Geographic barriers to prenatal care access and their consequences

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BACKGROUND: Although prenatal care has long been viewed as an important strategy toward improving maternal morbidity and mortality, limited data exist that support the premise that access to prenatal care impacts perinatal outcomes. Furthermore, little is known about geographic barriers that impact access to care in an underserved population and how this may influence perinatal outcomes.

OBJECTIVE: This study aimed to (1) evaluate perinatal outcomes among women with and without prenatal care and (2) examine barriers to receiving prenatal care according to block-level data of residence. We hypothesized that women without prenatal care would have worse outcomes and more barriers to receiving prenatal care services.

STUDY DESIGN: This was a retrospective cohort study of pregnant women delivering at ≥24 weeks' gestation in a large inner-city public hospital system. Maternal and neonatal data were abstracted from the electronic health record and a community-wide data initiative data set, which included socioeconomic and local geographic data from diverse sources. Maternal characteristics and perinatal outcomes were examined among women with and without prenatal care. Prenatal care was defined as at least 1 visit before delivery. Outcomes of interest were (1) preterm delivery at <37 weeks' gestation, (2) preeclampsia or eclampsia, and (3) days in the neonatal intensive care unit after delivery. Barriers to care were analyzed, including public transportation access and location of the nearest county-sponsored prenatal clinic according to block-level location of residence. Statistical analysis included chi-square test and analysis of variance with logistic regression performed for adjustment of demographic features.

RESULTS: Between January 1, 2019, and October 31, 2019, 9488 women received prenatal care and 326 women did not. Women without prenatal care differed by race and were noted to have higher rates of substance use (P=.004), preterm birth (P<.001), and longer lengths of newborn admission (P<.001). After adjustment for demographic features, higher rates of preterm birth in women without prenatal care persisted (adjusted odds ratio, 2.65; 95% confidence interval, 1.95−3.55). Women without prenatal care resided in areas that relied more on public transportation and required longer transit times (42 minutes vs 30 minutes; P=.005) with more bus stops (29 vs 17; P<.001) to the nearest county-sponsored prenatal clinic.

CONCLUSION: Women without prenatal care were at a significantly increased risk of adverse pregnancy outcomes. In a large inner city, women without prenatal care resided in areas with significantly higher demands for public transportation. Alternative resources, including telemedicine and ridesharing, should be explored to reduce barriers to prenatal care access.

Key words: access to care, antenatal care, barriers to care, bus routes, geographic mapping, healthcare disparities, inner-city population, perinatal outcomes, prenatal care, preterm birth, public transportation, ZIP codes

Introduction

Prenatal care (PNC) has long been considered of fundamental importance in maintaining a healthy pregnancy. Since the turn of the 20th century, PNC services have been implemented in the hopes of improving maternal mortality and preterm birth rates, low birthweight infants, and infant mortality.[1−6] In 1991, an expert panel on prenatal care convened to define the aims of PNC; this panel recognized several points: (1) the main purpose of PNC is to promote the health of the mother and baby; (2) for this intervention to be effective, it must be easily accessible to all; and (3) PNC serves to provide early and continued risk assessment, promote health, and provide a means for medical and psychosocial interventions, and follow-up as needed.[7] Although intuitive, and encouraged for more than a century, there continues to be limited data to support the premise that access to PNC improves outcomes.

In recent years, concerns for rising maternal morbidity and mortality throughout the United States have led to an increased national focus on maternal health.[8−13] With this heightened awareness, many groups have attempted to analyze how different social determinants of health may increase pregnancy-related morbidity and mortality.[14−18] Race and ethnicity, insurance status, level of education, and location of residence have all been identified as potential socioeconomic factors associated with adverse maternal outcomes. However, limited data are available on the association of these social determinants of health with the access to PNC.

