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Maternal Characteristics and Neighborhood Characteristics: How do they impact birth-weight and infant mortality?

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Infant mortality is a family tragedy and an index of community health and progress. Infant mortality (death in the first year) remains a serious problem in the US and locally (Kochanek, 2002). High rates of infant mortality suggest poor maternal health care, inadequate access to and utilization of health services, insufficient prenatal care, and other social, economic, and health related factors. Thus, the rate of infant mortality indicates the state of a population. The purpose of this study is to investigate the relationship between individual level characteristics and neighborhood characteristics on infant mortality. Four data sources were compiled to analyze secondary data regarding maternal characteristics, neighborhood characteristics and birth outcomes—birth-weight and infant death. The study population consisted of all live births in specified zip codes within Tarrant County. Neighborhood characteristics from the same areas were also studied. The findings from the study were that there is a significant relationship between some maternal characteristics and neighborhood characteristics on birth-weight; and that the significant relationships on infant mortality are primarily maternal characteristics. Future research should focus on the impact of social support for the pregnant mother.

MATERNAL CHARACTERISTICS AND NEIGHBORHOOD CHARACTERISTICS:
HOW DO THEY IMPACT BIRTH-WEIGHT AND INFANT MORTALITY?

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MATERNAL CHARACTERISTICS AND NEIGHBORHOOD CHARACTERISTICS:
HOW DO THEY IMPACT BIRTH-WEIGHT AND INFANT MORTALITY?

DISSERTATION

Presented to the School of Public Health

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In Partial Fulfillment of the Requirements

For the Degree of

Doctorate of Public Health

By

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CHAPTER 1

INTRODUCTION

Infant mortality is a family tragedy and an index of community health and progress. Infant mortality (death in the first year) remains a serious problem in the US and locally (Kochanek, 2002). Infant mortality is a strong indicator of health, social and economic development of a population (Laveist, 1993; Gortmaker & Wise, 1997). It embodies a “social mirror” of societal inequalities in a population (Wise & Pursley, 1992; Gortmaker & Wise, 1997). High rates of infant mortality suggest poor maternal health care, inadequate access to and utilization of health services, insufficient prenatal care, and other social, economic, and health related factors. Thus, the rate of infant mortality indicates the state of a population.

At the genesis of the twentieth century, the United States had an infant death rate of approximately 100 deaths per 1,000 live births (Healthier Mother and Babies, 1999; Berger, 2001). Infant death rates plummeted progressively in the United States for all racial and ethnic populations. The infant death rate fell from 100 deaths per 1,000 live births in 1915 to 7 deaths per 1,000 live births in 1999 (Healthier Mother and Babies, 1999; Berger, 2001). During the 1995-2002, the overall IMR in the U.S. also declined from 7.6 infant deaths per 1,000 live births in 1995 to 6.8 in 2001, however, infant death slightly rose to 7.0 in 2002 (CDC). Despite this slight increase, the significant reduction of infant mortality is a historical landmark in public health.

The Healthy People 2010 has a goal “to increase the years and quality of healthy life and to eliminate health disparities” (U.S. Department of Health and Services, 2000). Infant mortality is one of the six major objectives in health disparities research (U.S.

Department of Health and Services, 2000). The target rate to eliminate disparities in infant mortality is 4.5 deaths per 1,000 live births. Thus, a further decline of 36% overall is needed to reach the target rate in 2010, and even greater declines are required for certain racial/ethnic populations to reach the target.

Research shows that infant mortality has significantly decreased among all racial and ethnic groups over the past decades. Despite the significant reduction of infant mortality among all racial and ethnic groups, the infant death rate for African Americans is double compared to Whites in the United States. The disparity in infant mortality exists not only among African Americans and Whites, but also among other minority groups such as American Indians and Hispanics.

