Curbing Infant Mortality in the Near East Side of Columbus

Honors Research Thesis

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Abstract
The rate of infant mortality in the United States is higher than most other developed countries. Ohio has second highest infant mortality rate (IMR) in the country, and Franklin County has one of the highest IMRs in Ohio. Moms2B is a pregnancy education and support program that seeks to reduce the IMR throughout Franklin County. The aim of this study was to evaluate the program efficacy of Moms2B's East location. Data collected from Moms2B was compared to data from Columbus Public Health (CPH) on Near East Side births. The data analysis concluded that Moms2B has similar low birth weight rates to that of the Near East Side, but has significantly lower rates of preterm births than in the Near East Side. The data also demonstrates that Moms2B East participants had not experienced infant deaths. Based on these results, this study identifies the need for more comprehensive programs like Moms2B, which aim to help high-risk mothers by targeting and addressing social determinants of maternal and infant health.

Background

Infant mortality is defined as the death of a child under the age of 1 year. The infant mortality rate (IMR) measures the number of deaths of infants under age one, in a given year for every 1,000 live births in the same year. IMR is often used as an indicator of the level of health in a community. Research shows that the IMR in the United States was 5.87 per 1,000 live births in 2015. This places the United States 167th of 224 countries (Central Intelligence Agency, 2013). Although IMR in the United States has declined over the past several decades, Ohio's IMR has plateaued since 1995. Today, Ohio has the second highest IMR among all 50 states. The most current data suggests that Ohio's infant mortality rate is 7.4 deaths per 1,000 live births, meaning that the Ohio IMR remains over 25% higher than the national average (Columbus Public Health, 2012). Franklin County has one of the highest rates of infant mortality in the state of Ohio, and since 1990, the IMR in Franklin County has declined less than 1%. According to the Ohio Department of Health, nearly 155 infants do not live until their first birthday. This places Franklin County's infant mortality rate at 8.3 deaths per 1,000 live births. Leading causes of infant mortality in Franklin County are preterm birth, low birth weight, and Sudden Infant Death Syndrome (SIDS). The county's large racial disparity in IMR is also a point of concern. Since 1995, the IMR for non-Hispanic blacks has been at least twice the IMR for non-Hispanic whites (Columbus Public Health, 2012).

A few organizations have began working to curb the IMR in Franklin County, one of which is Moms2B. Founded in 2010, Moms2B is a program seeking to aid mothers at high risk for infant mortality. Moms2B targets central Ohio zip codes with the highest infant mortality rates, labeled infant mortality hot spots. A map of Columbus's infant mortality hot spots can be seen in the Appendix, under Figure 1. Moms2B provides weekly meetings at four locations: Moms2B Weinland Park at Grace Missionary Baptist Church, Mom2B West at Mount Carmel West Hospital, Moms2B South at John R. Maloney Neighborhood Health Center, and Moms2B East at Ohio State University Hospital-East. These weekly support sessions are aimed to educate high-risk pregnant women, both during pregnancy and through the first year of their child's life. Taking a comprehensive approach, Moms2B works to address some of the social determinants that lead to the high IMR in Franklin County. Moms2B provides education, support, and resources pregnant women need to address issues with housing, finances, food insecurity, stress,

transportation, and more. Moms2B aims to assist expectant mothers in making healthy choices during pregnancy, enabling them to deliver healthy, full-term babies (Moms2B, 2016).

Recently, Moms2B joined Partners for Achieving Community Transformation (PACT). PACT aims to revitalize the Near East Side of Columbus, specifically within the 43203, 43205, and 43211 zip codes (Partners for Achieving Community Transformation, 2012). Moms2B, a member of PACT's Health & Wellness subcommittee, works out of OSU East Hospital on Thursday evenings. As a part of working with PACT, Moms2B wants to analyze their work on the Near East Side of Columbus. The goal of this research is to evaluate Moms2B's effectiveness in curbing infant mortality in the Near East Side of Columbus, an infant mortality hot spot.

Literature Review

Review of the main published work concerning infant mortality is pertinent to this research. A literature review is necessary to answer two principal questions for this research. First, it is necessary to ascertain the prominent causes of infant death in the Unites States. Secondly, it is critical to explain what contributes to the large racial disparities in IMR.

According to research, the primary cause of infant mortality in the United States is preterm birth, classified as birth before 37 weeks of gestation. William Callaghan and his colleagues found that 34.3% of all infant deaths were attributable to preterm birth. They also found that of all of the twenty leading cause categories, ranked by the National Center for Health Statistics (NCHS), eleven were either partially or completely attributable to preterm birth. Of the 10,372 infants who died a death attributable to preterm birth, 9,596 (93.0%) of them were born under 37 weeks of gestation. Callaghan and his colleagues found that more infants die because they were born preterm than any other cause of death (Callaghan et al, 2006). According to research from NCHS, the percentage of preterm births has increased in recent years. From 2000 to 2005, there was a 9% increase in the percentage of preterm births. During that 5 year period, there were increases in the the percentage of very preterm births, defined as births before 32 weeks gestation, and increases in late preterm births, which are births from 34 to 36 weeks of gestation. IMR for late preterm births was three times that of babies carried to term (MacDorman & Matthews, 2008). IMR for very preterm infants was 182.45, which was 76 times the IMR, 2.39, for infants carried to term (Matthews & MacDorman, 2007). Because preterm birth is the most frequent cause of infant mortality and the percentage of preterm births is increasing, programs aiming to curb infant mortality must use strategies to identify, test for, and prevent premature births.

