligible for Medicaid benefits were now eligible and had increased access to healthcare. The country hoped to see a drop in the number of adverse birth outcomes following this, specifically in infant mortality and preterm birth rates. Many state-level evaluations of these policies revealed increases in Medicaid enrollment, accompanied by both earlier initiation and more adequate utilization of prenatal care (Alexander, Kogan, & Nabukera, 2002). The country did see a decrease in infant mortality rates, but rates of preterm birth and low birthweight were still on the rise (Alexander & Kotelchuck, 2001). It became apparent that something was missing in the relationship between pregnancy Medicaid expansion and prenatal care delivery. Since more women now had access to care, why were adverse birth outcomes still rising? Much research was conducted to identify barriers to prenatal care, to understand the etiology of these barriers, and to compare levels of prenatal care utilization to birth outcomes. The resulting body of research provides a clear picture of the barriers to prenatal care that may exist for pregnant women of different sociodemographic groups, but almost all research contained a call-to-action for the field of medicine that some believed was “too innovative” for immediate adoption at the time (Novick, 2004). Redesigning the delivery and content of prenatal care to address the wide range of barriers and factors that were discovered was considered a radical idea for the field of medicine. One author holds that if the objectives of prenatal care were expanded beyond improving specific biomedical outcomes, prenatal care might eventually take full advantage of its unique role as a vital gateway into ongoing health care for women (Novick, 2004).

Today the country is feeling the brunt of not taking that difficult step in innovating the delivery of prenatal care as a recent CDC report released in January 2018 indicates that the preterm birth rate [in the United States] rose for the second straight year, and the rate of low birthweight increased by 1% (Martin JA & Driscoll AK, 2018). According to reports from the Agency for Healthcare Research and Quality (AHRQ) and their Healthcare Cost and Utilization Project, it would be in the economic interest of all states in the nation to decrease rates of preterm birth. The AHRQ reports that in 2014 the average hospital length of stay for a mother with a preterm delivery was 3.2 days and costed roughly \$16,130. For a mother with a normal delivery, the average length of stay was 1.9 days with a cost of about \$14,762 (*HCUPnet* -

Hospital Inpatient National Statistics, 2014). This \$2,000 difference is attributed to the “fetal monitoring” that occurs with a preterm infant as these infants are at higher risk of birth defects and health complications (*HCUPnet - Hospital Inpatient National Statistics*, 2014). The AHRQ’s “National Hospital Bill” report states that in 2008 the cost of healthcare for newborn infants was the 3rd most expensive healthcare bill in the nation and comprises 4.1% of healthcare expenditures in the nation (Wier, 2011). The report does not include a comparison of the healthcare costs for premature infants versus those that were born at full term but, it can be assumed that due to fetal monitoring these infants require more healthcare expenditure.

Evidence in prenatal care literature shows that barriers to care, the populations at-risk for inadequate or no care, and the directions in which the delivery of prenatal care needs to go are well understood and documented. A gap in knowledge exists when attempting to investigate delivery access to prenatal care on a smaller scale such as at the state or county level. The 1980’s pregnancy Medicaid expansion was done at the federal level, so the discrepancy between expanding access to care and not seeing improved birth outcomes nationally could indicate a breakdown in access at one of these lower levels. Because of this possibility, an in-depth investigation of access to care and birth outcomes at the state level may reveal valuable information that could be used to improve birth outcomes on a national level. Georgia was one of eleven states to receive a grade of D on the 2017 March of Dimes Premature Birth Report Card, where five states (including Puerto Rico) received an F, eighteen received a C, thirteen received a B, and just four received an A (*2017 Premature Birth Report Card*, 2016). This may indicate that some states have instituted policies that have positively affected either prenatal care delivery or access to care for the women in these states. There may also be certain characteristics of the women residing in these states that have led to this difference in birth outcomes.

A gap in the literature exists for research concerning prenatal care in the state of Georgia. Two prenatal care studies have been conducted in the state Georgia. One investigated an obstetrician shortage throughout the state and the other examined spatial access to prenatal care and how it relates to utilization of care. To date, an investigation into the demographics of women who give birth without having prenatal care in Georgia does not exist. Nor does a study exist which examines birth outcomes in the state stratified by rural or non-rural counties. Investigating the factors that influence a woman’s decision to seek prenatal care and factors that influence the quality of the care she receives can yield vital information about access and

delivery of prenatal care in Georgia. Knowing state-specific information concerning birth outcomes and individuals who are lacking care can have an influential impact on Georgia healthcare policy decisions and the economics of healthcare spending in the state.

CHAPTER II.

REVIEW OF THE LITERATURE

A Brief History of Prenatal Care in the United States

Through the years, prenatal care has evolved into the detection, treatment, or prevention of adverse maternal, fetal, and infant outcomes as well as interventions to address psychosocial stress, detrimental health behaviors such as substance abuse, and adverse socioeconomic conditions (Alexander & Kotelchuck, 2001). The nation has seen demographic changes, environmental changes, and changes in causes of mortality over the 20th and 21st centuries. The delivery and content of prenatal care was not immune to these changes, so an evolutionary change in prenatal care can be seen when observing this particular type of healthcare over the years.

Richard Meckel provides a detailed overview of the evolution of prenatal care from 1850 to 1929 (Meckel, 1990). In 1900 in some U.S. cities, up to 30% of infants being born died before reaching their first birthday. Early efforts of prenatal care were to reduce infant mortality with a focus on improving environmental and living conditions in urban areas. During the first three decades of the century, public health, social welfare, and clinical medicine (pediatrics and obstetrics) collaborated to combat infant mortality. This partnership began with milk hygiene but later included other public health issues. In 1912, the Children's Bureau was formed and became the primary government agency to work toward improving maternal and infant welfare. The bureau also advocated for comprehensive maternal and infant welfare services, including prenatal, natal, and postpartum home visits by health-care providers. By the 1920s, the integration of these services changed the approach to infant mortality from one that addressed infant health problems to an approach that included infant and mother and prenatal-care programs to educate, monitor, and care for pregnant women. Through the 1950s, an increasing proportion of infant deaths were attributed to perinatal causes and occurred among high-risk neonates, especially low birth weight and preterm babies. During the late 1960s, after Medicaid and other federal programs were implemented, infant mortality declined substantially (Pharoah Po Fau - Morris & Morris). From 1970 to 1979, neonatal mortality plummeted 41% ("Healthier Mothers and Babies," 1999) because of technologic advances in neonatal medicine and in the regionalization of perinatal services. Some see the strides that prenatal care has made in reducing

fetal and maternal mortality as more of an advance in medical technology rather than an advance in the delivery of prenatal care (Alexander & Kotelchuck, 2001; Novick, 2004). From this perspective, one could say that babies are still being born with adverse outcomes such as low birthweight and birth defects, but it is medical technologies that are keeping these babies alive, not the doings of prenatal care.

In the 1980s pregnancy Medicaid expanded to include those who previously were not eligible for benefits. Federal and state agencies were looking forward to improved birth outcomes from this expansion because more access to funds for healthcare would mean more healthcare delivered and thus better outcomes (Alexander et al., 2002; Alexander & Kotelchuck, 2001). However, this was not the case since during the early to mid-1980s the previous decline in infant and maternal mortality rates slowed (Kleinman Joel, 2008) and rates of adverse birth outcomes did not change.

Following this discovery, much research was done to figure out why this phenomenon was occurring. If more women have access to care, it was assumed they should be having better birth outcomes. However, during 1989-1991, infant mortality declined slightly faster, probably because of the use of artificial pulmonary surfactant to prevent and treat respiratory distress syndrome in premature infants (Schoendorf & Kiely, 1997). During 1991-1997, infant mortality continued to decline primarily because of decreases in sudden infant death syndrome (SIDS) and other causes. Although improvements in medical care were the main force for declines in infant mortality during the second half of the century, public health actions played a role (Schoendorf & Kiely, 1997). For example, during the 1990s, a greater than 50% decline in SIDS rates (attributed to the recommendation that infants be placed to sleep on their backs) has helped to reduce the overall infant mortality rate (Willinger et al., 1998). Meckel holds that moving into the 21st century and to develop effective strategies for the 21st century, studies of the underlying factors that contribute to morbidity and mortality should be conducted. These studies should include efforts to understand not only the biologic factors but also the social, economic, psychological, and environmental factors that contribute to poor maternal and infant outcomes (Meckel, 1990).

