Original Research

An analysis of Georgia mothers who gave birth in 2015 and 2016 without receiving prenatal care

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ABSTRACT

Background: 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. The association between mother's place of residence (rural/non-rural) and preterm delivery was also examined.

Methods: This study examined data obtained from the Georgia Department of Public Health which includes data for 7,062 mothers who did not receive prenatal care before giving birth to a live infant in Georgia in the years 2015 and 2016. Data on the resulting births was also studied. Descriptive analyses of the following variables were used to characterize mothers not receiving prenatal care: mother's age, race/ethnicity, education level, and county of residence in Georgia. Multivariable logistic regression examined the association between rural and non-rural residence in Georgia and the outcome of preterm birth, controlling for age, race, and education level

Results: From 2015 to 2016 there were a total of 261,273 live births in Georgia, of which 2.91% of births were from mothers who received no prenatal care. Of these infants, 21.53% were born preterm, 12.12% were born low birthweight and 5.34% were born very low birthweight. There was no statistically significant difference observed for preterm births between rural and non-rural mothers who did not receive prenatal care (p= 0.0873).

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

Keywords: prenatal care, rural healthcare, preterm birth, maternal and child health, women's health

INTRODUCTION

Prenatal care is important for the developing fetus and mother, because it encompasses the detection, treatment, and prevention of adverse maternal, fetal, and infant outcomes. Prenatal care also serves as an entry point for physicians to identify and intervene to address risks such as psychosocial stress, detrimental health behaviors such as substance abuse, and adverse socioeconomic conditions (American Academy of Pediatrics Committee on Fetus and Newborn, 2012; Dahlem et al., 2015; Yan, 2017). Due to its many benefits, delaying prenatal care can cause gaps in the information system, and more importantly, in cases of preexisting conditions, or complications, mothers do not get the care they need during pregnancy (Shahin et al., 2020).

A significant amount of research exists that documents factors that act as barriers to receiving prenatal care at the national level (Feijen-de Jong et al., 2012; Alexis Gadson et al., 2017; Lennon et al., 2015; Phillippi, 2009). This body of research identifies these barriers to care as: negative attitudes toward the pregnancy (unplanned pregnancy, consideration of abortion, and unhappiness about the pregnancy), negative attitudes toward prenatal care (going to the emergency room when problems occur, receiving advice about pregnancy from family and friends), and psychosocial stress (stress, depression, and personal problems) (Mazul et al., 2017). These national studies also report that women with illicit drug use, who are younger than 20 years of age, who have had five or more births, and who have less education are populations most at-risk for receiving inadequate levels of prenatal care or none at all (Ayoola et al., 2010; Feijen-de Jong et al., 2012; M. I. Heaman et al., 2015). Certain structural barriers such as insurance/financial constraints, as well as childcare and transportation problems have also been associated with inadequate or no prenatal care (Maureen I. Heaman et al., 2015). Poor patient-provider interaction such as ineffective communication or negative interactions with pregnant women from racial/ethnic minorities is associated with disparities in general health care, including perinatal health care (Dahlem et al., 2015; A. Gadson et al., 2017; Lori et al., 2010; Slaughter-Acey et al., 2013). More specifically,

research documents that previous negative experiences and mistrust in medical providers that some African American women have experienced can lead to a contentious relationship with the healthcare system and can have a detrimental effect on maternal health outcomes that could have been prevented with adequate prenatal care (Shahin et al., 2020).

Intensive prenatal care research at the state and county levels that details which mothers are less likely to receive prenatal care has the potential to reveal valuable information that could be used to inform county, state, and national efforts. A lack of widespread research in this area and thus lack of targeted health care efforts may contribute to the incidence of poor birth outcomes in maternal and infant mortality that many states see. Because of this possibility, the present study serves to add to such a body of research as an in-depth investigation specific to the lack of prenatal care and their birth outcomes at the state level.