We examined our experience at a large inner-city public hospital system, which provides PNC and delivery services to a medically indigent population within the Dallas County. Historically, approximately 97% of women delivering at our institution have accessed PNC within the system before delivery.[19] This is accomplished by strategically locating 10 women's health centers across more than 900 square miles of Dallas County[1]. These clinics, which are staffed by nurse practitioners and

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AJOG MFM at a Glance

Why was this study conducted?

We hypothesized that women without prenatal care (PNC) would have worse outcomes and more barriers to receiving PNC services.

Key findings

Women without PNC differed by race and had higher rates of substance use, higher rates of preterm birth, and longer lengths of newborn admission. These women lived in areas that relied more on public transportation and required longer transit times to the nearest county-sponsored clinic.

What does this add to what is known?

Women without PNC have an increased risk for adverse perinatal outcomes. Based on block-level data, women without PNC live in areas that have considerably higher demands on public transportation.

resident physicians and supervised by faculty physicians within our institution, perform approximately 80,000 PNC visits yearly and refer to a centrally located maternal-fetal medicine clinic as needed, where an additional 42,000 visits are provided annually.[20]

This study aimed to identify women who delivered at our institution without PNC and to compare their perinatal outcomes and barriers to accessing PNC with those receiving PNC within our system. In addition, local environmental factors were examined to understand the reasons for barriers to obtaining PNC. We hypothesized that women delivering without PNC would exhibit worse perinatal outcomes and increased barriers to accessing care.

Materials and Methods

This was a retrospective cohort study of pregnant women delivering at ≥24 weeks' gestation at a large inner-city public hospital system. This quality assurance initiative was undertaken to identify women seeking delivery services without PNC, hoping to identify ways to improve their access to care and, ultimately, their outcomes. This study was reviewed and approved by our institutional review board.

Data sources were the hospital system electronic health record and the community-wide data initiative (CDI) data set developed and maintained by PCCI, a nonprofit technology and analytics organization affiliated with our institution. The CDI gathers socioeconomic data from diverse sources and organizes and analyzes the data to produce neighborhood indicators of social determinants of health, down to the block level.

For this study, women who delivered at our hospital system from January 1, 2019, to October 31, 2019, at ≥24 weeks' gestation were included. The study period was chosen given the availability of data that would not be influenced by changes in the prenatal schedule and implementation of virtual visits following the COVID-19 pandemic. Women were allocated into the following 2 cohorts: (1) those with PNC established for the current pregnancy and (2) those presenting for delivery without PNC for the current pregnancy. The exclusion criteria were women who delivered within the period following PNC at a local community clinic that did not utilize existing county-sponsored clinic care. For example, hospital employees who received their PNC from a local private physician were excluded to specifically examine the comparison of lack of PNC to county-sponsored services.

To ascertain information from these pregnancies, a stepwise approach was used. All deliveries were queried for prenatal clinic encounters using advanced data analytics within the electronic medical record. PNC was defined as at least 1 completed prenatal clinic appointment before delivery. Gestational age at delivery was determined using the best obstetrical estimate.[21] For those women without evidence of PNC within the system, a manual audit of medical records was performed to look for possible PNC within another local institution. In addition, many iterations of further manual medical record reviews were performed as audits to ensure accuracy of data acquisition.

Once the cohorts were identified, maternal characteristics and perinatal outcomes were examined among women with and without PNC. Primary outcomes of interest were (1) preterm delivery at <37 weeks' gestation, (2) preeclampsia or eclampsia, (3) days in the neonatal intensive care unit (NICU) after delivery. Barriers to care were analyzed using the CDI, including block-level data on household characteristics, public transportation access, and distance from the residence block to the nearest county-sponsored prenatal clinic. Residence blocks were evaluated for transportation time and number of bus stops to the nearest county-sponsored clinic based on public transportation routes. Moreover, mental and behavioral health comorbidities were examined, with a specific focus on substance use disorder, defined as any listed diagnosis of substance use, excluding tobacco use, within 1 year before delivery.