Difficulties in Measuring Prenatal Care Utilization

Researchers wanted to quantify how adequately women were utilizing prenatal care in hopes of discovering why infant mortality was at a standstill and adverse birth outcomes were

still occurring despite more women having access to care. This led to multiple prenatal care adequacy indices being developed over the years, the first of which was called the 1972 Kessner index (Alexander & Kotelchuck, 2001). This index, initially labeled the “Three Factor Health Services Index” and commonly called the IOM (Institute of Medicine) or Kessner index, took the month in which prenatal care is initiated, the number of prenatal care visits, and the type of obstetric service used into consideration while adjusting for the infant’s gestational age at delivery. The index classified “adequate” utilization of prenatal care as a first trimester initiation of service, a specified number of visits for the gestational age at delivery, and delivery by a *private* obstetric service. This last specification of the need of a private obstetric service was commonly ignored by those who used the IOM/Kessner index in their research. Additionally, any cases with missing data concerning month of initiation of care, number of visits, or obstetric service provider were automatically deemed as “inadequate” prenatal care utilization (Alexander & Kotelchuck, 1996).

In 1987, Alexander and Cornely formulated a graduated index, the “GINDEX” as a means to better quantify prenatal care utilization. They argued that it was inappropriate for the Kessner index to assume that cases with missing data had inadequate prenatal care. This graduated index expanded the three levels of the IOM/Kessner index from adequate, intermediate, and inadequate to six categories. They included categories for cases with missing data, assigning them to missing or no care categories, and an intensive category for women who had an unexpectedly large number of prenatal care visits given their gestational age at delivery and the month their prenatal care began. The aim of the GINDEX was to delineate a nominal category of cases with a utilization pattern that suggests a high risk morbid condition requiring more than the standard recommended number of prenatal care visits (Alexander & Kotelchuck, 1996).

Yet another index, the “Kotelchuck’s Adequacy of Prenatal Care Utilization” (APNCU) index was formulated in 1994. This is the most recent and most commonly used index in current prenatal care literature (Koroukian & Rimm, 2002). It classifies adequate and inadequate utilization of prenatal care based on the month in which prenatal care is initiated and the number of visits from initiation of care until delivery. The APNCU index compares the number of actual prenatal care visits to the number of expected visits, which is derived from the full American

College of Obstetricians and Gynecologists (ACOG) prenatal care visit recommendation (Alexander & Kotelchuck, 1996).

Researchers (one of whom developed the APNCU) compared the results obtained from applying five different indices to women who gave birth in South Carolina. The modified IOM index, which ignores the type of obstetric delivery service, a variation of the M-IOM index using the full ACOG visit recommendation, an index suggested by the U.S. Public Health Service Expert Panel on Prenatal Care recommendation (1999), the GINDEX, and the APNCU index were all used on the same population. There were marked differences between how each index quantified the different levels of adequate and inadequate care received by the same population of women in South Carolina. An invalid report that overestimates gestational age may result in a woman's prenatal care being classified as less than adequate. The authors hold that all indices are subject to gestation age bias, do not take spacing of prenatal care visits into consideration, and most importantly content of prenatal care visits (Alexander & Kotelchuck, 1996).

Multiple studies published following the development of these indices note that they still produce varying results. An understanding of the conceptual basis and limitations of each index is a prerequisite for the valid interpretation of the patterns of prenatal care utilization revealed by each index and for the effective use of that information to develop sound policies to further improve pregnancy outcomes (Alexander & Kotelchuck, 1996). Selection of a prenatal care utilization index requires careful consideration of its methodological underpinnings and limitations and the indices should not be used interchangeably. Use of these indices to study the association between utilization of prenatal care and pregnancy outcomes affected by the duration of pregnancy should be approached cautiously (Heaman, Newburn-Cook, Green, Elliott, & Helewa, 2008).

Motivating Factors and Barriers to Prenatal Care

There are many factors at play in a woman's decision to seek prenatal care and her access to care. Studies have shown these factors appear at both internal and external levels. Nearly all studies that have attempted to investigate motivators and barriers to prenatal care produce extensive, wide-ranging lists of these factors. Many studies investigating barriers to prenatal care have been conducted through interviews and surveys administered to pregnant or postpartum women. Some of these studies are based on interviews or focus groups with small samples

(ranging from dozens to hundreds) and only target specific population groups, such as inner-city, low-income, or specific ethnic women (Yin, 2017).

One robust prenatal care study is a systematic review of prenatal care studies by Feijen and colleagues that produced a concise overview of the list of factors that lead to inadequate prenatal care use. These factors were grouped into individual, contextual, and behavioral factors. The individual factors leading to inadequate prenatal care use were low maternal age, low educational level, non-marital status, ethnic minority, planned pattern of prenatal care (having a care team delivering care or not), hospital type, unplanned place of delivery, uninsured status, high parity, no previous premature birth and late recognition of pregnancy. Contextual factors included living in distressed neighborhoods, living in neighborhoods with higher rates of unemployment, single parent families, medium–average family incomes, and low-educated residents. Regarding health behavior, inadequate use was more likely among women who smoked during pregnancy (Feijen-de Jong et al., 2011). Another robust study explored women’s perception of access to prenatal care in the United States but groups them differently than the Feijecn-de Jong study. The factors were grouped into societal, maternal, and structural dimensions. Societal and maternal reasons cited for poor motivation to seek prenatal care include a fear of medical procedures, fear of disclosing the pregnancy to others, depression, and a belief that prenatal care is unnecessary. Structural barriers include long wait times, the location and hours of the clinic, language and attitude of the clinic staff and provider, the cost of services, and a lack of child-friendly facilities (Phillippi, 2009).

Braveman and colleagues conducted a study to identify non-insurance barriers to prenatal care. The significant barriers they discovered included lacking a regular source of pre-pregnancy health care, fear of medical procedures, concerns about confidentiality and disclosure of pregnancy, unplanned pregnancy, unwanted pregnancy, and smoking status. The authors also noted trends in sociodemographic characteristics such as age, educational attainment, parity, marital status, and ethnic identification among the women. They also noted logistic barriers, but these played a relatively limited role in explaining untimely initiation of prenatal care (Braveman, Marchi, Egerter, Pearl, & Neuhaus, 2000). Poland et al. corroborated many of the findings with the Braveman study. A woman’s attitude toward health professionals, her of telling others about the pregnancy, perception of the importance of prenatal care, and initial attitudes about the pregnancy were important predictors of seeking prenatal care (Poland, Ager, & Olson,

1987). These are just a few studies in the large body of literature concerning prenatal care in the United States and internationally. The way these studies group the factors that are related to prenatal care utilization differs among almost all of them. This goes to show how complex the situation surrounding prenatal care utilization and access is in the United States and abroad.

Based on this literature review and the factors discovered in these studies, the factors influencing prenatal for the present study are grouped into the following categories: environmental/contextual factors, individual factors, psychological factors, patient-provider relationship factors, and policy related factors. Existing studies concerning prenatal care utilization and access specifically in the state of Georgia will be presented as well.

Environmental/Contextual Factors

Environmental or contextual factors include a woman's access to prenatal care providers, transportation to prenatal care, and the availability of prenatal care providers. The time it takes for a woman to get to a prenatal care appointment has been shown to be associated with her likelihood of receiving care. In a study conducted in Haiti, it was found that walking time to the dispensary (the prenatal care point of care) was independently associated with prenatal care utilization. The study found that women living 3 or more hours walking time from the dispensary were only 38% as likely to receive prenatal care as women living less than 3 hours from the dispensary (King-Schultz & Jones-Webb, 2008). The long walking distance can be seen as a barrier to care. In another study conducted in Pakistan, rural women were found to have lower odds of utilizing prenatal services as compared to mothers in urban environments (Budhwani, Hearld, & Harbison, 2015). In various studies when women are asked about barriers to receiving care they do mention transportation as a barrier as some report difficulty keeping their appointments due to lack of transportation (Mikhail, 2000).