Published studies on prenatal care that have focused on the state of Georgia indicate that a maldistribution of obstetricians exists among the urban and rural areas of Georgia and that within Georgia, even if a woman has better spatial access to prenatal care this is not associated with her having an adequate number of prenatal care visits (Pinto et al., 2016; Yin, 2017). Currently, there is no formal publication of an analysis of the demographics of Georgia women who have given live birth without having received prenatal care. Nor does a published study exist which examines birth outcomes of the infants born to Georgia mothers who had no prenatal care. Therefore, the current study sought to investigate the following research questions: 1) What are the characteristics of women who gave birth to a live infant in Georgia in 2015 and 2016, but did not receive prenatal care? and 2) Is rural residency among women who did not receive prenatal care in Georgia in 2015 and 2016 associated with higher rates of preterm birth? We test the null hypothesis that rates of preterm birth among infants born in 2015 and 2016 to mothers who did not receive prenatal care do not differ between mothers who live in non-rural and rural counties in Georgia.

METHODS

Institutional Review Board Approval

Georgia State University's Institutional Review Board approved this research (IRB number: H18285) on January 3, 2018.

Participants/Setting

For the present study, 2015 to 2016 combined data on women who did not receive prenatal care and their infants were obtained from the Georgia Department of Public Health (GADPH), where all vital records (birth and death records) in the state of Georgia are housed. The information a mother provides on a birth worksheet is used to complete and file the official birth certificate of every infant born in Georgia. All new mothers are asked to complete the birth worksheet before being discharged from the birthing facility and administrative staff may assist the mothers in completing the worksheet. The same worksheet is provided across all birthing facilities in Georgia. In the section of the birth worksheet, Mother Stats II, a mother indicates the date of her first prenatal visit or may select "No Prenatal Care," or "Unknown" (*Out of Institution Birth Packet*, 2021).

The GADPH dataset used for this study contains compiled birth worksheet and birth certificate data on 7,602 live births to women who reported no prenatal care. Data obtained from the GADPH that was derived from each birth worksheet includes: mother's age, race/ethnicity, highest educational level, county of residence, funding source for the medical costs associated with delivery, and number of previous pregnancies (including previous terminations of pregnancy). Data obtained from the GADPH that was derived from each infant's birth certificate includes: birthweight, gestational age at birth, and the mode of delivery. Since the birth worksheet data is used to complete the birth certificate, there is some overlap in the information provided in these two documents (e.g., mother's age and race). For the purposes of this study, the data for each mother comes from the birth worksheet and the data for her infant comes from the birth certificate.

A separate web-based system, the Online Analytical Statistical Information System (OASIS), provides statistics on all live births in Georgia. For this study, data from OASIS was used to present only state-wide data for the following information for live births: mother's age, race, ethnicity, county of residence, and the following state-wide data for their infants: low birthweight (LBW), very low birthweight (VLBW), and premature birth rates.

Independent Variables

Age

Mother's age was categorized as less than 19 years old, 20-24 years old, 25-29 years old, 30-34 years old and 35 and older.

Race

Mother's race was categorized into White, Black or African American, Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander, and Multiracial.

Ethnicity

Mother's ethnicity was either Hispanic/Latina or non-Hispanic/Latina.

Education

Education level was categorized as: 8th grade or less; 9th to 12th grade, no degree; High school diploma or General Education Degree (GED); Some college, no degree; Associate degree; Bachelor's degree; Master's degree; and Doctoral degree.

Residence

Mother's residence county was indicated by her reported ZIP code. The designation of rural (less than 35,000

residents) and non-rural counties (more than 35,000 residents) in Georgia replicates that of the OASIS database.

Gravida

The gravida variable is the mother's number of previous pregnancies (including the infant used in the present study). For this study, gravida is based on the mother's self-report on the birth worksheet of previous pregnancies, including any previous terminations or losses of pregnancy.

OASIS data was used to provide a state-level perspective of birth data in Georgia based on the variables of mother's age, race, ethnicity, and county of residence in Georgia.

Dependent Variables

Premature birth

Premature birth was determined using the infant's recorded weeks of gestation. For this study, births that occurred before 37 weeks gestation are classified as a preterm birth . Gestational age data is reported on the infant's birth certificate and for mothers with no prenatal care, it is based on the mother's self-report of her last menstrual period (LMP) and/or physical assessment of the infant by a clinician at birth (Committee on Obstetric Practice et al., 2017).

Birthweight

In this study, a low birthweight (LBW) infant is defined as the infant weighing less than 2,500 grams at birth and a very low birthweight (VLBW) infant is defined as the infant weighing less than 1,500 grams at birth (Cutland et al., 2017).