Following preterm births, the second leading cause of infant mortality in the United States is low birth weight. Low birth weight is defined as babies born 2500 grams or less. Very low birth weight is defined as babies born 1500 grams or less. According to data published by the CDC in its National Vital Statistics Report, low birth weight was a major indicator of infant mortality. The findings showed that infants who were born over 2500 grams had an IMR of 2.26, and low birth weight infants had an IMR of 57.64. Very low birthweight infants had an IMR of 244.50, meaning they are at 100 times the risk of infant mortality than normal birth weight babies. More than 85 percent of infants born less than 500 grams died within their first year of life. Infant mortality rates were lowest among infants born between 3,000 and 4,999 grams (Matthews & MacDorman, 2007). Often times, babies born preterm are also born low birth

weight. Attempting to reduce preterm births should also reduce low birth weight births. Programs hoping to decrease infant mortality must try to reduce the occurrence of preterm births and the number of babies born under 2500 grams.

According to the Columbus Public Health Department (CPH), in central Ohio, preterm and low birth weights are the two leading causes of infant mortality, and the third cause is Sudden Infant Death Syndrome (SIDS). Nationwide, SIDS is ranked as the fourth cause of infant mortality; following preterm birth related deaths, low birth weight related deaths, and deaths due to congenital anomalies. SIDS is defined as the sudden death of an infant, younger than 1 year old, that remains unexplained after a thorough case investigation. The case investigation typically includes an autopsy, examination of the scene of death, and review of the infant's clinical history. Though there are no uniform criteria among pathologists to determine a SIDS diagnosis, there are some indicators that occur frequently among SIDS victims. Petechial hemorrhages are found in about 70% to 90% of SIDS cases. Pulmonary edema is also often present amongst SIDS victims (Hunt, 2001). The exact cause of death is unknown in SIDS cases, but there may be an association with abnormalities in the portion of an infant's brain that controls breathing and arousal from sleep. Often SIDS cases are sleep-related infant deaths. Sleep-related deaths can be avoided when babies are put to sleep alone, on their back, and in a crib or bassinet. This is known as the "ABC's of Sleep," an pneumonic device to help remind parents about safe sleep practices: A for alone, B for back, and C for Crib (Columbus Public Health, 2015).

In Franklin County, there were 67 sleep-related infant deaths between 2012 and 2014. This accounted for 14.8% of infant deaths for those 2 years. Of those 67 infants who had sleep related deaths, 67% slept with another child, adult, or pet. Nearly half, 47%, of those infants were sleeping on their side or stomach. Crib use was low amongst the 67 infants who had sleep related deaths; 79% were found sleeping in an adult bed, a couch or chair, or another surface that was not a crib or bassinet. Crib and bassinet availability was not a factor, as 92% of the households where the sleep-related deaths occurred had a crib or bassinet. Seven of the 67 sleep-related infant deaths occurred among infants who slept alone, on their back, and in a crib. Three of those seven infants, 42.9%, slept in a crib with suffocation hazards such as pillows, blankets, small toys, or bumper pads. Six of those seven infants who followed the ABC's of safe sleep, or 85.7%, were exposed to maternal tobacco use or environmental tobacco smoke. Second hand smoking because of maternal smoking and/or environmental tobacco smoke is an identified risk factor for sleep-related infant deaths and SIDS. In Franklin County, 13% of births from 2012-2014 were to mothers who smoked during pregnancy, but among the 67 sleep-related infant deaths, 71% of the infants' mothers smoked during pregnancy (Columbus Public Health, 2015).

African Americans have the highest incidence of preterm deliveries and low birth weight deliveries, consequently they have the highest IMR for any racial or ethnic group in the United States. In Franklin County, the IMR for non-Hispanic blacks is two times greater than the IMR for non-Hispanic whites. This disparity follows nation-wide trends (Columbus Public Health, 2012). Reviewing studies on IMR reveals that there is controversy amongst researchers about the causes of the black-white IMR disparity. In the past, a number of researchers have attributed racial differences in health outcomes to biological and genetic differences between the races. More recent studies have discredited genetic explanations for racial disparities in health. Research conducted by Dr. Richard David Dr. James Collins, two neonatologists in Chicago,

demonstrate that there are not genetic causes for the much higher occurrences of low birth weight among black babies. Their study compared birth weight, of babies born to American black women, to American white women, and to African-born black women in Chicago. Their theory was that if genetic factors were responsible for variances in birth weight between black and white American babies, there would be an even higher likelihood of low birth weight among the infants of African-born mothers; because American blacks have inherited nearly 75% of their genetic heritage from West African ancestors and the rest from European ancestors. David and Collins found that the rate of low birth weight births for African-born black women, 7.1%, was between the rate for US-born white women, 4.3%, and that for US-born black women, 13.2%. These findings challenge the genetic causation theory for racial disparities in IMR, because American black women have a higher likelihood of delivering a low birth weight infant than African black women (David & Collins, 1997). Another study conducted by David and Collins explored the birth weight patterns in the generation after women migrated to the United States. They found that recent European immigrants gave birth to girls of similar birth weight to the girls born to American white families, and these girls grew up to have daughters whose average birthweight was higher than their own. Black African and Caribbean immigrants, on the other hand, gave birth to girls who were heavier than the girls born American black families. Then, those first generation black girls, who grew up in the United States, had daughters whose birth weights were lower on average than their own weights had been at birth. Based on these findings, the authors concluded that genetic factors were not the cause of black-white disparities in infant mortality (David & Collins, 2007).

Though genetic explanations for differences in birth outcomes between black and white infants have been discredited, there is still not a consensus on what causes these disparities. Many in the field of public health attribute the racial disparities in infant mortality to differences in the overall socioeconomic status of white and black Americans. This partly explains racial disputes in IMR. Socioeconomic status is considered by many experts in public health to be a fundamental cause of health disparities, because proximate risk factors have changed over time but the socioeconomic status-health gradient has persisted across time, place, and outcome measures. Proximate determinants have changed over time, but distal socioeconomic causes remain steadily causal. Socioeconomic status has, and continues to influence multiple disease outcomes, through multiple risk factors. Low socioeconomic status is related to numerous mortality risk factors. Examples include unsanitary water supplies, substandard and overcrowded housing conditions, being overweight, smoking, increased stress, occupational health hazards, lacking preventive health care, and social isolation. Low socioeconomic status is closely associated with increased mortality for chronic disease, infectious disease, and injuries. Additionally, the relationship between socioeconomic status and mortality has been reproduced over time. Furthermore, socioeconomic status determines access to resources like wealth, knowledge, power, prestige, and beneficial social networks. These resources can be purposefully used to avoid health risks or to minimize consequences of disease. Evidence for socioeconomic status as the fundamental cause of health disparities can best be seen in preventable disease. As a disease moves from unavoidable to preventable, socioeconomic disparities become substantially more pronounced. As more is known about health risks and protective factors for a disease, those with high socioeconomic status use that knowledge to benefit themselves. Preventable diseases

become diseases of the poor and the socioeconomic status-health gradient increases over time (Phelan et al, 2004). The impact of socioeconomic status on access to prenatal care increases the likelihood of infant mortality amongst the poor. As more is known about prenatal care and its effects on birth outcomes, the socioeconomic disparities in infant mortality rise.