In a recent report released by the Centers for Disease Control and Prevention's National Center for Health Statistics, it was stated that the overall infant mortality rate has declined by 10 percent since 1995, when the rate was 7.57 per 1,000 live births. However, the rate has not declined much since 2000 when it was 6.89 per 1,000 live births. Three years of data (2002-2004) were combined to get specific estimates of infant mortality rates by state, race and Hispanic origin (Mathews and MacDorman, 2007). Non-Hispanic black women had the highest infant mortality rate in the United States in 2004 – 13.60 per 1,000 live births compared to 5.66 per 1,000 births among non-Hispanic white women. Women of Cuban ethnicity in the United States had the lowest infant mortality rate of 4.55 per 1,000 live births. Other infant mortality rates in the United States broken down by race and Hispanic origin include American Indian (8.45), Puerto Rican (7.82), Mexican (5.47), Asian/Pacific Islander (4.67) and Central/South American (4.65). For multiple births, the infant mortality rate was 30.46, more than five times the

rate of 5.94 per 1,000 live births for single births. The report also finds that infants born at 34-36 weeks gestation had infant mortality rates three times higher than for those born at 37-41 weeks gestation.

In another report examining trends in preterm-related causes of infant death in the United States by maternal race and ethnicity, the Centers for Disease Control and Prevention's National Center for Health Statistics stated that in 2004, 36.5% of all infant deaths in the United States were related to preterm delivery, up from 35.4% in 1999 (McDorman et al, 2007). The preterm-related infant mortality rate for non-Hispanic black mothers was 3.5 times higher and the rate for Puerto Rican mothers was 75% higher than for non-Hispanic white mothers. The preterm-related infant mortality rate for non-Hispanic black mothers was higher than the total infant mortality rate for non-Hispanic white, Mexican, and Asian or Pacific Islander (API) mothers. The report also states that the leveling off of the U.S. infant mortality decline since 2000 has been attributed in part to an increase in preterm and low birthweight (LBW) births. Continued tracking of this group of preterm-related causes of infant death will improve our understanding of trends in infant mortality and perinatal health in the United States.

State Ranges: For the three-year period there were significant differences in infant mortality rates by state, ranging from a rate of 10.32 per 1,000 live births in Mississippi to 4.68 per 1,000 live births in Vermont. For infants of non-Hispanic black mothers, rates ranged from 17.57 per 1,000 live births in Wisconsin to 8.75 per 1,000 live births in Minnesota. For infants of non-Hispanic white mothers, the infant mortality rate ranged from 7.67 per 1,000 live births in West Virginia to 3.80 per 1,000 live births in New Jersey (Mathews and MacDorman, 2007).

Texas/Tarrant County: The infant mortality rate for Texas has shown a gradual increase since 2000 and that for Tarrant County has been fluctuating. The magnitude of the infant mortality rate still poses a significant challenge to society and to the public health system (Tarrant County Infant Mortality Task Force, 2005).

Locally, infant mortality rates continue to be higher for Hispanics and highest for Blacks. To gain additional insight into associated or contributing factors for these disparities, further analyses of infant mortality rates are conducted for neonatal deaths (within the first month of life, <28 days) and post-neonatal deaths (from 28 days to less than a year). Different factors are known to contribute to neonatal and post-neonatal deaths. Heredity, prenatal development, and the birth process are major factors in neonatal deaths. Sudden Infant Death Syndrome (SIDS) and environmental factors such as nutrition, hygiene, and accidents, contribute to post-neonatal deaths. The proportion of neonatal mortality deaths in African Americans (65.7%) was less than the proportions for Whites (74.2%) and Hispanics (71.1%) (Tarrant County Infant Mortality Task Force, 2005).

The primary cause of infant mortality in Tarrant County is prematurity and low birthweight. Approximately 80% of all neonatal deaths in Tarrant County occur within the first week. Neonatal infant deaths are further examined by early neonatal deaths (<7 days) and late neonatal deaths (between 7 and 27 days). Hispanics had the lowest proportion (10.4%) of late neonatal deaths, compared to Whites (13.8%) and Blacks (13.9%). Conversely, Hispanics (60.7%) and Whites (60.4%) had the highest proportions of early neonatal deaths compared to Blacks (51.9%). Infant mortality and morbidity due

to prematurity and low birth-weight result in emotional suffering and significant direct and indirect costs (Tarrant County Infant Mortality Task Force, 2005).