Method/route of delivery

The routes of delivery were vaginal or Cesarean. Some vaginal birth methods reported were spontaneous or assisted with the use of forceps or vacuum.

Other Variables

Funding source for delivery

The funding source for delivery includes the insurance coverage type or payment method the mother reports using to cover the costs associated with delivering her infant.

Statistical Analyses

All statistical analyses were conducted in SAS (9.4). Descriptive statistics, more specifically prevalence and rates, were generated to assess the characteristics of women who gave live birth but received no prenatal care. Odds ratios were calculated to measure the association between rural residence and the outcome of preterm birth while controlling for confounding factors that were identified through bivariate analyses and confounders previously documented in prenatal care literature. The reference group used in the calculation of odds ratios were mothers who reside in non-rural ZIP codes in the state of Georgia. Statistical significance was tested at p=0.05.

RESULTS

From 2015 to 2016 there were a total of 261,273 live births in Georgia, of which 2.91% were from mothers who received no prenatal care. Of these infants, 21.53% were born preterm, 12.12% were LBW and 5.34% were VLBW. Table 1 lists the descriptive statistics for the independent, dependent, and control variables among the study population of no prenatal care mothers, and these variables among the population of all mothers in Georgia. Table 2 lists the descriptive statistics of the birth outcomes of preterm birth, LBW, and VLBW for the infants born to no prenatal care mothers. Table 3 presents 2015 to 2016 birth outcome data for overall Georgia births. Table 4 presents the unadjusted and adjusted odds ratio estimates for the bivariate and multivariate analyses of residence (rural vs. non-rural) and the outcome of preterm birth.

Table 1 shows that in 2015 and 2016 African American women had the highest percentage of births in the no prenatal care population at 46.37% (45.24 – 47.50) while representing 34.48% of the overall births in Georgia within that time frame. Hispanic or Latina mothers comprised 23.06% (22.12 – 24.02) of the no prenatal care population while representing 13.66% in the overall Georgia births. The education level of most mothers in the no prenatal care population, at 35.20% (34.13 – 36.29), were those who obtained their high school diploma or GED. Medicaid was identified as the payment source for the hospital expenses for 59.91% (58.79 – 61.01) of the mothers who did not receive prenatal care. For mode of delivery, 28.27% (27.26 – 29.30) of the no prenatal care mothers had a Cesarean birth.

Table 2 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, LBW, and VLBW infants. Percentages across rows do not equal 100% because these values represent the prevalence of a birth outcome within a certain group (see Footnote of Table 2 for further explanation). Mothers in the 19 years and younger age group had the highest percentages of their births preterm at 24.19% (21.60 – 26.78). These mothers also had the highest percentages of the birth outcomes of LBW at 13.8% (11.61 – 14.60) and VLBW at 6.19% (4.73 – 7.65). For race, African American mothers had more than double the number 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, these births have the highest proportion of LBW infants at 15.89% (14.68 – 17.09) and VLBW infants at 8.06% (7.16 – 8.96) compared to other races of mothers. For education, mothers whose highest education level was 9th to 12th grade with no high school degree had the highest percentage of LBW infants at 24.94% (22.82 – 27.05). VLBW infants were highest in the high school diploma/GED education level category of mothers.

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 used for the highest proportion of LBW and VLBW infants. Most preterm infants born to no prenatal care mothers were delivered vaginally (a combined percentage of 55.99%). All gravida values show similar rates of preterm birth with mothers having 6 or more reported pregnancies or terminations 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 the births to non-rural mothers were preterm births and 21.53% (20.25 – 22.21) of the births to rural mothers were preterm.

Table 1

Sociodemographic variables of mothers in Georgia who gave birth to a live infant in and received no prenatal care and those for all mothers in Georgia, 2015 – 2016.