As for provider availability, the number of providers available in a population has been shown to be associated with prenatal care use. In a nationwide U.S. study, the number of Ob-Gyn doctors per 100,000 females of childbearing age in a county was associated with the percentage of women receiving late or no prenatal care (Shoff, Yang, & Matthews, 2012). Not having a sufficient population of doctors in a given area to support the number of women seeking prenatal care can affect when and how care will be received. There are various providers who can provide prenatal care, but the percentage of prenatal visits provided by family physicians in the U.S. decreased from 11.6% in 1995-1996 to 6.1% in 2003-2004 (Cohen & Coco, 2009) and it is likely

that this number is decreasing. Provider availability has been shown to have a detrimental effect on the provision of prenatal care in the state of Georgia, which will be discussed in detail in subsequent sections. The phenomenon of less variety of doctors providing care and more specialist physicians doing so does not benefit areas where there is already a shortage of prenatal care providers in certain areas.

Individual factors

Individual level factors such as a mother's age, race, education, and her attitudes and knowledge towards healthcare or prenatal care has been shown to be associated with her likelihood of getting prenatal care. Race is associated with socioeconomic status, education level, and many other factors that at first glance do not seem to be related to prenatal care ("Ethnic and Racial Minorities & Socioeconomic Status," 2018). However, the complexity of care-seeking behavior and access to care involves all of these factors, with race interacting with all of them. When looking at race, LaVeist and colleagues found that once prenatal care is initiated, black women still receive fewer prenatal care contacts and less adequate care (LaVeist, Keith, & Gutierrez, 1995). Black women delayed prenatal care, received too few visits, and were more likely to have either "inadequate PNC" or "no care" compared to white women. Although there are no black/white differences in the initiation of prenatal care, black women are still less likely to receive adequate care as measured by the Kessner index, or to have as many total prenatal care contacts as white women (LaVeist et al., 1995).

A mother's age has been shown to be a significant factor in prenatal care utilization as well. Older adolescents were more likely to start care in the first trimester than younger adolescents, whereas younger adolescents were more likely to start care earlier than preteens (Alexander et al., 2002). Hueston and colleagues looked specifically at adolescents who received no care or waited until the third trimester to start their care, and found that younger adolescents or preteens were significantly more likely than older adolescents to have delayed care. For the youngest adolescents, white teens were at higher risk for delaying prenatal care. However, for the 15–16-year age group and the older group, adolescents of white race/ethnicity were less likely to delay care (Hueston, Geesey, & Diaz, 2008).

As far as attitudes, investigators have found that internal barriers to prenatal care include the mother having a negative attitude about her pregnancy and/or having limited knowledge about the value of prenatal care (Braveman et al., 2000). Friedman and colleagues found that

among 211 women with no prenatal care 29% of the women experienced denial of pregnancy and 6% believed they did not need prenatal care due to multiparity (Friedman, Heneghan, & Rosenthal, 2009). These two opinions held by mothers not seeking care fall into the categories of negative attitudes toward a pregnancy and knowledge of prenatal care.

Women who do not plan their pregnancies often delay seeking care (York et al., 1993; Young et al., 1989). An unplanned pregnancy can be an unwanted pregnancy, a woman may feel ambivalent towards the pregnancy, or a woman may not recognize that she is pregnant until well into the pregnancy. Late recognition of a pregnancy is also a barrier to prenatal care since the American Academy of Pediatrics and American College of Obstetricians and Gynecologists Guidelines for Perinatal Care (2012) recommends that women begin receiving prenatal care in their first trimester of pregnancy (Selchau et al., 2017). Studies have shown that women who recognized their pregnancies early are more likely to initiate prenatal care early than women who recognized their pregnancies late (Ayoola, Nettleman, Stommel, & Canady, 2010). This is of course, because the mother is aware of her pregnancy early on and is thus more likely to establish care earlier than a mother who does not know early on. Selchau and colleagues found that primiparous women (first time mothers) were significantly less likely to start first trimester prenatal than multiparous women. (Selchau et al., 2017). This could be due to the fact that multiparous women may be more familiar with the signs of pregnancy more than a primiparous one would be.

Luecken and colleagues showed that unintended pregnancy is associated with later entry into prenatal care (Luecken, Purdom, & Howe, 2009) and research has shown this phenomenon at play in Mexican Women especially (Quelopana, Champion, & Salazar, 2009). A woman is likely to have a negative attitude towards an unintended pregnancy since it is possible that the woman was not prepared mentally, emotionally, or financially to support the care of a child. Furthermore, not planning to become pregnant means that a woman is not actively looking for signs of pregnancy changes within her body and is likely to not notice she is pregnant. With an unintended pregnancy, the state of a mother's social or family life may not be advantageous for a child to grow up in at the time she discovers that she is pregnant. It is likely that unintended pregnancies can also be unwanted pregnancies and these types of pregnancies are even less likely to be associated with prenatal care. When controlling for socio-demographic variables, women

with unwanted pregnancies had less prenatal care than intended pregnancies in a cross-sectional survey of 351 women (Erol, Durusoy, Ergin, Doner, & Ciceklioglu, 2010).

As for prenatal care knowledge, Lin and colleagues discovered that pregnancy knowledge can differ vastly even within the same country. In comparing prenatal care behavior scores for Southeast Asian immigrant women and Taiwanese women, the scores for the immigrant women were significantly lower than those for Taiwanese women (Lin, Shieh, & Wang, 2008). LaVeist and colleagues also found that increasing general education more strongly increases prenatal care utilization for African Americans compared to whites (LaVeist et al., 1995). In Africa, literacy rates were found to be associated with the quality of prenatal care that a woman received. Researchers found that each percentage increase in the literacy rate was associated with 4% higher odds of having adequate prenatal care. The authors hold that higher literacy rates among women may help to promote adequate prenatal care (Y. J. Taylor, Laditka, Laditka, Brunner Huber, & Racine, 2017). These studies have established a knowledge base pointing to the positive impact that just having a high level of general knowledge or education can have on the likelihood of a woman receiving prenatal care.

Psychological Factors

Drug use, and mental disorders such as bipolar disorder, schizophrenia, and depression are factors that fall into the category of psychological factors. These particular factors can have very negative effects on a woman's decision to seek prenatal care. Women who delay prenatal care or fail to obtain care are more likely to be in a "social chaos" situation characterized by poverty, unstable relationships, substance abuse, and interfamily violence. Research has shown that childhood adversities are associated with substance use and abuse. It is a reason why pregnant women may engage in these risky behaviors during pregnancy (Hillis et al., 2004). mother who suffered adverse childhood experiences is tied to whether or not she will engage in health promoting behaviors such as seeking prenatal care or health risk behaviors such as drug and alcohol use during pregnancy.

In a focus group-style study conducted amongst African American women in Washington D.C., the group at highest risk for inadequate prenatal care use were women who primarily reported psychosocial problems as barriers. More specifically these women reported personal problems, being under stress, depressed, family problems, did not feel good about self, did not feel well, and reported not thinking straight (Johnson et al., 2007). In a study conducted by

Luecken and colleagues, women who had higher distress and more frequent stressful life events had later entry into prenatal care (Luecken et al., 2009)

As for drug use, among 211 women who gave birth without receiving prenatal care beforehand, 30% of the women had problems with substance use (Friedman et al., 2009). At 30%, substance use was the reason reported by the highest number of mothers. Although knowing which substance is most deleterious to a woman's motivation to seek care has not been studied, knowing that its use negatively affects prenatal care use is important.

Cultural, Social, and Family Factors

Social and family networks are associated with a woman's decision to seek prenatal care. Healthy social and family networks have been shown to have a positive effect on a woman's health seeking behaviors. Mexican American culture (and perhaps Hispanic culture in general) places an extremely high value on familial, childbearing, and childrearing roles, and thus Hispanic mothers, both expectant and after delivery, receive greater social support from family and friends than do their counterparts in other groups, regardless of whether the mother is married or unmarried (Frisbie, Echevarria, & Hummer, 2001). Being an unwed mother can carry undesirable social stigma and if Hispanic women do not feel this stigma at the levels of women of other races and ethnicities this could lead to differences in their likelihood of seeking and receiving prenatal care.