Those in low socioeconomic positions are also at an increased risk for mortality because of the relationship between health behaviors and stress. Those with the fewest socioeconomic resources are the most likely to engage in negative health behaviors. Perceived stress level and poor health behaviors combine to place the socioeconomically disadvantaged at a "double jeopardy" for mortality. Engaging in poor health behaviors, especially smoking and physical inactivity, to cope with high perceived stress actually increases stress levels and they increase the impact of stress on mortality. Moreover, poor health behaviors increased the impact of perceived stress on mortality on those with low socioeconomic status, while not effecting the relationship between unhealthy behaviors and stress moderation in middle and high socioeconomic groups. This is explained by the social vulnerability hypothesis, which states that low socioeconomic groups are especially disadvantaged by the combination of high perceived stress and negative health behaviors, because they have fewer coping resources to maintain health or effectively manage stress (Krueger, 2008). Poor mothers, who cope with stress by smoking cigarettes or engaging in sedentary lifestyles increase their risk of mortality, and this toll on the body subsequently effects birth outcomes.

The socioeconomic-health gradient persists within and between races. Socioeconomic status is highly associated with race because a great deal of economic opportunities are afforded based on the color of a person's skin. Four common measures of socioeconomic status, median income, poverty, educational attainment, and net worth, all rate African Americans below other racial and ethnic groups. Net worth is especially telling; for every $1 white families accumulate, black families accumulate only between 6 and 7 cents (Dominguez, 2010). Net worth involves careful financial decision-making to prompt intergenerational transfer of wealth. This requires institutional support, to which blacks have far less access. Home value is also the largest source of equity for American families, and because of racial residential segregation, the homes of black families are worth much less than property values of white family homes. Consequently, even among those with similar incomes, racial disparities in net worth persist. Racial residential segregation also limits educational and employment opportunities for blacks, perpetuating their lower socioeconomic status (Williams & Collins, 2001).

For the vast majority of diseases and conditions, controlling for socioeconomic status yields far more similar health outcomes between black and white Americans. In the case of infant mortality, controlling for socioeconomic factors only emphasizes racial disparities (Strain et al, 2008). The racial disparities in infant mortality persist when socioeconomic status is accounted for, because of the centuries of socioeconomic subjugation of blacks, and the current institutional obstacles to the social advancement of minority groups. Middle and high economic status was not a possibility for black families until the relatively recent passage of the Civil Rights Act in 1964, which ended segregation in public places and banned employment discrimination on the basis of race. Thus, black families are new members of the middle and upper classes, but whites with similar socioeconomic status may have inherited that socioeconomic status generationally. As such, many black men and women who occupy high socioeconomic positions today have

likely experienced socioeconomic hardships as children. Though relatively recent socioeconomic gains have been made by blacks, they continue to face institutional blocks. For example, blacks on average face higher housing, food, and insurance costs than whites, while earning less than whites of similar educational attainment. Because of the impact of historical and contemporary form of institutional racism, socioeconomic status may not be directly comparable for blacks and whites (Dominguez, 2010).

Studies on infant mortality demonstrate that the racial gap widens amongst those with high socioeconomic status, the stress process model explains much of this paradox. In the study discussed above, David and colleagues studied rates of delivering a low birth weight infant among American born white mothers, American born black mothers, and African born black mothers. When they controlled for social and reproductive risk factors, amongst women who were deemed low risk, the differences between infants of American born whites and the infants of African born blacks in mean birth weight were narrowed, but differences between the infants of American whites and blacks were unchanged. Low risk mothers were those who were between 29 to 39 years old, began prenatal care in the first trimester, had at least 12 years of education, and were married to men who also had at least 12 years of education. They found that regardless of socioeconomic status, and controlling for use of tobacco, illicit drugs, and alcohol, the infants of black women born in Africa weighed more on average than infants of American born black women. Because of this, they conclude that a woman's exposure to poverty and racial discrimination adversely affects the likelihood she will deliver a low birth weight infant (David & Collins, 1997). Another study, by Camara Phyllis Jones, a medical epidemiologist at the CDC, also saw that the IMR gap between blacks and whites widened as education and socioeconomic status were controlled for. The IMR among babies of white mothers with a college degree or higher was 4.0. However, the IMR among babies with black mothers with a college degree or higher is 10.0, almost three times that of their white counterparts. Black mothers with college degree have a higher risk of having their babies die within the first year of life than white mothers without a high school education (Strain et al, 2008). This demonstrates that differences in socioeconomic status alone do not account for racial disparities in infant mortality, rather these differences reflect the larger social significance of race, beyond its economic ramifications.