Variable (% Unknown)	No Prenatal Care Mothers, % (CI)	All Mothers, %*
Residence (0%)		
Non-rural	88.48 (87.74 – 89.19)	84.61
Rural	11.52 (10.81 – 12.26)	15.39
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%)		
8th grade or less	14.04 (13.26 – 14.84)	
9th to 12th 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 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)	
Gravida (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)	

Note: *No confidence intervals computed due to lack of data
**No data available in OASIS

Table 2

Birth outcomes of preterm birth, low birthweight, and very low birthweight infants born in 2015 and 2016 among mothers who did not receive prenatal care stratified by sociodemographic variables. Row percentages are presented

Variable name	Birth outcome		
	Preterm Birth* (%)	**Low Birthweight (%)**	**Very low Birthweight (%)**
Residence			
Non-Rural	21.23 (20.25 – 22.21)	12.79 (10.57 – 15.00)	6.39 (4.77 – 8.01)
Rural	23.86 (21.04 – 26.68)	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			
8th grade or less	13.50 (11.45 – 15.55)	6.37 (4.91 – 7.84)	2.06 (1.21 – 2.91)
9th to 12th 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 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)

Note: *Preterm birth (a birth before 37 weeks gestation) is generally based on ultrasound dating data that is acquired in the first or second trimester of pregnancy. This data is not captured when a mother does not have prenatal care. In those cases, the obstetric age at birth is based on the mother's self-report of her LMP and/or physical assessment of the infant at birth.

† The row percentage value of 26.92 (25.46 – 28.39) is interpreted as among all births to Black/African American mothers in the no prenatal care population, 26.92% of those births were preterm births.

Table 3
No prenatal care births and all Georgia births for the years 2015 and 2016 stratified by selected birth outcomes

Birth outcome	2015		2016	
	No prenatal care births (%)	All Georgia births (%)	No prenatal care births (%)	All Georgia births (%)
LBW	11.4	9.0	12.7	9.8
VLBW	5.3	1.8	5.4	1.9
Preterm	21.5	10.8	21.6	11.2
C-section rate	27.6	33.6	28.9	33.8

Table 4
Results of the bivariate and multivariate regression analysis for the association between preterm birth and rural residence, 2015 – 2016

Variable	Unadjusted Odds Ratio Estimate (95% CI)	p-value	Adjusted Odds Ratio Estimate (95% CI)	p-value
Preterm birth (2.75%) No preterm birth (8.77%)	1.163 (0.985 – 1.372) 1.00 Referent	0.0754	1.177 (0.966 – 1.354) 1.00 Referent	0.0564 *

Note: *Adjusted based on bivariate analyses and the presence of confounders in the literature. Preterm birth was adjusted for the following confounders: age, race, and education level. *Significant relationships at $p<0.05$ are starred

DISCUSSION

In our study we found that mothers most commonly linked with receiving no prenatal care in Georgia are women aged 20 to 24 years old, of African American/Black race, and with no high school diploma (Feijen-de Jong et al., 2012; A. Gadson et al., 2017). Multivariable regression analysis results in this study are consistent with previous reports that confounding, or outlying factors, exist in the residence and preterm birth relationship where in the present study these include the variables of age, race, and education level (Yin, 2017). The findings also coincide with previous research associating sociodemographic factors such as a mother's age, education level, and race with increased risk of adverse birth outcomes such as preterm birth (Mazul et al., 2017; Yan, 2017). Recalling that these birth outcomes can be monitored and managed on a regular basis with adequate prenatal care, it is likely that the sociodemographic factors leading to adverse birth outcomes also have an effect on the likelihood of receiving adequate prenatal care. This study found that the rate of LBW infants born to African American mothers in Georgia who received no prenatal care are more than four times the overall rate in Georgia. Women of African American race have been highlighted as a specific group with lower rates of utilization of prenatal care, particularly for intensive utilization of care (Alexander et al., 2002; Feijen-de Jong et al., 2012; A. Gadson et al., 2017), which supports the fact that lack of prenatal care can lead to poor birth outcomes.

Thi

s study reveals that the no prenatal care births paid for by Medicaid funding in Georgia does not involve the poorest birth outcomes. The monetary expenditure for infants born with the poor outcomes of either very preterm birth or LBW/VLBW is high. Adequate care of these infants may require a longer hospital stay, the performance of complicated medical procedures, and the extended use of health care resources and staff (Kowlessar et al., 2013), all of which increase medical care costs for either the insurance company or state that provides funding. In this study, 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. The remaining half of no prenatal care mothers used one of the various types of Medicaid coverage, commercial insurance, or government assistance. 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 prenatal care due to lack of insurance or being under-insured before giving birth to their infant, but with Emergency Medicaid available, Medicaid was likely to cover the costs of these types of births.