This could also hold true for age. As previously described, mothers of young ages are one of the groups at highest risk of starting prenatal care late. Adolescents' perception about prenatal care could be based upon the influence of peers or parents, which may have an effect on their perception of its relevance, importance, or need (Tilghman & Lovette, 2008). At a young age, a girl is likely to conceal a pregnancy from parents or peers for fear of judgement. In Friedman's study of 211 women with no prenatal care, 9% of the women reported concealing their pregnancy (Friedman et al., 2009) from friends or family. A woman seeing the need to conceal a pregnancy is likely due to the pressures of her social or family network.

Strong cultural beliefs and family support have been identified as resources that may improve pregnancy experiences among Hispanic women (Luecken et al., 2009). However, when family relationships are harmful as in the case of intimate partner violence, it has a detrimental effect on health seeking behaviors. Dietz and colleagues found that mothers who experienced physical violence from their partners were significantly more likely to have delayed prenatal care

compared to mothers with no physical violence experience. A 2001 systematic review and meta-analysis paper reported that women who were abused during their pregnancy were 1.4 times more likely to have a low birth weight baby compared to non-abused women (Murphy, Schei, Myhr, & Du Mont, 2001).

The Patient-Provider Relationship

The patient-provider relationship has been shown to influence the content of prenatal care that a woman receives and the woman's attitudes toward her healthcare providers influences it as well.

Various studies have shown that minority women report more negative experiences in the process of seeking care and receiving care. Sword and colleagues conducted a study among 40 pregnant women and 40 providers in Canada and found that clinical and interpersonal care processes emerged as being most essential to quality care. The study findings suggested the need to focus on more than the biomedical aspects of care and attend to elements of prenatal care that foster a meaningful relationship between a woman and her prenatal care provider (Sword et al., 2012). More studies have been published to support this finding. A study investigated what Hispanic women want in a patient-provider relationship when they are seeking prenatal care. 42% of the participants believed that a friendly relationship was one of the most important aspects of care, and was demonstrated by providers smiling, making eye contact, displaying patience, and engaging in formal greetings, introductions, and farewells. A high percentage of the women also associated the availability of Spanish speakers during their visit as a better prenatal care experience (Bergman & Connaughton, 2013). A study investigating what African American women want in providers showed that they want their prenatal providers to know and remember them. They also wanted their providers to understand the context of their lives from their prenatal interactions (Lori, Yi, & Martyn, 2011). Among low-income African American and Hispanic patients in Washington D.C., researchers found that overall patients want to seek more knowledge. Patients' perceptions emphasized the importance of acquiring knowledge to improve their own health. This study is contrary to long held beliefs, as this finding highlights the desire for more information by low-income, inner city patients' regarding their health (Johnson et al., 2011).

Looking at the negative aspects that may appear in the patient-provider relationship, discrimination against women of minorities has been reported in some studies. In a focus group

style study, African American women with limited incomes perceive many provider practices and personal interactions during prenatal care as discriminatory. More specifically they perceived discrimination based on insurance/income and race when using prenatal care services (Salm Ward, Mazul, Ngui, Bridgewater, & Harley, 2013). Novick and colleagues found that low income women reported feeling stereotyped as single, welfare mothers. Additionally, Novick found that the likelihood of feeling that one had been treated respectfully by professionals and staff was lower for Hispanic than non-Hispanic women (Novick, 2009). The content of the care received by minority women has also been shown to differ significantly. In a study that investigated the content of prenatal care visits among white women and black women, Kogan found that black women receive less prenatal care advice on alcohol and tobacco use than white women (Kogan, Kotelchuck, Alexander, & Johnson, 1994). These studies show that the patient-provider relationship is an important aspect of prenatal care and it is important for women to feel comfortable with their provider in order to motivate them to seek care.

Policy Related Factors

Insurance coverage status, the amount or type, can be related to income and socioeconomic status and has been shown to be heavily associated with a woman's decision to seek prenatal care and her perception of the quality of care received (Salm Ward et al., 2013). The effects of insurance coverage on prenatal care has been documented internationally and in the U.S. In the country of Ghana, pregnant women who had access to insurance were more likely to seek prenatal care compared to uninsured pregnant women (Abrokwah, Moser, & Norton, 2014). This was also shown in the Philippines when after controlling for demographic and socioeconomic characteristics, the PhilHealth insurance program scale-up (increase in insurance coverage) was associated with increased odds of receiving at least four prenatal visits and receiving a visit during the first trimester of pregnancy (Kozhimannil, Valera, Adams, & Ross-Degnan, 2009). In the United States, increasing insurance coverage for low-income women was one of the 10 recommendations issued by the Centers for Disease Control and Prevention in 2006 to improve national preconception health (Wherry, 2017).

Women with lower incomes have been shown to be less likely than higher income women to have health insurance coverage prior to pregnancy (Braveman et al., 2000). Health coverage during periods of nonpregnancy, including family planning services, may further impact pregnancy outcomes. Perhaps insured women are more likely to plan pregnancies during

periods of optimal health or spacing between births, as well as improve their health behaviors prior to conception (Wherry, 2017).

As for Medicaid in the U.S., many studies have examined how Medicaid coverage influences prenatal care utilization. In addition to the amount of insurance that a woman has being a barrier to prenatal care, the insurance process for Medicaid has been shown to be a barrier. Participants from CMOs noted that the length of time it takes for women to complete the Medicaid application leads to some women not seeing a provider until their second trimester, thereby delaying the care they need to mitigate potential risks and complications during pregnancy. Consequently, clinical providers then find themselves “playing catch up” and struggling to address and manage these risks at a later stage in pregnancy (Poland et al., 1987). In a population of women with Medicaid Managed Care coverage in Massachusetts, 85% of women initiated care in the first trimester, but only 62% met the goal of receiving more than 80% of the recommended number of prenatal visits. McDonald and Coburn corroborated insurance being a barrier since they found type of financial coverage to be a predictor of prenatal care use and hold that receipt of Medicaid does not assure adequate prenatal care use (McDonald & Coburn, 1988).

Women who enrolled in Medicaid in the first trimester were more likely to receive the recommended number of prenatal visits than those who were enrolled before pregnancy (Weir et al., 2011). In Puerto Rico, Medicaid Managed Care reduced but did not eliminate the gap in the amount and adequacy of prenatal care received by pregnant women covered by Medicaid when compared to their counterparts covered by private insurance (Marin et al., 2009).

In California, a survey of Medicaid directors showed that economic pressure is leaving states with more strain on Medicaid budgets and many were planning major reductions in coverage/eligibility (Kaiser Commission on Medicaid, 2009). (Ruwe, Capitman, Bengiamin, & Soto, 2010). Among threats to maintaining the benefits of pregnancy Medicaid expansion is the refusal by some providers to accept Medicaid patients because of low reimbursement rates (Ruwe et al., 2010). This could tie into the occurrence of the women who perceived that they had been treated differently by health care providers during prenatal care, labor, or delivery based on their insurance status (Thorburn & De Marco, 2010).

In all, the factors influencing a woman’s decision to seek or forgo prenatal care is complex. It seems that oftentimes motivating factors are at play while barriers exist at the same time. Sword et al. proposed that – given both the external hurdles to accessing care and the poor experiences

women have once they are receiving care – some women may perform something similar to a cost-benefit analysis. As a result, women may decide that the benefits of receiving prenatal care do not outweigh the expenditure of time and resources required to obtain care. Thus, these women, who may sometimes be viewed within the health care system as non-compliant, or passive non-users of care, may in fact be making rational choices (Novick, 2009).

Prenatal Care in Georgia

The prenatal care studies conducted in the state of Georgia have been focused on access to care. One study examined the maldistribution of prenatal care providers in the state, another investigated the relationship between spatial access to care and utilization rates of prenatal care, and one investigated travel time to care and how it relates to birth outcomes.