Chronic stress accounts for the physical toll racism takes on the body. Institutionalized racism throughout the history of this country has forced African Americans to have much higher rates of stress exposure than whites. Racial residential segregation is one of the primary methods of institutionalized racism that has contributed to increased stress exposure for blacks. Residential segregation has legislative origins; it was integral to housing policies of the federal government following the Second World War, and these policies were upheld and enforced by the nation's judicial system. These institutional policies were then supported by most economic establishments, cultural norms, and religious institutions. This has led to a US index of dissimilarity, a measure of segregation, rating of 0.66 in 2000. This means, that 66% of blacks would have to move from their current residences in order to eliminate segregation. This level of black-white segregation has remained largely the same since the 1940s. Residential segregation directly effects educational opportunities available to blacks and whites. It has led to segregated elementary and high school education. Residence is the primary determinant of which public school a child attends, and because funding for public schools is usually gathered through

property taxes, the quality of education for minority students is worse than that of predominantly white schools. The differences in education quality leads to differential employment opportunities between whites and blacks, contributing to differences in SES. Residential segregation also limits employment opportunities for blacks because businesses have increasingly moved away from urban cores, which are occupied by many black families, to suburban, primarily white neighborhoods. The concentration of blacks in primarily poor and urban areas also leaves them at increased exposure to violent crime, and illicit drugs. This has led to the mass incarceration of young black men, often leaving families led by single mothers. Residential segregation has also left blacks with lower access to healthcare facilities, recreational facilities and healthy food stores, because these are more likely to be located in more affluent neighborhoods. Minorities are also more likely to live in substandard housing and more likely to live close to waste processing or chemical waste facilities. In addition, residential segregation limits the social networks of minorities, to others who face similar circumstances and stress burdens (Williams & Collins, 2001). Additionally, racial discrimination is a unique stressor with which racial or ethnic minorities must contend throughout their entire lives. Racism heightens the exposure to, and impact of other types of stressors, like status strains, contextual strains, and role strains (Dominguez, 2010). The increased level of stress due to racism accumulates over the life-course and, places higher allostatic loads on black women. This may eliminate many of the benefits that white counterparts experience as their socioeconomic status improves.

Differential stress exposure among black and white women, throughout their lives and during pregnancy, directly affects the likelihood of delivering preterm and or low birth weight infants, who in turn have lower rates of survival in their first year of life. Racial discrimination acts as a psychosocial stressor that increases the likelihood of preterm births and low birth weight deliveries (Mustillo et al, 2004). Stress directly affects pregnancy in a few ways. Stress hormones are always present, and during pregnancy, when stress hormones reach a certain level, they can induce labor (Dominguez, 2010). Psychological stress can release a corticotropin-releasing hormone, which is associated with delivering preterm (Mustillo et al, 2004). Stress hormones can also inflame the mother's uterine lining to the point where labor is triggered early. Stress can also trigger premature labor because stress hormones can restrict blood circulation to the fetal placenta, which prompts labor (Strain et al, 2008). Dr. Michael Lu, a physician and professor at UCLA, has done extensive studies to demonstrate that racial disparities in birth outcomes are not the result of mother's stress exposure during pregnancy, but rather due to the increased stress exposure black women face over their whole life. The life-course perspective, suggests that black women have poorer birth outcomes because the allostatic load, from life long stress exposure, takes its toll on the reproductive health of black women. Disparities in birth outcomes are the consequences of cumulative allostatic load over the life-course (Lu & Halfon, 2003).

Racial disparities in infant mortality are caused by the effects of racism on minorities. Its' effects are amplified by socioeconomic status, health behavior choices, and stress. Those with low socioeconomic status are at heightened risk of mortality when they choose to engage in poor health behaviors, because they have fewer coping resources to mediate stress and improve health. Past and present institutional racism leads many blacks to feel the burdens of socioeconomic hardship, because it acts as a barrier to heightened socioeconomic status for many

African Americans. Racism has effects beyond its economic ramifications as it is a unique psychosocial stressor. Racial discrimination throughout the life-course, compounded with socioeconomic disadvantages have led to the large racial disparity in infant mortality.

Methodology

In order to track the effectiveness of Moms2B as a program which seeks to curb IMR, Moms2B birth outcomes must be compared with all the birth outcomes in the same area. Because this research is primarily concerned with Moms2B's East location, this is done by comparing the birth outcome data from mothers who attended Moms2B's East sessions to birth outcome data for the Near East Side from Columbus Public Health (CPH). Because they are the leading causes of infant mortality in Columbus, the birth outcome data analysis compares rates of preterm births, low birth weight deliveries and infant deaths.

Trained social workers, nutritionists, and physicians fill out paper charts about Moms2B participants. The chart includes forms about mother's demographics, weight gain through pregnancy, diet through pregnancy, perceived stress, depression pre- and post- delivery, prenatal care, food security, smoking patterns, clinical history, previous pregnancies, and birth outcomes. Attendance is also collected by Moms2B staff at each session. All of the data from the paper charts were entered onto the web data collection site REDCap. Following this data entry, demographic information, birth outcome information, and program attendance were extracted for mothers who attended Moms2B East sessions. The data was de-identified to protect the privacy of program participants and in order to adhere to HIPAA regulations. The demographic data extracted from REDCap for this research includes age of mother, zip code of the mother's residence, mother's race, mother's educational attainment, food insecurity questions, and smoking patterns of the mother. Birth outcome data extracted from REDCap includes baby's gestational age, baby's birth weight, and whether or not breastfeeding was initiated. Moms2B also tracks infant death data. Program data extracted from REDCap, includes number of prenatal sessions the mother attended, and gestational age of the baby during the first session the mother attended. These variables help track frequency of contact Moms2B had with the mother in the program. Missing data variables were left blank. There were available files for 213 moms from Moms2B East, but after removing mothers who we did not have any birth outcome data for, there was a sample size of 127 mothers.

A Columbus Public Health epidemiologist, Anne Trinh collected data on the Near East Side of Columbus and provided it for this research. She provided data on all births and infant deaths in the 43203, 43205, and 43211 zip codes from 2006 to 2015. These zip codes were chosen because PACT defines the Near East Side to include these three zip codes, and because they encompass the Near East Side infant mortality hot spot. We were unable to provide CPH with a list of the mothers who participated in the Moms2B East program because time constraints made obtaining an additional IRB, for this purpose, unviable. To mitigate the effects of this problem, CPH provided data for years 2011 to 2015. Moms2B has only been working in the area since November of 2010, so data was analyzed to track changes to birth outcomes over time, which helps track the impact of the Moms2B program. Data from 2006 to 2010 will be considered pre-Moms2B data and 2011 to 2015 as data including Moms2B mothers. Both of these time periods will be compared to the Mom2B data in order to better capture effectiveness.