An interesting finding from this study regarding Cesarean deliveries is that among the no prenatal care mothers, C-section rates were lower in that population compared to Georgia's overall C-section rates (Martin et al., 2018; Martin et al., 2017).

The percentage of preterm births in this data set (21.50% in 2015 and 21.56% in 2016) is significantly higher than the percentage of LBW infants (11.43% in 2015 and 12.72% in 2016) and VLBW infants (5.33% in 2015 and 5.35% in 2016) in this data set. For a mother who receives prenatal care, a premature birth would be based on an ultrasound reading that is generally acquired at or before the 20th week of gestation, while a premature birth for a mother without prenatal care is determined by less reliable last menstrual period (LMP) report and/or physical assessment of the infant (Committee on Obstetric Practice et al., 2017). The discrepancy between preterm birth rates and infant birthweights in the state of Georgia elucidates the utility of prenatal care in providing accurate gestational dating. Accurate dating of gestational age can have large implications on many of the infant health indicators that the state of Georgia uses to monitor its progress with maternal and child healthcare efforts.

Limitations in this investigation include the lack of a comparison population and thus the inability to make causal inferences between the characteristics discovered in our study population and the receipt of prenatal care or certain infant birth outcomes. Not having a comparable population to pair with the variables of interest in the no prenatal care population of mothers limits our ability to make causal inferences. Furthermore, limitations with the OASIS data prevented the calculation of confidence intervals and thus prevented potentially valuable analysis by way of performing chi-squared testing within variable categories. Finally, the inability to make causal inferences also stems from the lack of randomization in this study. Since this study is an observational study and not an experimental one, any associations or relationships described in this investigation are not causal relationships.

CONCLUSIONS

In conclusion, the purpose of this study was to obtain a characterization of the women who gave birth to live infants in Georgia in 2015 and 2016 without having received prenatal care during their pregnancies. The other aim was to test the hypothesis that there was no difference in preterm birth rates among rural and non-rural mothers who did not receive prenatal care. 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 points to factors beyond residence in Georgia influencing a mother's likelihood of having a preterm birth. The authors fail to reject the hypothesis that there is no difference in preterm birth rates among rural and non-rural mothers. The results of this investigation are similar to the findings of previous prenatal care studies; that a woman's receipt of prenatal care is influenced by a variety of factors, especially sociodemographic ones.

RECOMMENDATIONS AND FUTURE IMPLICATIONS

Currently, prenatal care data in the OASIS data repository combines mothers receiving late prenatal care with mothers who received no prenatal care. Our first recommendation is to separate these populations of mothers, as this study reveals the value of investigating mother and infant characteristics specific to the no prenatal care population. The sociodemographic variables used in this study provide a great starting point for comparing characteristics between no prenatal care mothers and mothers who did receive prenatal care.

Future research should exert caution when drawing conclusions specific to preterm births and gestational age. This study has shown the importance of taking into consideration that when studying birth outcomes where there has been no prenatal care (thus no dating ultrasound in the first or second trimester of pregnancy), the complete picture of gestational age is limited and may not be accurate. Our findings suggest that birthweight may be a better proxy for measuring adverse birth outcomes rather than preterm birth.

Once prenatal care data specific to no prenatal care mothers in Georgia is more robust, we recommend further subgroup analysis on birth outcomes. The findings from this study show that relevant subgroups include Georgia's women who are young (less than 20-24 years of age), African American, living in urban counties, and enrolled in Medicaid. With attention and funding directed to innovative efforts, these populations may experience improved access to prenatal care. Such efforts could include, but are not limited to, offering group prenatal care options(Smith et al., 2020) and making the delivery of prenatal care to Georgia women more multidisciplinary by promoting the use midwives and nurse midwives, community health workers (McCray et al., 2020), physician assistants, and other allied health care professionals in the prenatal portion of the perinatal spectrum. Identifying subpopulations at risk can inform policy makers and improve programs to better reach these women (Reyes et al., 2021). With identification as the first step, actionable change is a required next step in closing gaps seen in health care delivery and outcomes.