Univariate analyses were performed to compare women with and without PNC using the chi-squared test and analysis of variance for categorical and continuous variables, respectively. Multivariable logistic regression analyses were further performed for adjustment of demographic features and other confounders for perinatal outcomes. A P value of <.05 was considered significant.

Results

Between January 1, 2019, and October 31, 2019, 9488 women (97%) received PNC and 326 women (3%) did not. Maternal demographics and selected perinatal outcomes are listed in Tables 1 and 2. Although most women who delivered were Hispanic in both cohorts, women of African American and White race were in higher proportions within the no PNC group.

TABLE 1
Selected maternal characteristics by access to prenatal care

Characteristic	No PNC n=326	PNC within the healthcare system n=9488	*P* value
Age (y)	27±6	28±7	.24
Race and ethnicity			<.001
Hispanic	210 (64.4)	7299 (76.9)	
Non-Hispanic Black	59 (18.1)	1528 (16.1)	
Non-Hispanic White	43 (13.2)	407 (4.3)	
Other	14 (4.3)	254 (2.7)	
Mental illness	25 (7.7)	655 (6.9)	.59
Substance use	10 (3.0)	96 (1.0)	.004
Public transit time to nearest clinic (min)	42±20	30±17	.005
Number of bus stops	29±16	17±13	<.001

Data are presented as number (percentage) or mean±standard deviation, unless otherwise indicated.

PNC, prenatal care.

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Frequencies of mode of delivery were similar between both the groups. Although frequencies of mental illness did not differ between the groups, those without PNC at delivery had significantly higher frequencies of substance use (*P*=.004). There was no difference in frequencies of preeclampsia with severe features, eclampsia, and intrauterine fetal demise between the 2 groups.

Women without PNC had higher frequencies of preterm birth (*P*<.001 at <37 weeks' gestation; *P*=.002 at <34 weeks' gestation) and delivered low birthweight infants (*P*=.005). Moreover, these infants were noted to have longer lengths of hospital stays (*P*<.001) and more NICU admissions (*P*<.001). After adjustment for demographic features, including age and race, higher rates of preterm birth in women without PNC persisted (adjusted odds ratio, 2.65; 95% confidence interval, 1.95−3.55).

To address the barriers in access to care, home residence locations were mapped using both block-level and ZIP code−level data. Compared with those delivering with PNC, women without PNC were geographically concentrated and resided in areas that differed from those with PNC (Figure 1). Women with no PNC relied more on public transportation by bus and required longer transit times (42 minutes vs 30 minutes; *P*=.005) with more bus stops (29 vs 17 stops; *P*<.001) to the nearest county-sponsored PNC clinic (Figure 2).

TABLE 2
Selected perinatal outcomes by access to prenatal care

Outcome	No PNC n=326	PNC within the healthcare system n=9488	*P* value
Cesarean delivery	53 (16.3)	1444 (15.2)	.61
Gestational age of <37 wk at delivery	57 (17.5)	692 (7.3)	<.001
Gestational age of <34 wk at delivery	16 (4.9)	213 (2.2)	.002
Preeclampsia with severe features	9 (2.8)	207 (2.2)	.48
Eclampsia	1 (0.3)	5 (0.1)	.07
HELLP syndrome	1 (0.3)	4 (0.0)	.02
Intrauterine fetal demise	1 (0.3)	32 (0.3)	.95
1-min Apgar score of ≤3	12 (3.7)	265 (2.8)	.33
Infant birthweight (g)	3033±598	3303±575	.005
Newborn length of stay (d)	3 (2−4)	2 (2−3)	<.001
NICU admission	81 (24.8)	1010 (10.6)	<.001
Neonatal demise	0 (0)	8 (0.1)	.50

Data are presented as number (percentage), mean±standard deviation, or median (interquartile range), unless otherwise indicated.

HELLP, hemolysis, elevated liver enzymes, and low platelet count; *NICU*, neonatal intensive care unit; *PNC*, prenatal care.