CPH also sorted the data by separating Medicaid birth data. The Medicaid population may be a better control group for Mom2B participants, since the two groups are more likely to have similar demographic characteristics. There were some caveats to data retrieval from CPH: first, any indicator with a count of less than 5 must be suppressed, and second any rate with the difference between the numerator and denominator being less than 10 must be suppressed. Unknown data was also left blank. CPH gave us numbers of births and deaths sorted by race. They then provided us with the number of low birth weight babies, and number of preterm births, so proportions were calculated for these figures. The comparison was done using the statistical software JMP 11. First, measures of central tendency were measured for all variables for Moms2B data. Then measures of central tendency were calculated for CPH data, separated by data by time period and Medicaid births. Following these calculations adverse birth outcome rates were compared. Chi-squared tests were used to compare birth outcomes across various categories. A confidence level of 95% was used for these calculations.

Results

Upon completing data analysis for Moms2B East data there were a number of results that were of interest. We had 127 moms for whom we had birth outcome data. The mean age of the 107 Moms2B East mothers for whom we had age data on was 23.83, with a standard deviation of 6 years. The mothers' ages ranged from 14 to 43, and the rate of teen motherhood amongst Moms2B participants is 31.76% (n=34). The most frequent level of educational attainment, amongst the 123 Moms2B East participants we had education data on, was completion of high school (n=42, 34%), and the second most common level of educational attainment was 1-3 years of high school education (n=37, 30%). The majority of the 118 Moms2B East participants, whom we had income data for, were in the lowest average monthly income bracket, of less than $800 per month (n =78, 66%), and the next most frequent level of of average monthly income for Moms2B East moms was $801-&1,100 (n=22, 19%). We only had data for father's involvement for 89 moms, and the father was involved for 82% (n=73) and was not involved in 18% (n=16). We had ethnicity data for 123 moms, and 93% (n = 115) were Non-Hispanic/Latino, while 6% (n=8) identified as either Hispanic or Latino. We were able to gather data on race for 125 of the mothers, 76% of Mom2B east mothers are Black or African American (n=95), 10% are White (n=13), and 7% were Multiracial (n=9). This demographic information demonstrates that Moms2B participants are primarily minority women, of low socioeconomic status.

We had information on gestational age at first prenatal doctor's visit for only 85 moms, much of this data was missing (n =42). The mean gestational age was 11 weeks, with a standard deviation of 5.7 weeks. This is within the first trimester. The mean number of past pregnancies for the 118 moms we had information on was 1.6, with a standard deviation of 2. The mean number of children the 116 Moms2B East participants we had information on was 1.07, with a standard deviation of 1.38. Smoking was measured by three questions: first moms were asked about ever using tobacco, then they were asked about current tobacco use, and then finally they were asked to estimate their level of second hand smoke exposure. We had ever smoked data for 115 moms, and 54% (n=62) had smoked. We had current tobacco use data for 111 mothers: 79% (n=88) did not use at the time, while 21% (n=23) did currently smoke. Only 90 moms provided information about second-hand smoke exposure; the most frequent category was never exposed

(n=28, 31%), but the second most frequent category was exposed all the time (n=20, 22%). Moms2B also collected information on access to food through a food security questionnaire. Mothers were able to rate their experience as often true, sometimes true, or never true in the last 12 months. We had information on 111 moms for the five food security questions. To the first question, "The food that I bought just didn't last, and I didn't have money to get more," the most common response was sometimes true (n=54, 48%). For the second question, "(I/we) couldn't afford to eat balanced meals," the most common response was again sometimes true (n=48, 43%). The third question asked "Did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?" and more moms answered no (n=66, 59%) than yes (n=45, 41%). Next moms were asked "Were you ever hungry but didn't eat because couldn't afford enough food?" again more moms said no (n=69, 63%) than yes (42, 37%). Lastly, moms were asked "In the last 12 months were you ever hungry but didn't eat because you could't afford enough food?" and again moms said no (n=72, 65%) than yes (n=39, 35%). These variables measured some social determinants of maternal and infant health. The smoking data reflected that Moms2B moms do tend to have higher tobacco use, and second hand smoke exposure than is healthy for fetal development. Food security data indicated that many participants lived in food insecure positions.

Next, birth outcome data was analyzed for all Moms2B East. There was only one multiple birth in this group; a mother delivered twins. The average gestational age for 126 births we had data on was 38.89 weeks, with a standard deviation of 1.89. Of those 126 births, 115 (91.2%) were not preterm births, while 11 (8.73%) were preterm. The average birth weight in grams among the 123 babies we had information on was 3088.55 grams with a standard deviation of 590.78 grams. We also calculated that 102 (82.92%) of those babies were not low birth weight, and 21 (17.07%) were low birth weight. We had information on breastfeeding for 113 moms, and 92 of them (81%) did breastfeed. Most importantly, Moms2B reported no infant deaths among their East participants. These are all categorized as good birth outcomes.

Program data information was to estimate frequency of contact between Moms2B and its participants. Information on the gestational age of the baby when the mother first came to Moms2B and attendance was calculated. The mean gestational age for the 103 mothers we had this information for was 24.5 weeks, with a standard deviation of 9.32. Mothers attended an average of 9.11 Moms2B sessions, with a standard deviation of 5.97. Based on other program retention analyses, Moms2B classifies meaningful impact as meeting mothers for at least 3 sessions while pregnant. These program data show that Moms2B had meaningful contact with participants.