Generally, traditional comparisons of birth characteristics associated with infant mortality were unremarkable and followed historical trends. This included a high correlation between very low birth weight and gestational age and infant deaths. Unlike expected benchmarks however, births to local White teens indicated a substantially higher rate of infant deaths (Tarrant County Infant Mortality Task Force, 2005).

Five hundred and thirty-nine infants died in Tarrant County in 2001-2003 and African American mothers lose more infants than other racial and ethnic groups (Migala, 2004).

CHAPTER 2

LITERATURE REVIEW

Maternal Characteristics

Infant mortality is the death of infants within the first year of life. Infant mortality can be categorized into two types: Neonatal mortality and Postneonatal mortality.

Neonatal mortality is infant death before reaching 28 days of life, and postneonatal mortality is the infant death between 28 days of birth and one year of age (Hessol, Fuentes-Afflick, 2005). The aggregation of these two types constitutes the death rate of infant mortality. Factors associated to racial and ethnic differences in infant mortality are intricate and these factors occurred at multi-levels (e.g. at individual and environmental level). Two-thirds of deaths are due to neonatal mortality and one-third is due to post-neonatal mortality. Causes of neonatal mortality include, but are not limited to, birth defects, preterm births, low birth weight (LBW), very low birth weight, and pregnancy complications (Carmichael, Iyasu, and Hatfield-Timajchy, 1998). Postneonatal death in infancy is most often due to Sudden Infant Death Syndrome (SIDS), injuries, and homicide (Hessol, Fuentes-Afflick, 2005).

While the infant mortality rate has significantly waned among all racial and ethnic groups, very little progress is noted in the infant mortality ratio of blacks versus whites. The infant death rate for African Americans is double in comparison to Whites, with a rate of 14.1 per 1,000 live births among African Americans to 6.8 per 1,000 live births among whites (CDC). Hispanics and Indians have infant death rates of 7.6 per 1,000 live births and 9.0 per 1,000 live births, respectively (CDC). Progress toward abating racial and ethnic disparity in infant mortality has not yet been achieved.

During the 1980s, substantial reductions in infant mortality were achieved through the deployment of specific, largely apolitical healthcare system measures, including high-technology care for low-birthweight and very-low birthweight infants (LeFevre et al. 1992; Palta et al. 1994; Philip 1995; Rosenblatt, Mayfield, and Hart 1991) and public health programs to increase access to prenatal care among disadvantaged communities (Broekhuizen et al. 1993; Clarke et al. 1994; Collins and David 1992; Luke et al. 1993; Schwartz 1990; Tyson et al. 1990).

Using national data, Gortmaker estimated the relative impact of a variety of biological, social, and economic factors upon the risk of infant death. The estimated direct effects of poverty upon infant mortality were larger than the effects of poverty mediated by the birth weight of the infant. The persistence of poverty and the continuing unequal distribution of health care resources to pregnant women and young mothers in the United States imply the reproduction of these differentials to the present day. Increasing access to health services and increased help to families through income supports and employment programs are indicated as possible policy actions to reduce these differentials (Gortmaker, S., 1979.)

In search of a better understanding of the effect of ecological and individual risk factors on infant health for black and white women in a large metropolitan city, researchers examined the association among neighborhood economic indicators, neighborhood quality, access to prenatal care, and individual perinatal risk factors and subsequent birthweight among residents of New York City. Multivariate analyses indicated the continuing importance of factors such as smoking and being uninsured as individual-level risk factors for low-birthweight babies, particularly among black women.

The implications of these findings emphasize the need for socially and ecologically focused policies that can reduce individual-level risks for low birthweight in the future (Jaffee, K. and Perloff, J., 2003).

Lu and Halfon conducted a literature review for longitudinal models of health disparities, and presented a synthesis of two leading models, using a life-course perspective. Disparities in birth outcomes are the consequences of differential developmental trajectories set forth by early life experiences and cumulative allostatic load over the life course.