The provider maldistribution study holds that inadequate use of prenatal care may be exacerbated by the increasingly frequent hospital closings throughout rural Georgia and the reduction in the amount of doctors seeking to practice in rural areas of the state. Since 1994, there have been nearly twenty labor and delivery unit closures in hospitals outside metropolitan Atlanta (Pinto, Rochat, Hennink, Zertuche, & Spelke, 2016). In a nationwide study of rural counties, the percentage of rural counties with hospital-based obstetric services declined from 55% to 46% between 2004 and 2014 (Kozhimannil, Hung, Henning-Smith, Casey, & Prasad, 2018) and this phenomenon is present in Georgia as well. The study found that in Georgia, 52 % of Primary Care Service Areas outside of metropolitan Atlanta, Georgia, had an overburdened or complete lack of obstetric care services.

For the prenatal care access and utilization study, no obvious difference was observed in prenatal care utilization between urban and rural areas. The study found that mothers with better spatial access are less likely to receive adequate prenatal care as measured by the Adequacy of Prenatal Care Use (APCNU) which was developed by Kotelchuck in 1995 (Kotelchuck, 1994). The study found that many socioeconomically disadvantaged populations in urban areas have excellent spatial access to health care, and that spatial clusters of high inadequate service rate were mainly around Athens, south to Atlanta, and in some suburban and rural areas of western and southern Georgia. (Yin, 2017). Although this study shows that access to care does not lead to underutilization, this suggests that factors outside of proximity to a provider are causing women in Georgia to go without prenatal care.

The travel time to point of care study found that in Georgia, women who drive over 45 minutes to get to their delivering hospital are 1.53 times more likely to have a premature delivery than women who drive 15 minutes (Zertuche, Spelke, Julian, Pinto, & Rochat, 2016). This study is an unpublished master's thesis, so the general public does not have access to the findings of this study or limitations. With only two *published* studies having been conducted in the state of Georgia concerning prenatal care or birth outcomes, there is knowledge gap that must be filled. Knowing more about prenatal care access, delivery, and its effect on birth outcomes specifically in the state of Georgia can empower health care providers, legislators, and the general public to make necessary changes in the state to improve it. From the literature it is evident that the degree and nature of motivating and discouraging factors change varies greatly. The literature points to these factors in various populations of women in the United States and abroad. The present study is unique in that it focuses individual characteristics and external factors that are at play concerning women who reside in and have given birth in Georgia, but who did not receive any prenatal care. What is spelled out in the literature is a good starting point for addressing the issue of women going without prenatal care, but in order to target the specific populations of such women in Georgia, this information must be combined with Georgia's state-specific data.

CHAPTER III.

JOURNAL MANUSCRIPT for THE GREEN JOURNAL

**AN ANALYSIS OF GEORGIA MOTHERS WHO GAVE BIRTH IN 2015
AND 2016 WITHOUT HAVING RECEIVED PRENATAL CARE**

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ABSTRACT

OBJECTIVE: The present study characterizes the population of women residing in the state of Georgia who did not receive prenatal care before giving birth to a live infant between 2015-2016. In addition, the association between mother's place of residence (rural/non-rural) and pre-term delivery was also examined.

METHODS: Natality data were obtained from Georgia Department of Public Health and included a total of 7,062 women who did not receive prenatal care and gave live birth in Georgia from 2015-2016. Descriptive analyses used to characterize mothers not receiving prenatal care included: mother's age, race, ethnicity, education level, county of residence in Georgia, parity, funding source for her birth. Multivariable logistic regression examined the association between place of residence in Georgia with pre-term delivery controlling for sociodemographic variables.

RESULTS: 2.91% of all births in Georgia from 2015 to 2016 were from mothers who received no prenatal care. For the infants of these births, 21.53% were born preterm, 12.12% born low birth weight and 5.34% born very low birth weight. Although rates of preterm birth were the same for rural and non-rural mothers who did not receive prenatal care ($p = .0754$), five significant predictors for preterm birth were identified and included.

CONCLUSION: Continued monitoring of women not receiving prenatal care is needed. The findings from this study can assist the state of Georgia to tailor healthcare outreach efforts and formulate population-specific intervention strategies that aim to improve access and allocation of prenatal care resources throughout the state of Georgia.

INTRODUCTION

Prenatal care is essential clinical service for the developing fetus and mother, because it encompasses the detection, treatment, or prevention of adverse maternal, fetal, and infant outcomes. Prenatal care also serves as an entry point for physicians to identify and intervene with mothers to address risks such as psychosocial stress, detrimental health behaviors such as substance abuse, and adverse socioeconomic conditions (Alexander & Kotelchuck, 2001).

A significant amount of research exists documenting factors associated with receiving no prenatal care at the national level (Alexander & Kotelchuck, 2001; Braveman et al., 2000; Feijen-de Jong et al., 2011; Kogan et al., 1994; Phillippi, 2009; Poland et al., 1987). For example, the barriers to care, the populations at-risk for inadequate or no care, and the delivery of prenatal care needs are well understood and documented (Braveman et al., 2000; Kogan et al., 1994; Phillippi, 2009; Poland et al., 1987). However, a gap in knowledge exists at the state and county level when attempting to understand which mothers are less likely to receive prenatal care. This lack of knowledge may contribute to the observed discrepancy between access to care expansion and lack of improved birth outcomes nationally. Because of this possibility, an in-depth investigation of the absence of prenatal care and adverse birth outcomes at the state level may reveal valuable information that could be used to inform national efforts.

The 1980's pregnancy Medicaid expansion was implemented at the federal level. Despite efforts such as this at the national level, significant disparities related to receipt of prenatal care are observed at the state level. For example, Georgia was one of eleven states to receive a grade of D on the 2017 March of Dimes Premature Birth Report Card, where five states (including Puerto Rico) received an F, eighteen received a C, thirteen received a B, and just four received an A (*2017 Premature Birth Report Card*, 2016). This may indicate that some states have instituted policies that have positively affected either prenatal care delivery or access to care for the women. However, certain sub-population of women residing in these states may be less likely to access prenatal care and thus the observed differences in birth outcomes.

Within the state of Georgia, two prenatal care studies were conducted. One found that an obstetrician shortage exists throughout the state and the other examined spatial access to prenatal care and how it relates to utilization of care (Pinto et al., 2016; Yin, 2017). To date, an investigation into the demographics of women who give live birth without having prenatal care in Georgia does not exist. Nor does a study exists which examines birth outcomes in the state

stratified by rural or non-rural counties. Investigating and identifying the sub-population of women who don't receive prenatal care and can yield vital information about access and delivery of prenatal care in Georgia. Knowing state-specific information concerning birth outcomes and individuals who are lacking care can have an influential impact on Georgia healthcare policy decisions and the economics of healthcare spending in the state. Therefore, the current study sought to investigate the following research questions: What are the characteristics of women who gave birth to a live infant in Georgia, but did not receive prenatal care in 2015 and 2016 and does place of residence (non-rural/rural counties) contribute to preterm births among women who did not receive prenatal care in Georgia in 2015 and 2016? The investigation also tests the null hypothesis that rates of preterm birth in 2015-2016 will not differ between women who live in non-rural and rural counties in Georgia.

METHODS

For the present study, a combined Georgia Department of Public Health (GADPH) dataset on live births between 2015-2016 among women who did not receive prenatal care were obtained. The GADPH dataset contains information on the 7,602 live births in Georgia among mothers who reported not receiving prenatal care. To compile the data, a birth worksheet is used to complete the birth certificate of every infant born in Georgia. When a woman presents to a facility to give birth she fills this document out with a healthcare professional. The same form is provided across birthing facilities in Georgia. In the section of the birth worksheet entitled *Mother Stats II*, a mother indicates the date of her last prenatal visit or indicates "No Prenatal Care" or "Unknown" ("Out of Institution Birth Packets," 2013). The population of no prenatal care mothers used in this study are those who selected the "No Prenatal Care" option on the birth worksheet. Georgia State University's Institutional Review Board approved the present study.

Variables

The GADPH data were used to analyze the following variables: mother's age, race/ethnicity, educational level, county of residence, parity (number of previous pregnancies the mother had, including the current one), funding source for her birth, baby's birth weight, gestational age at birth, and the mode of delivery.

