RESEARCH BRIEF

A Close-up Examination of Racial Disparities in Infant and Maternal Outcomes in Montgomery County, Ohio

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ABSTRACT

Background: Infant and maternal outcomes in Montgomery County, Ohio, are among the worst in the state and rival that of many low-income nations. This study compares maternal and infant outcomes across 3 zip codes in Montgomery County to discern factors that are influencing health outcomes for their residents. The zip codes represent 3 distinct communities with unique racial and socioeconomic makeups.

Methods: A cohort of mother-infant dyads (n=5098) who delivered at Miami Valley Hospital and Good Samaritan Hospital from January 1, 2009, to January 1, 2019, was analyzed via retrospective chart review. Maternal health outcome composite score (MCS) and infant health outcome composite score (ICS) from Trotwood, Ohio, (zip code 45426) were compared to those of 2 nearby zip codes (45415 and 45424), which were chosen for their lower infant mortality rates and proximity to Trotwood. Continuous variables were compared by ANOVA followed by post hoc Tukey tests. Categorical variables were compared via chi-square analysis.

Results: The MCS and ICS were stratified by zip code and maternal age, race, and BMI. There was a statistically significant difference in MCS for race and BMI across all zip codes, but no statistically significant difference for maternal age. There was no statistically significant difference in ICS across maternal age, race, and BMI.

Conclusion: Maternal outcomes for Black women were consistently worse across communities while outcomes for other races varied. Our study shows that maternal outcomes did not correlate with infant outcomes, indicating that interventions focusing on improving maternal outcomes may be inadequate at addressing infant outcomes. Investigations surrounding race-specific interventions in all populations are needed.

Keywords: Race-based disparities; Montgomery County; Maternal morbidity and mortality; Infant morbidity and mortality

INTRODUCTION

Recent state and county public health energy has been focused on improving maternal and infant health outcomes in Ohio. The infant mortality rate (IMR), the number of live born infants who die in the first year of life per 1000 live births, is a strong indicator of the health and well-being of a community.[1] While the IMR in the United States in 2019 was 5.6, the IMR in Ohio during the same year was 6.9 and was even worse in Montgomery County at 9.0.[2,3] Data from Dayton and Montgomery County Public Health in 2019 showed that Trotwood, Ohio, (zip code 45426) had one of the highest IMR (16.8) in the state. These statistics demonstrate the need for significant efforts to improve infant outcomes within Montgomery County and Dayton, Ohio.

The overall IMR in Ohio declined from 2015 to 2019, however the IMR in Montgomery County increased.[4] In 2019, a total of 58 infants in Montgomery County died before their first birthday, resulting in an increased IMR for 2019 compared to prior years. Of these deaths, 69% were neonatal deaths and were more common among Black infants.[4] Unfortunately, racial disparities in infant mortality continue to persist, and in 2019 Black infants in Mont-

gomery County died at a rate nearly double that of White infants, with IMRs of 13.1 and 7.1, respectively.[4]

Maternal morbidity and mortality are other significant indicators of community health. Similar to nationwide trends, Black-identifying mothers in Ohio, from 2016 to 2019, experienced severe maternal morbidity at more than twice the rate of White mothers, with similar trends for pregnancy-related mortality ratio (PRMR) at 29.5 for Black-identifying women and 11.5 for White women from 2008 to 2016.[5] The Ohio Department of Health identified 610 maternal deaths in Ohio, from 2008 to 2018, as temporally related to pregnancy, with 186 (31%) of these deaths determined to be pregnancy-related.[6] The most common causes of pregnancy-related death were cardiovascular and coronary conditions, infection, hemorrhage, preeclampsia and eclampsia, and cardiomyopathy.[5] In Montgomery County, 48 deaths were pregnancy-associated and 12 were pregnancy-related.[5] Of the 4 Ohio counties with 10 or more pregnancy-related maternal deaths, Montgomery County had the highest PRMR at 19.7 deaths per 100 000 live births over the 9-year period.[5]

All neighborhoods are not equally impacted by the ongoing maternal and infant mortality crises. Significant racial differences in outcomes in Montgomery County are consistent with previous literature that has shown Black infants have at least twice the infant mortality rate of White infants.[7] Much of this literature, however, focuses on poor infant and maternal outcomes on the state and national level and may overlook nuances that exist at the community level. This study compares maternal and infant outcomes across 3 zip codes in Montgomery County that represent 3 distinct communities with unique racial and socioeconomic makeups in order to better understand the factors influencing health outcomes for their residents.