The life course health development model integrates two complementary mechanisms to explain how different health trajectories develop—*Early Programming Mechanism* and *Cummulative Pathway Mechanism*. The early programming model and the cumulative pathways model are not mutually exclusive. The early programming model emphasizes the importance of sensitive developmental periods in utero or early life during which time internal organs are programmed for reproductive activities in the future. However, it does not thoroughly address the processes of development and decline beyond early life. In contrast, the cumulative pathways model conceptualizes a more gradual decline in reproductive potential. However, it does not thoroughly acknowledge the importance of critical or sensitive periods during the pregnancy (Lu, M. and Halfon, N, 2003).

Exposure and experiences during particular sensitive developmental periods in early life may encode the functions of organs or systems that become manifest in health and disease later in life, according to the early programming mechanism. Systematic differences in experiences and exposures, from conception onward, may thus become

embedded in developmental biology and manifested later in life as socioeconomic gradients or racial—ethnic disparities in health. “Women who report a history of childhood sexual and physical abuse exhibit higher hypothalamic-pituitary-adrenal (HPA) reactivity than do controls, as demonstrated by higher adrenocorticotropin (ACTH) and cortisol response to standardized psychosocial laboratory stressors (Lu, M. and Halfon, N, 2003).”

The cumulative pathway mechanism explores how wear and tear can add up over time to affect health and function. It is logical that differing levels of exposure to damaging physical and social environments at different life stages contributes to poor health conditions. “HPA hyperactivity and immune-inflammatory dys-regulation are two of several possible mechanisms by which chronic and repeated stress over the life course may lead to increased risk for cardiovascular diseases, cancers, autoimmune disorders, and a host of chronic adult diseases that contribute to health disparities (Lu, M. and Halfon, N, 2003).” Allostatic load—the price of adaptation, over the life course, should also affect reproductive health.

McEwen and Stellar presented a new formulation of the relationship between stress and the processes leading to disease. It emphasized the hidden cost of chronic stress to the body over long time periods, which act as a predisposing factor for the effects of acute, stressful life events. They also demonstrated how individual differences in the susceptibility to stress are tied to individual behavioral responses to environmental challenges that are coupled to physiologic and pathophysiologic responses (McEwen and Stellare, 1993). What this means is that when these adaptive systems are turned on and turned off again efficiently and not too frequently, the body is able to cope effectively

with challenges that it might not otherwise survive. However, there are a number of circumstances in which allostatic systems may either be over-stimulated or not perform normally (McEwen and Stellar, 1993).

Allostatic load over extensive periods can lead to disease over the life course. Types of allostatic load include (1) frequent activation of allostatic systems; (2) failure to shut off allostatic activity after stress; (3) inadequate response of allostatic systems leading to elevated activity of other, normally counter-regulated allostatic systems after stress (McEwen and Stellar, 1993).

According to Lu and Halfon, women who are subjected to chronic and repeated stress may respond to stressors during pregnancy with higher output of norpinephrine and cortisol, which could increase corticotrophin-releasing hormone (CRH) leading to preterm labor.

“Higher levels of glucocorticoids can also lead to relative immune suppression, which could increase the likelihood of chronic colonization of the genital tract by pathogens at conception and during early pregnancy. If they are not cleared by midgestation, spontaneous preterm labor or preterm premature rupture of membranes may follow. Alternatively, chronically elevated levels of glucocorticoids can result in loss of HPA counterregulation of the body’s immune-inflammatory response. In response to an infection, excessive amount of proinflammatory mediators is released, which could precipitate preterm labor. Thus vulnerability to preterm delivery may be traced to not only stress and infection during pregnancy, but more important HPA hyperactivity and immune-inflammatory dysregulation that may have been patterned by lifelong exposures to chronic and repeated stress (Lu, M. and Halfon, N, 2003).”

Future research on racial disparities in birth outcomes needs to examine differential exposures to risk and protective factors not only during pregnancy, but over the life course of women (Lu, M. and Halfon, N, 2003).

Neighborhood Characteristics

Socioeconomic status is one of the most well documented social determinants of adverse birth outcomes (Laveist, 1990; Finch, 2003). Extensive research has demonstrated a direct linear relationship between socioeconomic status (SES) and health (Adler et al., 1994; Finch, 2003). However, recent studies are noticing a curvilinear relationship between SES and health—poor health outcomes to increasing SES (Backlund, Sorlie, and Johnson, 1996; Finch, 2003). Studies on SES and health have focused mostly on adults. Finch (2003) analyzed the effects of SES and mortality at the genesis of one's life and the empirical shape of the correlation between SES and infant mortality. Results indicate a curvilinear relationship between income and causal related factors in infant mortality—length of gestation and birth-weight.