Mother's age was categorized into the groups of less than 19 years old, 20-24 years old, 25-29 years old, 30-34 years old and 35 and older. Mother's race was categorized into White, Black or African American, Asian, American Indian/Alaska Native, Native Hawaiian/Pacific

Islander, and Multiracial. Mother's ethnicity was either Hispanic/Latino or not. Education level was defined into the following categories: 8th grade or less, 9th to 12th grade, no degree, High school diploma or GED, Some college, no degree, Associate's degree, Bachelor's degree, Master's degree, and Doctoral degree. Mother's residence county was indicated by her reported ZIP code. Parity is based on the mother's self-report of previous pregnancies of a live infant or any previous terminations of pregnancy. Funding source for delivery is the insurance coverage type or method of payment indicated by the mother. A low birth weight is defined as the infant weighing less than 2,500 grams at birth and a very low birthweight infant is defined as weighing less than 1,500 grams at birth (Cleary-Goldman & Robinson, 2017). For this study, births that occurred before 37 weeks gestation are classified as a pre-term birth (Cleary-Goldman & Robinson, 2017). The modes of delivery were vaginal/spontaneous, vaginal/vacuum, vaginal/forceps, and cesarean. The designation of rural and non-rural counties in Georgia replicates that in the OASIS database.

All statistical analyses were conducted in SAS (9.4). Descriptive analysis was conducted to assess the characteristics of women who gave live birth but received no prenatal care. Multivariable analysis was also performed, controlling for covariates of residence, age, parity, race, education, funding source for the birth, delivery method. Statistical significance was tested at $p=.05$.

Data for All Georgia Women Giving Live Birth

A separate web-based system, the Online Analytical Statistical Information System (OASIS), provided stats on all live births in Georgia. OASIS contains data from the Georgia Department of Public Health's data repository. The standardized health data currently populated with Vital Statistics (births, deaths, fetal deaths, induced terminations, pregnancies), hospital discharge, emergency room visit, arboviral surveillance, youth risk behavior survey (YRBS), behavioral risk factor surveillance survey (BRFSS), STD, motor vehicle crash, and population data ("OASIS Web Query - Maternal Child Health (Birth) Statistics," 2018). OASIS data was used in the study to provide an overview of births in Georgia. It contains data on all mothers who gave birth in Georgia in 2015 and 2016, whether the mother received prenatal care or not and these mothers represent the "Overall Mothers" population. The OASIS data was used to provide an overview of births in Georgia based on the variables of mother's age, race, ethnicity, and county of residence in Georgia.

RESULTS

Table I. Sociodemographic variables of mothers in Georgia who gave birth to a live infant and received no prenatal care and sociodemographic variables of all mothers in Georgia who gave birth to a live infant between 2015 and 2016

Variable (% Unknown for No Prenatal Care Mothers)	No Prenatal Care Mothers, % (CI)	All Mothers, %*
Residence (0%)		
Non-rural	88.48 (87.74 – 89.19)	9.23
Rural	11.52 (10.81 – 12.26)	1.74
Age (0%)		
≤ 19	13.81 (13.04 – 14.61)	6.59
20-24	25.16 (24.19 – 26.14)	23.65
25-29	24.59 (23.62 – 25.57)	29.15
30-34	19.60 (18.71 – 20.51)	25.34
≥ 35	16.84 (16.00 – 17.70)	15.27
Race (1.76%)		
White	44.09 (42.97 – 45.22)	57.06
Black or African American	46.37 (45.24 – 47.50)	34.48
Asian	4.97 (4.49 – 5.49)	4.51
American Indian/Alaska Native	0.22 (0.13 – 0.36)	0.17
Native Hawaiian/Pacific Islander	0.58 (0.42 – 0.78)	0.16
Multiracial	2.00 (1.70 – 2.34)	2.32
Ethnicity (0.79%)		
Not Hispanic or Latino	76.15 (75.18 – 77.11)	85.03
Hispanic or Latino	23.06 (22.12 – 24.02)	13.66
Education (2.87%)		
8 th grade or less	14.04 (13.26 – 14.84)	**
9 th to 12 th grade, no degree	21.10 (20.19 – 22.03)	
High school diploma or GED	35.20 (34.13 – 36.29)	
Some college, no degree	13.92 (13.15 – 14.72)	
Associate's degree	3.67 (3.26 – 4.12)	
Bachelor's degree	6.63 (6.08 – 7.21)	
Master's degree	1.95 (1.65 – 2.28)	
Doctoral degree	0.63 (0.47 – 0.84)	
Funding Source (0.86%)		
Medicaid Managed Care	1.01 (0.80 – 1.26)	**
Blue Cross Blue Shield	0.33 (0.21 – 0.49)	
Tricare	1.46 (1.20 – 1.76)	
Medicaid	59.91 (58.79 – 61.01)	
Commercial Insurance	11.83 (11.11 – 12.57)	
Other/Non-specified managed care	0.01 (0.00 – 0.07)	
Other Government Assistance	0.51 (0.37 – 0.70)	
Other	4.56 (4.11 – 5.06)	
Self-Pay	19.11 (18.23 – 20.02)	
PeachCare	0.41 (0.28 – 0.58)	
Delivery Method (0.20%)		
Vaginal/Spontaneous	70.02 (68.98 – 71.05)	**
Vaginal/Forceps	0.26 (0.16 – 0.41)	
Vaginal/Vacuum	1.25 (1.01 – 1.53)	
Cesarean	28.27 (27.26 – 29.30)	
Parity (2.50%)		
1	27.43 (26.43 – 28.45)	**
2	22.05 (21.12 – 23.00)	
3	17.98 (17.12 – 18.86)	
4	12.30 (11.57 – 13.06)	
5	7.39 (6.81 – 8.00)	
6	10.35 (9.68 – 11.06)	

*No confidence intervals computed due to lack of data

**No data available in OASIS

The OASIS data was used to provide an overview of births in Georgia based on the variables of mother's age, race, ethnicity, and county of residence in Georgia. The GADPH dataset was used to present these variables in addition to education, funding source for birth, delivery method, and parity. Due to data limitations, confidence intervals were unable to be calculated for statistics from OASIS and no chi-squared tests could be run on GADPH and OASIS variables.

The descriptive statistics of mothers who gave birth without receiving prenatal care and all women who gave birth in Georgia to a live infant between 2015 and 2016 are listed in Table I. Data not presented in the table but obtained from the GADPH dataset include the average age of the no prenatal care mothers which was 27.74% (26.36, 29.12) years old. Also not presented is the mean weeks of gestation for the 7,602 live infant births to no prenatal care mothers which was 37.47 (37.55, 37.39) weeks and the mean birthweight was 2996.74 (2979.97, 3013.51) grams.

African American women have the highest percentage of births in the no prenatal care population at 46.37% (45.24 – 47.50) of births and White women have the highest percentage of births in the overall population. For no prenatal care mothers, 23.06% (22.12 – 24.02) of mothers identify as Hispanic or Latino while in the overall population, Hispanic/Latino mothers comprise 13.66% of the population of mothers. The highest percentage of mothers in the no prenatal care group obtained their high school diploma or General Education Degree (GED). Medicaid is shown to comprise 59.91% (58.79 – 61.01) of the funding source for the births from no prenatal care mothers. For mode of delivery, 70.02% (68.98 – 71.05) of no prenatal care mothers had a spontaneous vaginal birth.

Table II. Birth outcomes of preterm birth, low birthweight, and very low birthweight infants among mothers who did not receive prenatal care stratified by sociodemographic variables. Row percentage are presented.