Columbus Public Health provided data about all births from 2006 to 2015 from the Near East Side zip codes. The birth outcomes were then broken down by year, and then separated Medicaid mothers from all the births. Data on mother's race was calculated. Of the total 4131 births on the Near East Side from 2006 to 2010, the majority (n= 2917, 70.61%) were Black, followed by White (n=882, 21.35%), then other (n=280, 6.78%), and Hispanic (n=112, 2.71%). During the 2011 to 2015 period, there were a total of 4017 births. The majority of mothers were again Black (n=2740, 68.21%), followed by White (n=904, 22.50%), then other (n=224, 5.58%), and lastly Hispanic (n=149, 3.71%). In the Medicaid population, there were 2719 births from 2006 to 2010. Of those, the majority of mothers were Black (n=2113, 77.71%), then White

(n=361, 13.28%), followed by other (n=195, 7.17%), and then Hispanic (n=50, 1.84%). The Medicaid births from 2010 to 2015 followed this same pattern, with the majority of mothers being Black (n=1764, 74.56%), then Whites (n=412, 17.41%), followed by other (n=124, 5.24%) and Hispanic (n=66, 2.79%). This indicates that Moms2B East participants have a similar racial composition to that of the Near East Side in general. Please refer to Figure 2 and Table 1 in the Appendix for demographic comparisons.

Columbus Public Health also provided proportional data for number of low weight births, preterm births, and infant deaths for the 2006 to 2010 period, and the 2011 to 2015 period. These values were also calculated separately for the Medicaid population. For all 4120 births from 2006 to 2010, 16.28% (n=671) were low birth weight. During the 2011 to 2015 period, 14.71% (n=590) of the 4010 births were low birth weight. Among the Medicaid population, there were 2712 births from 2006 to 2010, and 17.62% (n=478) were low birth weight. From 2011 to 2015 there were 2363 Medicaid births, of which 15.36% (n=363) were low birth weight. Preterm births accounted for 24.02% (n=792) for the 3296 births from 2006 to 2010, and 18.23% (n=731) of the 4009 births from 2011 to 2015. For all 2698 Medicaid births from 2006 to 2010, 19.98% (n=539) were preterm. From 2011 to 2015, there were 2361 Medicaid births, of which 18.34% (n=433) were preterm. During the 2006 to 2010 period, a total of 72 infant deaths occurred in the three Near East Side zip codes; this accounted for 1.7% of the 4131 births from that period. From 2011 to 2015, there were 68 infant deaths, which is 1.69% of all 4017 births. In the Medicaid population, there were 48 infant deaths from 2006 to 2010, this accounted for 1.76% of the 2719 Medicaid births for this period. Infant death data was not available from 2011 to 2015 amongst Medicaid populations. The average infant mortality rate for all Near East Side births was 17.4 from 2006 to 2010, and 16.9 from 2011 to 2015. The average infant mortality rate among Medicaid births on the Near East Side from 2006 to 2010 was 17.62, this value could not be calculated for the 2011 to 2015 period because data on infant deaths in the Medicaid population from 2011 to 2015 was suppressed. A summary of this information is in the Appendix, in Table 2 and in Figure 3.

To compare the birth outcomes across the five comparison categories, chi-square tests were used. The result of the chi-square analysis for low birth weight showed significant difference across the five categories, with a p-value of 0.0237. The contingency table displaying this data can be seen in the Appendix, under Table 3. After performing z-tests, there were not significant differences between Moms2B participants and the other comparison groups. The result of of the chi-square analysis for preterm births showed significant differences among the comparison groups, the p-value is less than 0.001. The contingency table for this comparison can be seen in the Appendix under Table 4. Because of the significant result, I performed z-tests between the Moms2B group and the other four comparison groups. To reduce Type I error, I used 0.0125 as the critical value marking significance. Moms2B had significantly lower rates of preterm births than all four comparison groups. Compared to CPH all-birth data form 2006-2010, Moms2B had a significantly lower rate of preterm births, with a p-value of less than 0.0001. Compared to CPH all birth data form 2011-2015, Moms2B had a significantly lower rate of preterm births, with a p-value of 0.0008. Compared to Medicaid birth data from 2006-2010, Moms2B had a significantly lower rate of preterm births, with a p-value of 0.0002. Compared to Medicaid birth data form 2011-2015, Moms2B had a significantly lower rate of preterm births,

with a p-value of 0.0009. The result of the chi-square analysis for infant death rates was not significant, with a p-value of 0.2156. The contingency table outlining infant death rates across the comparison groups can be seen in the Appendix, under Table 5.

Conclusions

The above results show that Moms2B is effective in its goal to decrease infant mortality. Moms2B had no infant deaths; this is stark compared to the average infant mortality rates in the Near East Side. Moms2B had little effect on increasing birth weight. This is likely tied to mother's food insecurity issues, complications due to hypertension, and tobacco exposure. Moms2B should increase smoking cessation education in their sessions. After comparing the data to all Near East Side births, it is also clear that Moms2B was also very effective in reducing the rate of preterm births. This is likely because Moms2B provides a strong avenue of social support for moms. As the literature review suggested, stress has a large impact on the timing of delivery, and social support has been cited as a way to reduce the effects of stress. Moms2B provides an opportunity for peer connection during weekly meetings, and the staff provides many services. There are Moms2B team members who aid with, or directly provide mental health counseling, aid with contacting doctor's offices and scheduling appointments, contact with WIC office, help with diet and some aid with acquiring food. When moms need it, Moms2B staff also helps with transportation, housing, and a number of other needs through the "pathway" program. This information is helpful is ascertaining the impact of the Moms2B program on the Near East Side, and demonstrates some areas in which Moms2B can improve.