METHODS

A retrospective chart review was performed to examine maternal and infant birth outcomes to explore differences within these communities. We evaluated a cohort of women who delivered at Miami Valley Hospital (MVH) and Good Samaritan Hospital (GSH) from January 1, 2009, to January 1, 2019. This period was chosen for convenience as it overlaps with electronic record keeping at these institutions.

Data were extracted from the medical records for mother-infant dyads from Trotwood, Ohio, (zip code 45426) and mother-infant dyads from the 2 comparison zip codes. The comparison zip codes were chosen because they have lower infant mortality rates than Trotwood and, yet, are in close geographic proximity. Zip code 45426 (Trotwood) was chosen given its extremely high IMR of up to 16.8 from 2015-2019. Zip code 45415 (Northview) was chosen given its similar racial composition and geographic location to Trotwood (mostly Black-identifying residents) and had a lower IMR. Zip code 45424 (Huber Heights) was chosen given its different racial composition (mostly White), yet similar socioeconomic composition to zip code 45415 and had a lower IMR.

All pregnancies for each mother during the period of interest were included in the analysis if the mother resided in the zip codes of interest at the time of delivery. Mother-infant dyads were identified by searching for patients by the zip codes of interest and having procedure codes for vaginal delivery or cesarean delivery. Of note, reported race is based on patients' self-selected identity. The authors reviewed the data set to ensure that inclusion/exclusion criteria were met. Inclusion criteria included delivery at MVH or GSH (including transports from outside facilities) and women with a pregnancy resulting in live birth or fetal demise at greater than 20 weeks gestation. Cases were excluded if mother and infants could not be paired. This study was submitted to the institutional review board of Wright State University and determined to be exempt.

An infant health outcome composite score (ICS) was calculated based on the top causes of infant death per the 2019 Ohio Infant Mortality Report which included prematurity, congenital malformations, external injuries, obstetric conditions, and sudden infant death syndrome/perinatal infections.[3] A maternal health outcome composite score (MCS) was calculated based on the US Centers for Disease Control and Prevention definition of severe maternal morbidity and included myocardial infarction, cerebrovascular disease, renal disease, eclampsia, congestive heart failure, pulmonary disease, anesthesia complications, and embolus.[8] Composite scores were calculated by coding each of the above conditions as yes (1, present) or no (0, not present) and summing the number of conditions for each mother and infant. The composite scores (MCS and ICS) were then converted to represent 1 (at least 1 condition present) or 0 (no conditions present) for each mother and each infant, respectively. Adequacy of prenatal care was estimated using the Kotelchuck Index.[9]

Data analysis was performed using SPSS version 27 (IBM, Armonk, NY). For continuous variables, ANOVA was performed followed by post hoc Tukey tests. Categorical variables were compared via chi-square analysis. A p value of < .05 was considered statistically significant.

RESULTS

A total of 5098 mother-infant dyads were eligible and were included in the analysis. Maternal demographic and clinical characteristics by zip code are included in Table 1.

Table 2 shows MCS stratified by zip code and maternal age, race, and BMI. There were no differences in rates of MCS or ICS across zip codes when stratified for maternal age (p = .61 and p = .06, respectively). Rates of MCS were significantly different across zip codes when stratified by race with higher rates of MCS for White women living in Trotwood and Northridge than for White women living in Huber Heights, although Black women had similar rates of MCS regardless of zip code (p = < .001). This pattern was not evident for rates of ICS across the zip codes when stratified by race (p = .43).

Table 1. Maternal Demographic and Clinical Characteristics

	45426 (Trotwood zip code) n = 1473	45415 (Northview zip code) n = 719	45424 (Huber Heights zip code) n = 2906	p
Age at delivery (mean ± SD)	25.42 ± 5.50	27.56 ± 6.06	27.26 ± 5.51	<.001
Gravida	3.08 ± 2.16	2.81 ± 1.97	2.76 ± 1.74	<.001
Para	1.46 ± 1.61	1.20 ± 1.31	1.27 ± 1.32	<.001
BMI	33.95 ± 7.72	33.18 ± 6.88	32.93 ± 7.06	<.001
Race				<.001
Black	83.4% (1228)	52.3% (376)	18.2% (529)	
White	13.2% (194)	43.7% (314)	73.9% (2148)	
Hispanic/Latino	0.5% (7)	0.4% (3)	1.5% (44)	
Non-Black people of color	2.2% (44)	3.2% (23)	6.0% (174)	
Insurance				<.001
Private	23.5% (343)	43.1% (304)	48.3% (1334)	
Public	75.6% (1103)	56.3% (397)	51.1% (1528)	
Other	0.9% (13)	0.6% (4)	0.6% (34)	
Delivery facility				<.001
Miami Valley Hospital	66.3% (977)	63.8% (459)	76.8% (2233)	
Good Samaritan Hospital	33.7% (496)	36.2% (260)	23.2% (673)	
Adequacy of prenatal care				<.001
Adequate	46.6% (686)	53.3% (383)	44.1% (1281)	
Intermediate	12.4% (182)	10.6% (76)	13.5% (392)	
Inadequate	36.0% (530)	28.2% (203)	35.1% (1020)	
Unable to determine	5.1% (75)	7.9% (57)	7.3% (213)	