Findings from many studies have challenged the notion that the association between SES and health is due largely to the adversities associated with poverty. Instead of revealing a threshold effect, these associations have emerged at every level of the social hierarchy (e.g., the highest social class was shown to be healthier and have lower risks of dying than the next highest group), generating what researchers now refer to as a *social gradient* in health. The Whitehall Study of British Civil Servants demonstrated that the mortality gradient was present even within a relatively homogeneous group: civil servants in one type of occupation (stable office jobs) and one geographical location—London, but in different grades of employment (Marmot et al. 1991, 1992, 1995, 1999). Relationships between SES—measured by occupational class, income or education level,

and health status—have been established for other outcomes, including the infant mortality rate and the prevalence of major chronic diseases (Alder and Ostrove, 1999).

In a study intended to determine the extent to which low infant birth weight intervenes in associations between infant mortality and social and economic characteristics of populations residing in Cleveland neighborhoods, Brooks determined that neonatal and postneonatal mortality rates were strongly determined by low-birth-weight levels. These findings suggest why, despite the dramatic decline in infant mortality in the past century, many studies undertaken in Western Europe and the United States still continue to show a strong inverse relationship between indices of social class and infant loss (Brooks, C. 1980.)

Higher incomes may be a precondition for healthier environments and better health services, given competing demands on resources—this is self-evident at the community or national level but is also likely to hold at the individual level. One study used cross-sectional data from 56 countries. The basic criterion for choice of the countries was the availability of income distribution data. The results for life expectancy at birth suggested that the difference in average life expectancy between egalitarian and a relatively inegalitarian country is likely to be as much as five to ten years. The distribution of income may not be the only factor, of course—inequality in income distribution is likely to be associated with inequality in access to health and social services, in education, and in a number of other aspects of society relevant to mortality (Rodgers, G., 1979.)

Individuals in lower social status groups have the highest rates of morbidity and mortality within most human populations. Moreover, studies of the entire SES hierarchy show that differences in social position relate to morbidity and mortality even at the upper levels of the hierarchy. This observation calls into question traditional explanations for the relationship between SES and health, which pertain primarily to the lower SES levels and the health effects of poverty. As a first step in increasing our understanding of the SES gradient, SES should be examined in terms of a set of variables beyond the standard SES indicators. On the basis of existing studies, the authors suggested several domains of such factors, which include health behaviors, psychological factors, and perceptions of social ordering (Adler, N. et al, 1994). Variables in the physical and social environments, such as crowding, pollution, and access to health care, should also be included (Stokols, 1992).

Researchers found that community socioeconomic factors account for large observed variations in infant and working-age mortality, but especially working-age mortality for the black population. For black men, the mortality consequences of living in economically distressed communities were quite severe. Segregation effects on mortality are more modest and largely operate through neighborhood socioeconomic conditions, although some direct effects of segregation on mortality for blacks are apparent (Guest, Almgren, and Hussey, 1998).

Finch determined that absolute material conditions are the most important determinants of socioeconomic effects on the risk of infant mortality and that while poverty has the most pronounced effect on risk, income is decreasingly salutary across the majority of the mortality gradient. He determined that income is significantly related

to all-cause infant mortality in a curvilinear relationship that indicates that additional income above a given threshold no longer has salutary effects. Furthermore, income inequality is unrelated to the probability of dying during infancy (Finch, 2003).

A recent study examined whether there is a correlation between high-poverty (below the poverty threshold) and infant mortality rates across racial and ethnic groups in large urban areas (Sims, Sims, Bruce, 2007). Prior to this research, no empirical evidence was available to assess the relationship between high poverty and infant mortality across racial and ethnic populations. Results of this study revealed an association between high-poverty and infant mortality in Black-White, Latino-White, and Asian-White comparisons. However, Howell, Pettit, and Kingsley (2005) reported that the rate of birth to teenagers, late prenatal care, low birth weight, and infant mortality has declined in high-poverty neighborhoods. Despite this improvement, extensive prevention efforts are needed to sustain the reduction of maternal and infant mortality. O'Campo et al. (1997) reported that women who reside in a high-risk or poor neighborhood often initiate late prenatal care or do not receive adequate prenatal care, even after adjusting controlling for maternal risk (Perloff, Jafee, 1999).