Making the aforementioned adjustments to the way we collect, analyze and present prenatal care data in Georgia can provide the state with valuable information for decision-making. Findings from studies such as these can be used by the state of Georgia to implement targeted health

care efforts to the women living and giving birth in our state.

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References

Alexander, G. R., Kogan, M. D., & Nabukera, S. (2002, Dec). Racial differences in prenatal care use in the United States: are disparities decreasing? Am J Public Health, 92(12), 1970-1975. https://www.ncbi.nlm.nih.gov/pubmed/12453818

American Academy of Pediatrics Committee on Fetus and Newborn. (2012). Guidelines for Perinatal Care, 7th Edition. https://ebooks.aappublications.org/content/9781581107715/9781581107715

Ayoola, A. B., Nettleman, M. D., Stommel, M., & Canady, R. B. (2010, Mar). Time of pregnancy recognition and prenatal care use: a population-based study in the United States. Birth, 37(1), 37-43. https://doi.org/10.1111/j.1523-536X.2009.00376.x

Braveman, P., Marchi, K., Egerter, S., Pearl, M., & Neuhaus, J. (2000, Jun). Barriers to timely prenatal care among women with insurance: the importance of prepregnancy factors. Obstet Gynecol, 95(6 Pt 1), 874-880. https://www.ncbi.nlm.nih.gov/pubmed/10831984

Committee on Obstetric Practice, American Institute of Ultrasound in Medicine, & Society for Maternal-Fetal Medicine. (2017). Methods for Estimating the Due Date

Cutland, C. L., Lackritz, E. M., Mallett-Moore, T., Bardají, A., Chandrasekaran, R., Lahariya, C., Nisar, M. I., Tapia, M. D., Pathirana, J., Kochhar, S., Muñoz, F. M., & Brighton Collaboration Low birthweight Working, G. (2017). Low birthweight: Case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine, 35(48 Pt A), 6492-6500. https://doi.org/10.1016/j.vaccine.2017.01.049

Dahlem, C. H. Y., Villarruel, A. M., & Ronis, D. L. (2015). African American women and prenatal care: perceptions of patient-provider interaction. Western journal of nursing research, 37(2), 217-235. https://doi.org/10.1177/0193945914533747

Feijen-de Jong, E. I., Jansen, D. E., Baarveld, F., van der Schans, C. P., Schellevis, F. G., & Reijneveld, S. A. (2012, Dec). Determinants of late and/or inadequate use of prenatal healthcare in high-income countries: a systematic review. Eur J Public Health, 22(6), 904-913. https://doi.org/10.1093/eurpub/ckr164

Gadson, A., Akpovi, E., & Mehta, P. K. (2017, 2017/08/01/). Exploring the social determinants of racial/ethnic disparities in prenatal care utilization and maternal outcome. Seminars in Perinatology, 41(5), 308-317. https://doi.org/https://doi.org/10.1053/j.semperi.2017.04.008

Gadson, A., Akpovi, E., & Mehta, P. K. (2017, Aug). Exploring the social determinants of racial/ethnic disparities in prenatal care utilization and maternal outcome. Semin Perinatol, 41(5), 308-317. https://doi.org/10.1053/j.semperi.2017.04.008

Heaman, M. I., Sword, W., Elliott, L., Moffatt, M., Helewa, M. E., Morris, H., Gregory, P., Tjaden, L., & Cook, C. (2015). Barriers and facilitators related to use of prenatal care by inner-city women: perceptions of health care providers. BMC Pregnancy and Childbirth, 15(1), 2. https://doi.org/10.1186/s12884-015-0431-5

Heaman, M. I., Sword, W., Elliott, L., Moffatt, M., Helewa, M. E., Morris, H., Tjaden, L., Gregory, P., & Cook, C. (2015). Perceptions of barriers, facilitators and motivators related to use of prenatal care: A qualitative descriptive study of inner-city women in Winnipeg, Canada. SAGE Open Med, 3, 2050312115621314. https://doi.org/10.1177/2050312115621314

Kowlessar, N. M., Jiang, H. J., & Steiner, C. (2013). Hospital Stays for Newborns, 2011 HCUP Statistical Brief #163. http://www.hcup-us.ahrq.gov/reports/statbriefs/sb163.pdf.