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Comment

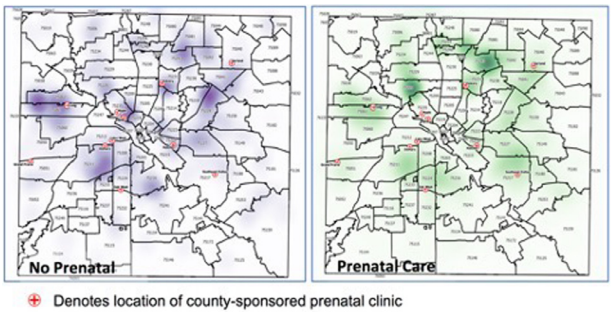
Principal findings

Women delivering without PNC were at a significantly increased risk for adverse pregnancy outcomes and more likely to have longer transit times to prenatal clinics. These women were more likely to have preterm births, and their infants were more likely to have low birthweights and spend longer days in the hospital after birth. Furthermore, women without PNC had significantly higher rates of substance use, were more likely to be African American, and resided in different areas within the Dallas County than those who received PNC. These women were more likely to have higher demands for public transportation and increased geographic barriers to accessing PNC.

Results

Our findings were consistent with arguments used in support of PNC services

FIGURE 1
Home residence distribution by ZIP code for those with and without PNC



The distributions of home residences were mapped by ZIP code throughout Dallas County for patients with and without PNC.

PNC, prenatal care.

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by many in the early 1900s, when the concept of PNC grew in popularity. During this period, the initiation of PNC was thought to impact preterm birth rates, rates of low birthweight infants, and infant mortality rates.[1–4] In more recent years, others have ascribed benefits of PNC, related to reductions in maternal morbidity and mortality from preeclampsia.[5,6] However, the idea that PNC improves outcomes has been challenged by some, given the lack of large, randomized trials and conclusive evidence.[22,23]

The larger proportion of African Americans seen in the group without PNC was an important finding, as significant racial disparities in maternal mortality have been described in the United States within the last decade with non-Hispanic Black women having the highest risk of dying from pregnancy-related complications.[24] Furthermore, recent data from Moaddab et al[25] have demonstrated similar racial disparities, noting a significant increase in maternal mortality for women receiving ≤4 prenatal visits.

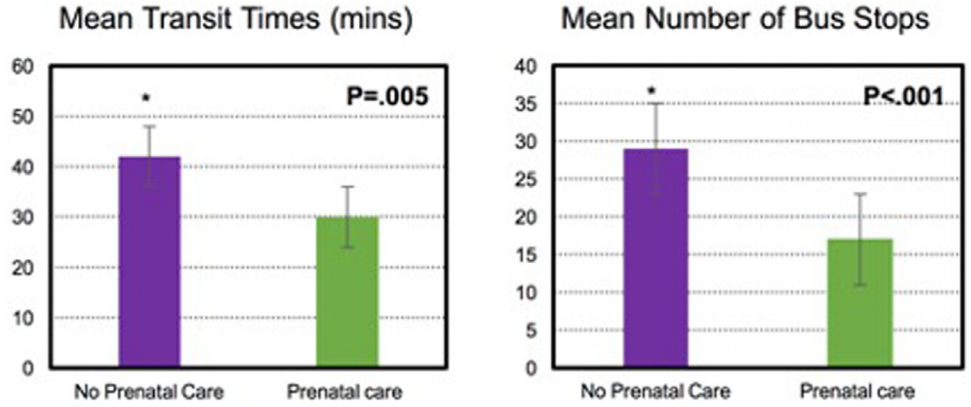
The significantly higher rate of substance use noted in the group without PNC was a relevant finding, as substance use, specifically opiate use disorder, is named as a major risk factor for pregnancy-associated deaths.[26] Furthermore, opiate use disorder in pregnancy has been associated with many adverse perinatal outcomes, including preterm birth, fetal growth restriction, placental abruption, intrauterine fetal demise, and neonatal abstinence syndrome. In addition, others have described the association between substance use in pregnancy and barriers to accessing resources.[27,28] By finding ways to expand access to PNC in these women, we can provide the necessary medical and social services needed to impact outcomes in this special population.