Variable	Birth outcome		
	Preterm Birth (%)	Low birthweight (%)	Very low birthweight (%)
Residence			
Non-Rural	23.86 (21.04 – 26.68)	12.79 (10.57 – 15.00)	6.39 (4.77 – 8.01)
Rural	21.23 (20.25 – 22.21)	12.03 (11.25 – 12.81)	5.20 (4.67 – 5.73)
Age			
≤ 19	24.19 (21.60 – 26.78)	13.81 (11.72 – 15.90)	6.19 (4.73 – 7.65)
20-24	22.95 (21.06 – 24.83)	13.12 (11.61 – 14.60)	5.49 (4.47 – 6.51)
25-29	19.05 (17.27 – 20.83)	10.70 (9.30 – 12.10)	5.03 (4.04 – 6.02)
30-34	19.93 (17.90 – 21.96)	11.01 (9.42 – 12.60)	4.97 (3.86 – 6.07)
≥ 35	22.73 (20.44 – 25.03)	12.58 (10.76 – 14.39)	5.31 (4.08 – 6.54)
Race			
White	17.66 (16.37 – 18.95)	9.13 (8.15 – 10.10)	3.07 (2.49 – 3.66)
Black or African American	26.92 (25.46 – 28.39)	15.89 (14.68 – 17.09)	8.06 (7.16 – 8.96)
Asian	7.41 (4.77 – 10.05)	6.08 (3.69 – 8.49)	1.32 (0.17 – 2.47)
American Indian/Alaska Native	17.65 (0.00 – 35.77)	23.53 (3.37 – 4.37)	0.00
Native Hawaiian/Pacific Islander	20.25 (8.54 – 32.40)	4.55 (0.00 – 10.70)	6.82 (0.00 – 14.27)
Multiracial	21.05 (14.57 – 27.53)	10.53 (5.65 – 15.41)	5.26 (1.71 – 8.81)
Ethnicity			
Not Hispanic or Latino	23.58 (22.49 – 24.67)	13.58 (12.70 – 14.46)	6.20 (5.58 – 6.82)
Hispanic or Latino	15.06 (13.39 – 16.73)	7.47 (6.24 – 8.70)	2.57 (1.83 – 3.31)
Education			
8 th grade or less	13.50 (11.45 – 15.55)	6.37 (4.91 – 7.84)	2.06 (1.21 – 2.91)
9 th to 12 th grade, no degree	24.94 (22.82 – 27.05)	14.40 (12.68 – 16.12)	5.42 (4.32 – 6.53)
High school diploma or GED	23.77 (22.15 – 25.38)	14.05 (12.73 – 15.37)	6.35 (5.43 – 7.28)
Some college, no degree	23.82 (21.25 – 26.39)	13.42 (11.37 – 15.48)	5.77 (4.36 – 7.17)
Associate's degree	16.49 (12.13 – 20.84)	10.04 (6.51 – 13.56)	5.38 (2.73 – 8.02)
Bachelor's degree	15.08 (11.96 – 18.20)	7.14 (4.89 – 9.39)	4.96 (3.06 – 6.86)
Master's degree	10.14 (5.27 – 15.00)	3.38 (0.47 – 6.29)	2.70 (0.09 – 5.32)
Doctoral degree	10.42 (1.77 – 19.06)	4.17 (0.00 – 9.82)	4.17 (0.00 – 9.82)
Funding Source			
Medicaid Managed Care	35.06 (24.41 – 45.72)	20.78 (11.72 – 29.54)	7.79 (1.81 – 13.78)
Blue Cross Blue Shield	48.00 (28.42 – 67.58)	20.00 (4.32 – 3.57)	16.00 (1.63 – 30.37)
Tricare	23.42 (15.54 – 31.30)	11.71 (5.73 – 17.69)	7.21 (2.40 – 12.02)
Medicaid	21.65 (20.46 – 22.85)	12.93 (11.96 – 13.91)	5.64 (4.97 – 6.31)
Commercial Insurance	17.80 (15.30 – 20.30)	9.45 (7.54 – 11.37)	4.89 (3.48 – 6.30)
Other/Non-specified managed care	100.00	0.00	100.00
Other Government Assistance	15.38 (4.06 – 26.71)	5.13 (0.00 – 12.05)	5.13 (0.00 – 12.05)
Other	23.92 (19.43 – 28.41)	12.39 (8.93 – 15.86)	3.17 (1.33 – 5.01)
Self-Pay	21.27 (19.16 – 23.37)	10.67 (9.08 – 12.25)	4.47 (3.41 – 5.54)
PeachCare	32.26 (15.80 – 48.71)	19.35 (5.45 – 33.26)	9.68 (0.00 – 20.08)
Delivery Method			
Vaginal/Spontaneous	18.88 (17.83 – 19.93)	10.69 (9.86 – 11.52)	4.38 (3.83 – 4.93)
Vaginal/Forceps	15.00 (0.00 – 30.65)	5.00 (0.06 – 14.55)	0.00
Vaginal/Vacuum	22.11 (13.76 – 30.45)	10.53 (4.36 – 16.73)	0.00
Cesarean	28.11 (26.21 – 30.01)	15.77 (14.23 – 17.32)	8.05 (6.90 – 9.20)
Parity			
1	21.29 (19.54 – 23.05)	13.29 (11.83 – 14.74)	6.09 (5.06 – 7.12)
2	19.81 (17.90 – 21.72)	10.98 (9.48 – 12.48)	4.89 (3.86 – 5.93)
3	22.09 (19.89 – 24.29)	12.73 (10.96 – 14.50)	4.83 (3.69 – 5.96)
4	20.21 (17.64 – 22.79)	9.09 (7.25 – 10.93)	4.60 (3.26 – 5.94)
5	23.67 (20.15 – 27.18)	11.03 (8.44 – 13.62)	6.76 (4.69 – 8.84)
6 or greater	26.81 (23.72 – 29.91)	16.01 (13.45 – 18.57)	5.46 (3.88 – 7.05)

Table II contains the within-group percentages (commonly called row percentages) of the mothers who did not receive prenatal care as it relates to the birth outcomes of preterm birth, low birthweight, and very low birthweight. Mothers who are younger than 19 had the highest percentages of their births preterm at 24.19% (21.60 – 26.78) in relation to the other age groups. This age group also highest percentage of low birth weight with 13.8% (11.61 – 14.60) and very low birth weight births at 6.19% (4.73 – 7.65). For race, African American mothers had more than double the amount of preterm births 26.92% (25.46 – 28.39) than Asian mothers who had the lowest percentage of preterm births at 7.41% (4.77 – 10.05). Among births to African American mothers, they had the highest proportion of low birth weight births 15.89% (14.68 – 17.09) very low birth weight births, equaling 8.06% (7.16 – 8.96). For the education variable, mothers whose highest education level was 9th to 12th grade with no high school degree had the highest percentage of preterm births. Very low birth weight births were highest in the high school diploma/GED category. Blue Cross Blue Shield, a commercial insurance company, was the payment method used for 48% (28.42 – 67.58) of preterm births. Blue Cross Blue Shield was also the payment method for the highest proportion of low birth weight and very low birth weight births. Most preterm infants born to no prenatal care mothers were delivered vaginally and there were more than double the cesarean deliveries of very low birth weight infants than spontaneous vaginal deliveries of these infants. All levels of parity show similar rates of preterm birth with mothers having 6 or greater pregnancies having the highest percentage of preterm births at 26.81% (23.72 – 29.91). In the no prenatal care population 23.86% (21.04 – 26.68) of non-rural mothers had a preterm birth and 21.23% (20.25 – 22.21) of rural mothers had a preterm birth. The percentages of low birth weight infants (12.79% vs. 12.03%) and very low birthweight (6.39% vs. 5.20%) are similar in the non-rural and rural mothers who did not receive prenatal care.

The logistic regression model testing the effect of a mother's residence on her likelihood of having preterm birth produced an odds ratio of 1.163 (0.985-1.372) with a p-value of 0.075. Multivariable analysis of preterm birth and mother characteristics yielded five statistically significant predictors for preterm birth. These variables were mother's age group, parity, race, education level, and delivery method.

Table III. Results of bivariate analysis of preterm birth and mother characteristics.

Variable	Odds Ratio Estimate (95% CI)	p-value
Age Group	0.965 (0.925 – 1.007)	0.1014
Residence (rural/non-rural)	1.163 (0.985 – 1.372)	0.0754
Parity	1.030 (0.998 – 1.062)	0.0657
Race	1.073 (1.015 – 1.134)	0.0128
Education Level	0.957 (0.925 – 0.991)	0.0129
Funding Source	0.993 (0.979 – 1.007)	0.3474
Delivery Method	1.185 (1.140 – 1.232)	<.0001

Table IV. Results of multivariable analysis of mother characteristics with preterm birth as an outcome.