Discussion

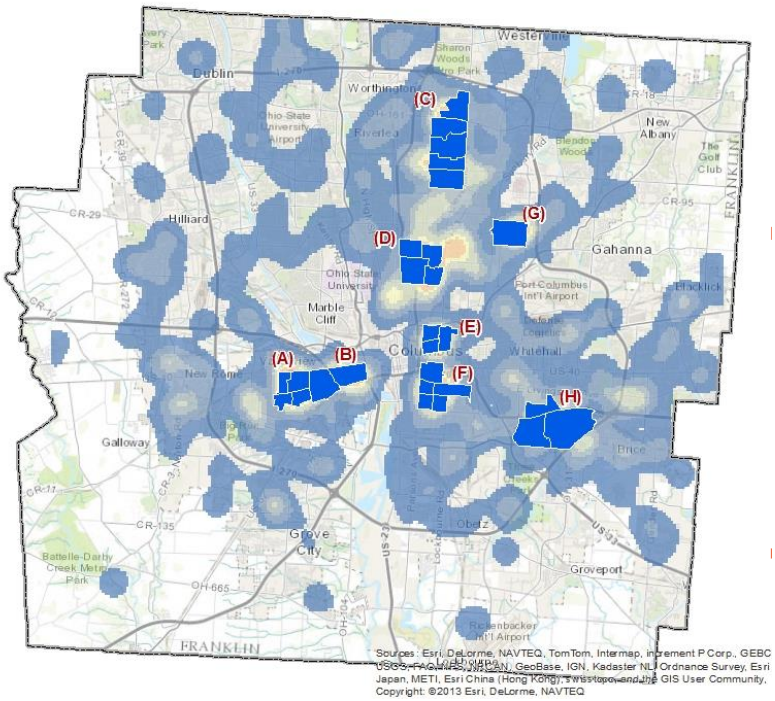
This research is not without limitations. The sample size of mothers in the Moms2B East program is small, and more representative results require larger sample sizes. Additionally, because of time constraints, this project does not have its own IRB; it falls under the IRB of general Moms2B research. Therefore, the data could not be shared with people who do not work for Moms2B. Because of this, identifying information on Moms2B participants could not be shared with the epidemiologists at CPH, and there was no way to extract data from Moms2B participants from the general birth data from the Near East Side. The information from CPH, therefore, represents mothers who have gotten Moms2B services, as well as those mothers who did not enroll in the program. To ameliorate the limitations this creates, CPH data for birth outcomes on the Near East Side of Columbus was analyzed from 2006-2015. Moms2B has only been working in the area since November of 2010, so data was analyzed to track changes to birth outcomes over time, which helps track the impact of the Moms2B program. Future research on this topic will seek to separate the Moms2B participants from the CPH data, in order to form better conclusions on program efficacy. In spite of the limitations, the data has demonstrated the effectiveness of the Moms2B program in curbing infant mortality in the Near East Side of Columbus.This research has wider public health implications. Despite the success of the Moms2B program, there is still a great deal of work to be done to reduce infant mortality in the Near East Side of Columbus, throughout the state of Ohio, and the country. There remains a surplus of women who need pregnancy education and support. This indicates the need for more programs, like Moms2B, that target not only proximate risk factors of infant mortality, but also

address its social determinants. This research also indicates a need for programs that specifically seek to reduce racial disparities in infant mortality.

Programs that seek to reduce racial disparities in infant mortality should be designed around the life-course perspective, which suggests that an infant's health is quite dependent on the health of his or her mother. The life-course model suggests that the increased risk of mortality for black infants is caused by heightened exposures to stress before and during pregnancy, which leads to higher allostatic load in pregnant black women. To address the accumulated allostatic load, programs designed to curb racial disparities in infant mortality should intervene on three levels: the individual, community, and societal. At the individual level, programs should go beyond addressing only access to prenatal care. Programs should strive to improve healthcare for black women throughout their lives, and integrate prenatal care into that continuum of care (Lu et al, 2010). Additionally, programs should target racial disparities in infant mortality at the family and community level. Programs should work to train public health workers from within the community. Community members possess insider knowledge on the health needs, living conditions, culture, and social norms and can use that insight to personalize interventions. They can better recruit and retain members of the at risk community. At the societal level, programs should seek to address fundamental causes, the social and economic inequities, that take a disproportionate toll on the health of black women and their children. Reducing racial residential segregation is a key strategy for this level of intervention. Elimination of racial disparities in infant mortality, and other diseases, is only possible if both proximate and fundamental causes are addressed. This research suggests the need for more programs aiming to, and designed for fixing these large-scale social issues.