Clinical implications

The overwhelming sense that PNC should be viewed as an intervention that improves maternal morbidity and neonatal outcomes has long impacted public policy. Within the last 2 years, this was noted as PNC coverage increased following Medicaid expansion related to the Affordable Care Act.[29] Our study further supported these ideas by comparing those delivering without PNC with a similar underserved cohort.

Although the included study period was before the onset of the COVID-19 pandemic within the United States, its findings served as a forewarning of the implications of limiting PNC access. In

FIGURE 2
Public transportation transit times and bus stops to nearest clinic



The mean public transportation transit times and number of bus stops from home residence to the nearest county-sponsored clinic were significantly higher for those patients who did not receive prenatal care.

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response to the pandemic, healthcare delivery systems throughout the country have found rapid ways to adapt to the social distancing requirements set forth by governing bodies. Telehealth has taken center stage in all facets of ambulatory medicine, whereas the PNC schedule has been reimagined in obstetrics.[30–34] Some groups even deployed drive-through prenatal clinics to allow for social distancing, before the COVID-19 vaccination, early in the pandemic.[35] As we move past the COVID-19 pandemic, many of the same tools may help improve access to PNC to those who need it most.

Others have previously used survey data to describe patients' perceptions of how transportation is a major barrier to PNC in both low-income and African American groups.[36,37] At our institution, a recent cross-sectional survey revealed that women were enthusiastic about decreased transportation needs with telehealth prenatal visits in response to the COVID-19 pandemic.[20] Unlike these survey studies, our current study qualified where women reside via block-level areas of residence data. Furthermore, our study attempted to quantify transportation barriers, such as public transit times and increased number of bus stops, in those delivering without PNC. Future planning efforts to help increase access to PNC in these women may be tailored toward services such as ridesharing and increasing options such as telemedicine.

Research implications

Here, we compared those receiving at least 1 prenatal visit with those receiving none. Although we believe that receiving at least 1 PNC visit is an opportunity to capture many comorbidities before delivery that may impact severe maternal morbidity and mortality, we acknowledge that naturally one would expect an increasing number of visits to be more valuable than 1 visit. Thus, we believe that future efforts should investigate whether a dosage-response of PNC in urban settings exists. Put another way, understanding how increasing the number of prenatal visits incrementally impact outcomes, would be beneficial moving forward.

We examined block-level data of home residence for women delivering with and without PNC within our inner-city public hospital system, aiming at further defining pregnant women within our community with barriers to care. Furthermore, we attempted to quantify transportation barriers, hoping to find ways to intervene and improve access to care in this population. Future research efforts should pursue quantifying the impact that strategic interventions (ie, additional clinic sites, ridesharing, and telemedicine) would have on access to care and subsequent outcomes. In addition, further investigation should be tailored toward looking at a broader set of confounders, such as socioeconomic variables and ethnic and cultural behaviors that may impact these geographic differences.

Strengths and limitations

This study was limited by its retrospective nature and reliance on documentation in the electronic medical record. Furthermore, data were from a single institution; although it included nearly 10,000 women, it may not be generalizable to the remainder of the US population, given that it was a predominantly Hispanic population. This study was strengthened by its relatively large sample size and availability of detailed demographic and outcome patient-level data. Moreover, this study was strengthened by the availability of block-level data, which allowed for geographic mapping and further analysis of both cohorts from a population health perspective.

Conclusions

This study suggested that in an underserved population, access to PNC before delivery helps improve perinatal outcomes. Moreover, in a large inner-city population, geographic barriers should be targeted to aid in increasing PNC access and potentially improving perinatal outcomes. This information was important for both providers and health policymakers as they consider ways to increase PNC access in the future. ■

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