Lennon, S., Londono, Y., Heaman, M., Kingston, D., & Bayrampour, H. (2015). The effectiveness of interventions to improve access to and utilization of prenatal care: a systematic review protocol. JBI Evidence Synthesis, 13(5). https://journals.lww.com/jbisrir/Fulltext/2015/13050/The_effectiveness_of_interventions_to_improve.3.aspx

Lori, J. R., Yi, C. H., & Martyn, K. K. (2010). Provider Characteristics Desired by African American Women in Prenatal Care. Journal of Transcultural Nursing, 22(1), 71-76. https://doi.org/10.1177/1043659610387149

Martin, J. A., Hamilton, B. E., Osterman, M. J. K., Driscoll, A. K., & Drake, P. (2018). Births: Final data for 2016. National Vital Statistics Reports, 67, 69.

Martin, J. A., Hamilton, B. E., Osterman, M. J. K., Driscoll, A. K., & Mathews, T. J. (2017). Births: Final Data for 2015. National Vital Statistics Reports, 66, 70.

Mazul, M. C., Salm Ward, T. C., & Ngui, E. M. (2017, 2017/02/01). Anatomy of Good Prenatal Care: Perspectives of Low Income African-American Women on Barriers and Facilitators to Prenatal Care. Journal of Racial and Ethnic Health Disparities, 4(1), 79-86. https://doi.org/10.1007/s40615-015-0204-x

McCray, G. G., Haynes, B. L., Proeller, A. S., Ervin, C. E., & Williams-Livingston, A. D. (2020). Making the Case for Community Health Workers in Georgia. Journal of the Georgia Public Health Association, 8(1). https://doi.org/10.20429/jgpha.2020.080116

Out of Institution Birth Packet. (2021). Georgia Department of Public Health. https://dph.georgia.gov/document/document/out-institution-birth-packet-pdf/download

Phillippi, J. C. (2009, 2009/05/01/). Women's Perceptions of Access to Prenatal Care in the United States: A Literature Review. Journal of Midwifery & Women's Health, 54(3), 219-225. https://doi.org/https://doi.org/10.1016/j.jmwh.2009.01.002

Pinto, M., Rochat, R., Hennink, M., Zertuche, A. D., & Spelke, B. (2016, Jul). Bridging the Gaps in Obstetric Care: Perspectives of Service Delivery Providers on Challenges and Core Components of Care in Rural Georgia. Matern Child Health J, 20(7), 1349-1357. https://doi.org/10.1007/s10995-016-1995-z

Reyes, A. M., Akanyirige, P. W., Wishart, D., Dahdouh, R., Young, M. R., Estrada, A., Ward, C., Cruz Alvarez, C., Beestrum, M., & Simon, M. A. (2021). Interventions Addressing Social Needs in Perinatal Care: A Systematic Review. Health Equity, 5(1), 100-118. https://doi.org/10.1089/heq.2020.0051

Shahin, Z., Hardwick, I., Jeffery, N., Jordan, J., & Mase, W. A. (2020). Maternal Mortality among African American Women in the State of Georgia, Causes, Policy, and Ethical Considerations. Journal of the Georgia Public Health Association, 8(1). https://doi.org/10.20429/jgpha.2020.080104

Slaughter-Acey, J. C., Caldwell, C. H., & Misra, D. P. (2013, Nov-Dec). The influence of personal and group racism on entry into prenatal care among African American women. Womens Health Issues, 23(6), e381-387. https://doi.org/10.1016/j.whi.2013.08.001

Smith, A. M., Zainab, M., & Lian, B. (2020). Effects of CenteringPregnancy on Pregnancy Outcomes and Health Disparities in Racial Groups versus Traditional Prenatal Care. Journal of the Georgia Public Health Association, 8(1). https://doi.org/10.20429/jgpha.2020.080108

Yan, J. (2017, 2017/08/01). The Effects of Prenatal Care Utilization on Maternal Health and Health Behaviors [https://doi.org/10.1002/hec.3380]. Health Economics, 26(8), 1001-1018. https://doi.org/https://doi.org/10.1002/hec.3380

Yin, P. (2017). Does Better Spatial Access Lead to Better Use of Prenatal Care? A Population Study in Georgia. The Professional Geographer, 1-11. https://doi.org/10.1080/00330124.2017.1385402