Appendix

Figure 1: Map of Columbus Infant Mortality Hot Spots



In the above map, the area marked (E) is the Near East Side

Figure 2: Racial Composition of Comparison Groups

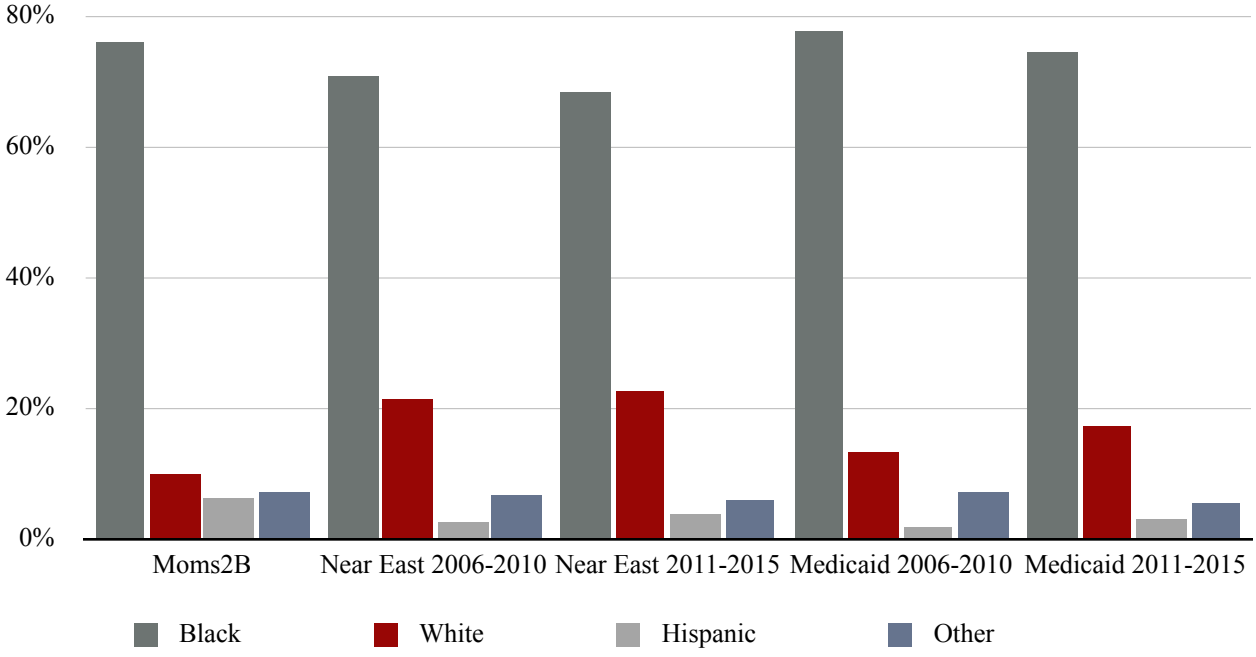


Table 1: Racial Composition of Comparison Groups

	Black	White	Hispanic	Other
Moms2B	76%	10%	6%	7%
Near East 2006-2010	70.61%	21.35%	2.71%	6.78%
Near East 2011-2015	68.21%	22.50%	3.71%	5.58%
Medicaid 2006-2010	77.71%	13.28%	1.84%	7.17%
Medicaid 2011-2015	74.56%	17.41%	2.79%	5.24%

Table 2: Birth Outcome Summary

	Low Birth Weight	Preterm Births	Infant Deaths	IMR
Near East 2006-2010	16.28% (n=671)	24.02% (n=792)	1.7% (n=72)	17.4
Near East 2011-2015	14.71% (n=590)	18.23% (n=731)	1.69% (n=68)	16.9
Medicaid 2006-2010	17.62% (n=478)	19.98% (n=539)	1.76 (n=48)	17.62
Medicaid 2011-2015	15.36% (n=363)	18.34% (n=433)	suppressed	suppressed
Moms2B	17.07% (n=21)	8.73% (n=11)*	0% (n=0)	0

Table 3: Contingency Table for Low Birth

Count Row %	No	Yes	Total
CPH 2006-2010	3449 83.71	671 16.29	4120 30.91
CPH 2011-2015	3420 85.29	590 14.71	4010 30.09
Medicaid 2006-2010	2234 82.37	478 17.63	2712 20.35
Medicaid 2011-2015	2000 84.64	363 15.36	2363 17.73
Moms2B	102 82.93	21 17.07	123 0.92
	11205 84.07	2123 15.93	13328

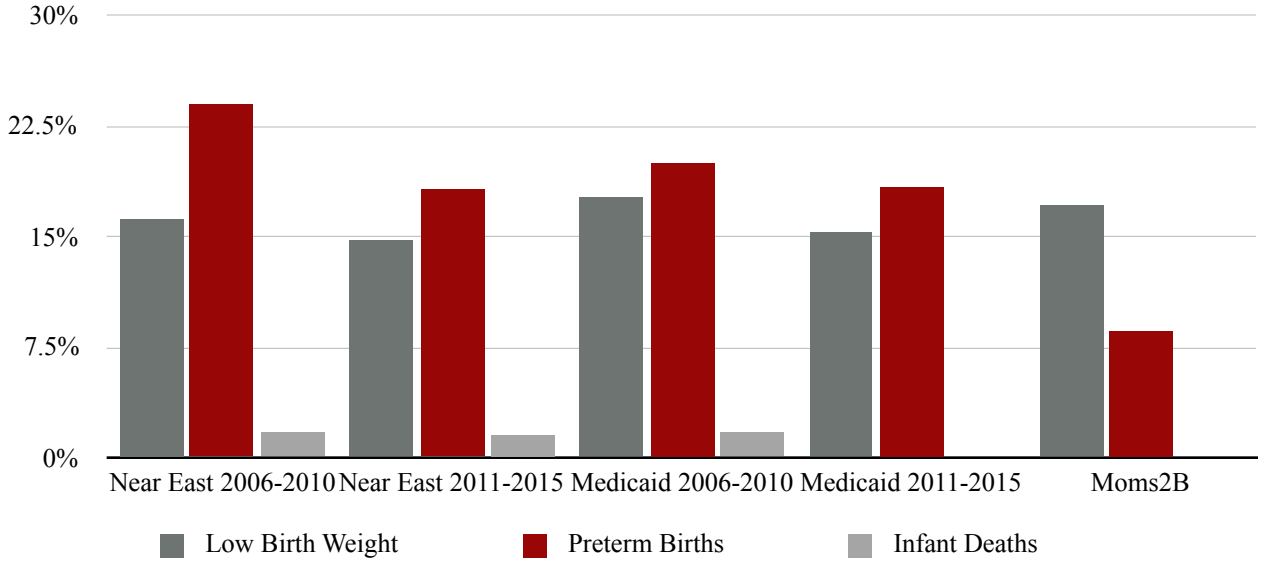
Table 4: Contingency Table for Preterm Births

Count Row %	No	Yes	Total
CPH 2006-2010	2504 75.97	792 24.03	3296 26.17
CPH 2011-2015	3278 81.77	731 18.23	4009 31.83
Medicaid 2006-2010	2265 80.78	539 19.22	2804 22.26
Medicaid 2011-2015	1928 81.66	433 18.34	2361 18.74
Moms2B	115 91.27	11 8.73	126 1.00
	10090 80.10	2506 19.90	12596

Table 5: Contingency Table for Infant Deaths

Count Row %	No	Yes	Total
CPH 2006-2010	4059 98.26	72 1.74	4131 37.58
CPH 2011-2015	3949 98.31	68 1.69	4017 36.54
Medicaid 2006-2010	2671 98.23	48 1.77	2719 24.73
Medicaid 2011-2015			
Moms2B	127 100.0	0 0.00	127 1.16
	10806 98.29	188 1.71	10994

Figure 3: Birth Outcomes Across Comparison Groups



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