Rates of MCS were significantly different across zip codes when stratified by BMI category (p = < 0.001). Within zip codes, Trotwood had its lowest rate of MCS among women in the normal BMI category (4.5%; p = .004) and Huber Heights had its highest rate of MCS among women in the class III obesity category (12.7%; p < .001). There were no differences across zip codes for rates of ICS when stratified by BMI category (p = .07), and the only difference within a zip code occurred in Trotwood where the highest rate of ICS (12.0%) occurred among infants born to women in the normal BMI category (p = .004). Rates of MCS did not correlate with rates of ICS (r = .01, p = .48).

DISCUSSION

We found that Black women had the highest rates of MCS regardless of zip code of residence. White women exhibited high rates of MCS only in Trotwood and Northridge, and the highest rate of MCS among White women was still lower than the lowest rate of MCS among Black women. We also found that higher rates of MCS were evident in higher BMI categories. However, higher rates of ICS were seen in women with normal BMI. The MCS among all zip codes, when stratified by race and BMI, was significantly different while ICS stratified by race and BMI was not. Rates of MCS were not associated with rates of ICS.

Although the 3 zip codes differed on socioeconomic level as indicated by higher graduation rates (high school and college), higher median income, and lower unemployment rate (see Appendix for a breakdown of population level demographic information for the individuals residing in these zip codes), Black mothers had consistently poor outcomes in all zip codes, while White women had

poor outcomes only in the zip codes with lower socioeconomic level. Socioeconomic factors such as unemployment rate and food insecurity negatively affect maternal mortality while other socioeconomic factors such as percentage of college educated adults and percentage of owner-occupied homes are protective, although the impact of these varies by race and ethnicity.[10] Our results showed little positive impact on maternal health for Black women living in the higher socioeconomic neighborhoods. Even with a higher percentage of women having private insurance in Huber Heights and no differences in adequacy of prenatal care across the zip codes, outcomes for Black women in Huber Heights did not differ from outcomes for Black women in other neighborhoods. Infant outcomes in Huber Heights were worse for Black infants than any other neighborhood.

These results strongly suggest the influence of other factors, such as experiences of racism or racial isolation occurring in mostly White neighborhoods, that may have a stronger influence on health outcomes than the impact of poverty on health. There is sparse literature exploring the experiences of Black women in predominantly White communities, although what is available suggests that Black women often feel socially and culturally isolated due to differences in race, gender, and difficulty connecting with the local Black community.[11]

It has been well demonstrated in the literature that Black populations are more likely to face poverty, live in violent neighborhoods, have fewer financial resources, and have higher mortality rates from disease.[12] In our study, Trotwood had higher rates of poverty, lower median income, and higher rates of poor maternal outcomes than the 2 comparison neighborhoods similar to the

Table 2. Composite Scores Stratified by Maternal Age, Race, and BMI

	Maternal health outcome composite score (MCS)				Infant health outcome composite score (ICS)			
	45426 zip code	45415 zip code	45424 zip code	P value	45426 zip code	45415 zip code	45424 zip code	P value
Age								
< 35 years	11.5%	10.8%	6.6%	.61	5.1%	3.7%	5.0%	.06
> 35 years	10.7%	8.1%	6.8%		4.9%	7.1%	7.4%	
P value within zip code	1.00	.48	.91		1.00	.17	.08	
Race								
Black	11.9%	11.2%	10.6%	<.001	4.9%	4.8%	6.2%	.43
White	10.3%	9.9%	5.8%		7.2%	3.8%	4.8%	
Hispanic/Latino	0.0%	0.0%	2.3%		0.0%	0.0%	11.4%	
Non-Black people of color	3.0%	4.3%	5.7%		3.0%	0.0%	6.9%	
Unreported	9.1%	33.3%	9.1%		0.0%	0.0%	0.0%	
P value within zip code	.44	.52	.002		.53	.79	.15	
BMI								
< 18.5	--	0.0%	--	<.001	--	0.0%	--	.07
18.5-24.9	4.5%	6.1%	4.8%		12.0%	4.1%	7.0%	
25-29.9	11.6%	8.3%	4.9%		4.6%	4.9%	5.0%	
30-34.9	11.3%	10.1%	6.1%		4.8%	3.5%	5.0%	
35-35.9	9.5%	16.0%	6.3%		3.7%	3.1%	5.6%	
> 40	17.0%	10.9%	12.7%		4.1%	5.9%	4.8%	
P value within zip code	.004	.26	<.001		.004	.88	.69	