The state of a neighborhood is a strong predictor of health outcomes, particularly birth outcomes. Poverty, socioeconomic status, and residential segregation strongly influence birth outcomes. Early research in infant mortality focused on individual factors (such as smoking, prenatal care, parity, and age). Emerging research in infant mortality shifted the focus from investigating individual factors to social and ecological factors (such as neighborhoods).

African Americans often live in high-poverty neighborhoods despite changes in socioeconomic status. Jargowsky (1997) reported that the prevalence rate of African American living in extreme poverty neighborhoods was proliferated between 1980 and 1990. It is estimated that 50% of those living in impoverished neighborhoods were non-Hispanic blacks. Consequently, they were at higher risk of poor health outcomes than other racial and ethnic groups (Laveist, 1989; Palpacek, 1996).

The effect of impoverished and non-impoverished neighborhood on health outcomes is well documented. Research concluded that a correlation exists between residential segregation and infant mortality (Laveist, 1989), neighborhood income and postneonatal mortality (Collins, Hawkes, 1997; Sims, Sims, Bruce, 2007). For example, Papalcek et al (2002) analyzed the race differentials of infant postneonatal survival among residents of poor neighborhoods and non-poor neighborhoods living in Chicago. Results of the study indicated that African Americans were more likely to reside in impoverished neighborhoods than Whites. The researchers found that residents living in impoverished neighborhoods were at higher risk of postneonatal mortality than those living in more affluent neighborhoods. Furthermore, the infant mortality rate for blacks and whites in poor neighborhoods was the same. However, infant mortality rate for blacks in non-poor neighborhoods was two times greater than for whites (Papalcek et al, 2002).

In the early nineties, Laveist (1993) analyzed 176 cities in the United States to investigate factors associated with infant mortality. After adjusting for residential segregation, poverty, and black political empowerment, he concluded that residential segregation is the main underlying factor accounting for racial disparities in infant

mortality. Residential segregation is defined as “the degree to which two or more groups live separately from one another, in different parts of the urban environment” (Masey et. al., 1987, p.34). Polednak (1991, 1996, 1997) also conducted similar analysis in 38 large metropolitan areas relating to residential segregation, poverty, and mortality among urban blacks. Similar to Laveist (1989, 1993), Polednak (1991, 1996, 1997) suggested segregation was an important predictor of infant mortality. The degree of residential segregation is directly related to adverse health outcomes among blacks; however, whites are not as affected despite the extent of residential segregation (Laveist, 1989; Laveist, 1993).

Masey and Denton (1993) noted that residential segregation and poverty are the main factors sustaining poverty in African American communities. They argue that the interaction of residential segregation and poverty compounded by economic isolation results in destructive behaviors to individuals and to the community. In an earlier study, Masey et al. (1987) analyzed the influence of residential segregation on inner-city residents in Philadelphia. They concluded that predominantly black residential communities along with poor socioeconomic status resulted in adverse birth outcomes to both blacks and whites (Guest, Almgren, Hussey, 1998). Furthermore, educational and income attainments among blacks are not sufficient to facilitate access to better residential communities with a lower-mortality rates.

Researchers in Chicago, Illinois sought to determine whether neighborhood impoverishment explains the racial disparity in urban postneonatal mortality rates. Stratified and multivariate logistic regression analyses were performed on vital records of all African-Americans and whites born in Chicago by means of a linked 1992-1995

computerized birth—death file with appended 1990 U.S. census income and 1995 Chicago Department of Public Health data. Seventy-nine percent of African-American infants compared to 9% of white infants resided in impoverished neighborhoods.