Variable	Odds Ratio Estimate (95% CI)	p-value
Age Group	1.074 (1.023 – 1.128)	0.004
Residence	0.864 (0.73 – 1.022)	0.0873
Parity	0.950 (0.917 – 0.984)	0.0047
Race	0.918 (0.868 – 0.972)	0.0032
Education	1.045 (1.007 – 1.084)	0.0199
Funding Source	1.003 (0.989 – 1.018)	0.669
Delivery Method	0.832 (0.8 – 0.865)	<.0001

DISCUSSION

Most mothers in the no prenatal care population were in the 25 to 29-year-old age group. The body of literature surrounding prenatal care notes that very young women are most likely to give birth without prenatal care. Women younger than age 20 years becoming pregnant is likely a side effect of ineffective family planning (Braveman et al., 2000) and unplanned or unwanted pregnancies have been shown to affect late initiation of prenatal care or no prenatal care (Johnson et al., 2007).

Finding in this study that African American mothers in Georgia women have the highest percentage of births in the no prenatal care population also reflects findings in the literature. African American women have been highlighted as specific groups for which trends toward more favorable prenatal care use have lagged, particularly for intensive utilization of care (Alexander et al., 2002) and adverse birth outcomes (Cox, Zhang, Zotti, & Graham, 2011). . In the state of Georgia, from 2015 to 2016 the percentage of preterm births among all mothers

(whether they received prenatal care or not) is 1.8% ("OASIS Web Query - Maternal Child Health (Birth) Statistics," 2018). In this investigation, African American mothers in Georgia who received no prenatal care had nearly four times this amount of preterm births. African American mothers also had the highest percentage of very low birth weight births compared to the other races of mothers in the no prenatal care population.

In this study, Medicaid in Georgia is shown to cover nearly 60 percent of deliveries to no prenatal care mothers. In its most recent report, the Department of Community Health in Georgia reports that overall, Medicaid covers approximately 52% of *all* deliveries in Georgia (Fulenwider, 2018). Additional analysis reveals that of the mothers who had no prenatal care and used Medicaid for the delivery of their infant, most were in the 20-24-year-old age group and were African American. White mothers comprised the majority of mothers using Medicaid Managed Care. Hispanic/Latino mothers comprised the highest percentage of self-pay deliveries (results not presented). This investigation reveals that the no prenatal care births that Medicaid pays for in Georgia does not involve the poorest birth outcomes. As discussed before, the expenditure for infants born with the poor outcome of very preterm or with low birth weight can require a longer hospital stay, the performance of medical procedures, and the extended use of healthcare resources (*HCUPnet - Hospital Inpatient National Statistics*, 2014). In this investigation, more than half of all preterm births to no prenatal care mothers were paid for by Blue Cross Blue Shield of Georgia, a commercial insurance company. However, for low birthweight births Medicaid and Blue Cross Blue Shield differ by only 0.78 percentage points for how many low birthweight infant births they paid for. This study also reveals that a large percentage of women who were covered with insurance – Medicaid or Blue Cross Blue Shield, did not receive prenatal care. It has been shown that for low-income women with continuous prenatal coverage, lack of a regular source of care before pregnancy was a significant risk factor for late entry into prenatal care (Braveman et al., 2000). These women could have lacked a regular source of care before conceiving their infant despite having the insurance coverage to see a prenatal care provider.

For Georgia mothers with no prenatal care, the finding that there were more cesarean deliveries of very low birth weight infants than spontaneous vaginal deliveries is reassuring. This is consistent with medical recommendations and convention which hold that low birth weight infants should have a cesarean delivery instead of vaginal. From a clinical standpoint, vaginal

delivery of a low birth weight infant will put pressure on the infant's head which could lead to serious complications or death (Cleary-Goldman & Robinson, 2017). The results showing that cesarean deliveries of preterm infants in no prenatal care women are more common than each type of vaginal delivery can suggest that this method of delivery is the preferred method when a mother with no previous prenatal visits presents to the birthing facility in preterm labor.

The absolute difference of preterm birth rates in rural versus non-rural mothers with no prenatal care is 2.63% and this difference shows no statistical significance at a significance level 0.75 at a significance level of 0.05. For there to be no statistically significant difference or a large absolute difference between preterm birth among rural and non-rural mothers not receiving prenatal care, this may indicate that factors beyond residence affect a mother's likelihood of having preterm birth.

Regression analysis to detect these factors shows that the variables of parity, age group, parity, race, and education were significant factors in the likelihood of a woman with no prenatal care having a preterm birth. This finding goes along with previous research since a mother's age, education level, and race have been proven in various studies to be associated with preterm birth (Cox et al., 2011; Hueston et al., 2008; Johnson et al., 2007; LaVeist et al., 1995). Parity, the mother's number of previous pregnancies, as a covariate is an interesting finding in this investigation as it has not been documented in the literature as being associated with preterm birth, but it has been shown to be linked to a mother not receiving prenatal care. Mothers with more children document that issues with childcare for their other children are a barrier to them receiving prenatal care (Phillippi, 2009). A cross-tab analysis was performed on the variables of parity and mother's age among no prenatal care mothers was performed. Among no prenatal care mothers in Georgia, older women made up the largest proportion of mothers with a parity of 6 or more. Women in the 30 to 34-year-old age group comprised 32.15% and those in the 35 and older group comprised 37.99% of these mothers. Mothers who are in the 10 to 19-year-old age group made up the largest percentage of first-time mothers (31.70%). Mothers with more children also believing that having been through previous pregnancies before, prenatal care is not as important to have. In an interview style study involving women who received varying amounts of prenatal care, statements made by many women across the groups was that prenatal care was most important for a first pregnancy (Poland et al., 1987).

Limitations in this investigation include missing data, lack of a comparison population, and the inability to make causal inferences. Some cases in this study were missing data of varying degrees, as noted in Table I, but there was no missing data to the degree in which the study results were heavily affected. Not having a population to compare the no prenatal care mothers to limits this study in the comparisons that are presented. Being unable to compare OASIS data to data for no prenatal care mothers limits the amount of associations that can be made and the internal validity of comparisons between prenatal care mothers and no prenatal care mothers. In OASIS, the strata for prenatal care include those who received prenatal care or mothers with “late or no care.” This investigation shows that valuable information can be obtained from analyzing mothers who received no prenatal care mothers as an independent population.

Reiterating the value of a comparison population, comparing no prenatal care mothers to prenatal care mothers can increase the validity of the conclusions found in this study since odds ratios on certain outcomes can be generated and chi-squared tests of associations can be done. Additionally, for the education variable mothers are grouped into high school diploma/GED category in OASIS. The educational and life experiences of a woman who receives a high school diploma and one who receives a GED can be different and it is possible that these differing experiences can yield different prenatal care use and birth outcomes. Studying the population of mothers who obtained a high school diploma independently could also yield valuable information. Grouping these mothers with mothers who obtained a GED poses limits on researchers in their ability to examine and comment on the population characteristics and birth outcomes of high school diploma mothers. Finally, the inability to make causal inferences stems from the lack of randomization in this study. Since this study is an observational study and not an experimental one, the associations and relationships described in this investigation are not causal relationships.

CONCLUSION

In conclusion, the purpose of this study was to obtain a characterization of the women who gave birth in Georgia in 2015 and 2016 and did not receive prenatal care. The other aim was to test the hypothesis that there was no difference in preterm birth among rural and non-rural mothers who did not receive prenatal care. Failing to reject this hypothesis and conclude that there is no difference in preterm birth among rural and non-rural mothers shows that this

investigation is similar to the findings of previous prenatal care studies; that a woman's receipt of prenatal care is influenced by a variety of factors. Further research should compare the variables used in this study between no prenatal care mothers and mothers who did receive prenatal care. This can help quantify the difference that prenatal care can make in regard to birth outcomes and the differences between the characteristics of mothers who receive care and those who do not. These findings can be used by the state of Georgia to implement targeted healthcare efforts to the women living and giving birth in the state.

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APPENDIX

I. THE GEORGIA BIRTH WORKSHEET

<https://dph.georgia.gov/sites/dph.georgia.gov/files/Out%20of%20Institution%20Birth%20Packet.pdf>

II. ONLINE ANALYTICAL STATISTICAL INFORMATION SYSTEM

<https://oasis.state.ga.us/>