Table values represent the percentage of mothers and of infants who had at least 1 condition present.

findings reported in the literature. Of note, infant outcomes were minimally better for Black infants compared to White infants in Trotwood, though both rates remain significantly higher than national and state averages. While clear explanations for this would be beyond the scope of this study, these results may suggest that maternal and/or community resiliency may provide mild blunting or be a protective factor for Black infant health compared to Black maternal health, particularly in regions that are majority Black.[13,14] Additionally, the differential impact of maternal BMI on infant outcomes suggests that higher BMI may also be protective for infant health which is consistent with the 2020 National Vital Statistics report on infant mortality.[12] Nonetheless, this study encourages public health and medical professionals to use caution in assuming that factors impacting Black maternal and infant outcomes are similar/connected, when in fact they are likely complex and require separate attention, research, and resources.

This study is limited by the lack of demographic information such as income and education level for the women included in this study. This information was added from publicly available statistics to summarize the socioeconomic level of each neighborhood to provide context (Appendix). Another limitation of this study was the disproportionate sample size within each zip code. Huber Heights was selected because of the racial diversity of the neighborhood although the larger sample size could have influenced our overall results.

This study demonstrates that poor maternal outcomes for Black women are consistent across neighborhoods that differ by socio-economic level and racial diversity and that poor infant outcomes differed by race and neighborhood. These findings suggest that interventions directed toward improving infant health may not translate into improved maternal health. While efforts to impact racism through the lens of poverty and through the lens of infant outcomes may serve a role in improving maternal health outcomes, this study suggests that experiences of women of color in mostly White communities, regardless of wealth, still result in poor outcomes. Race specific maternal interventions in all populations, regardless of wealth, are needed.

PUBLIC HEALTH IMPLICATIONS

Future research and public health interventions in this region should focus on several key gaps that remain poorly understood in these populations. First, it remains unclear why the infant mortality rates in Trotwood remain higher for White infants than Black infants, though both rates remain unacceptably high. Community-based participatory research that focuses on the outcomes of these groups is needed to do a deeper dive into this phenomenon. Second, ongoing maternal specific interventions are necessary in Ohio to address the ongoing maternal mortality crisis that is being disproportionately experienced by Black women. Third, more investigation and attention are needed on community specific outcomes for non-Black communities of color in Montgomery County. These findings likely highlight the consequences of public health programming that is infant focused with secondary goals of impacting maternal outcomes, a strategy that has been widely used to date to address maternal health outcomes in Ohio.

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APPENDIX.

Descriptive Facts and Figures for the Selected Zip Codes

	45426 (Trotwood)	45415 (Northview)	45424 (Huber Heights)
Zip code			
Total population[a,b]	15 315	12 653	51 344
Black	73.7%	40.0%	14.2%
White	18.6%	54.9%	74.6%
Hispanic	0.9%	1.6%	3.1%
Two or more races	5.0%	3.2%	4.2%
Female[c]	57.5%	48.7%	51.4%
Median age (years)[a]	39.8	44.9	39.1
Median education level (for population 25 years and over)[b]			
High school or higher	90.3%	93.5%	92.7%
Bachelor's degree or higher	16.0%	33.6%	28.2%
Graduate or professional degree	6.4%	12.3%	11.5%
Median income[a]	$35 637	$62 772	$69 452
Living in poverty	26.4%	10.0%	5.8%
Employment status[b]			
Unemployed	7.6%	4.7%	4.7%
Renters[b]	55%	34%	26%
Marital status[b]			
Married	31.5%	43.2%	52.3%
Never married	39.7%	31.8%	29.4%
Infant mortality rate [number of infant deaths per 1000 live births] (2014-2016)[c]			
Black	16.0	6.5	13.8
White	19.0	0.0	3.4

[a]Information collected from https://www.ohio-demographics.com/zip_codes_by_population (Cubit Planning, Inc., 2021).
[b]Information collected from https://www.city-data.com/2000-2020 (Advameg Inc, 2021).
[c]Information collected from https://www.phdmc.org/services/epidemiology (Dayton Montgomery County Public Health, 2021).