Strait (2006) assessed the role of neighborhood poverty on infant mortality among blacks and whites in the metropolitan United States. In his study, Strait (2006) hypothesized that the “racial disparity in infant mortality is partially a function of the increased concentration of blacks within poor neighborhoods relative to whites” (p.48). Results of this study suggest a relationship between infant mortality and neighborhood-level poverty, after adjusting for high-risk mortality behaviors, family income, and the level of racial segregation.

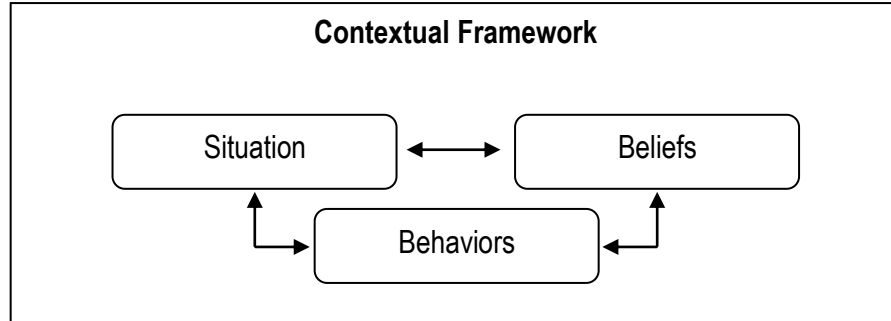
Ellen and Turner (1997) conducted a synthesis of findings from a wide range of empirical research into how neighborhoods affect families and children. No consensus emerged about which neighborhood characteristics affect which outcomes, or about what types of families may be most influenced by neighborhood conditions. Despite a growing body of evidence that neighborhood conditions play a role in shaping individual outcomes, serious methodological challenges remain that suggest some caution in interpreting this evidence. Future research should tackle the critical question of how and for whom neighborhood matters (Ellen and Turner, 1997).

The purpose of this study is to investigate the relationship between individual level characteristics and neighborhood characteristics on infant mortality. The primary research question is how do neighborhood characteristics impact infant mortality? Additionally, the researcher will assess the distribution of ecological and individual risk

factors for infant mortality. Finally, do the ecological and individual risk factors differentially affect the probability that a family will suffer an infant death?

This study works from a contextual framework that suggests that peoples' situation combined with their beliefs and perceptions dictate their behaviors. People are not allowed to pick the situation or circumstances into which they are born. Their beliefs and perceptions of the world are shaped by the experiences, to which they are exposed. A combination of these two things greatly influences the behaviors and choices that people make. Risky behaviors and health conditions sometimes present dynamics that create an environment of failure for birth outcomes. The intent of the contextual framework is to provide a support mechanism for the discussion of the components of the study.

Figure 1.



It is within this context that this study will benefit the field of public health and society by validating the connection between individual characteristics, neighborhood characteristics and poor birth outcomes.

The hypothesis of the study is that if one resides in a “bad neighborhood” then the likelihood of a poor birth outcome is greater. If the author’s hypothesis is true, then the potential policy implications, at the absolute least, are that a portion of resources for

intervention development should be directed to strategies targeting activities at the neighborhood level. On a broader scale, these implications may prove to be applicable to other public health challenges where customized interventions are needed.

CHAPTER 3

METHODOLOGY

Data Sources

In this investigation, the researcher compiled four data sources to analyze secondary data regarding neighborhood characteristics and perinatal outcomes. A proposed causal model is shown in Figure 1, which demonstrates the links between individual and neighborhood characteristics, birth outcomes and infant mortality. The study population consisted of all live births in specified zip codes within Tarrant County. Neighborhood characteristics from the same areas were also studied.

Linked birth and death records for Tarrant County for calendar years 2001, 2002, and 2003 were provided by the Texas Department of State Health Services to the University of Texas at Houston's School of Public Health. The Health Promotions Department agreed to provide these data to the researcher. This dataset was utilized to study individual level characteristics of successful birth outcomes. Variables of study included the mother's birth month, year of birth, race, birth city, and zip code of residence. Additionally, variables regarding residential and provider geography were studied. Provider information was also studied, including institution type and attendant type.

From the same dataset, birth outcomes—birth-weight and infant deaths—and risk factors associated with birth outcomes were analyzed. Risk factors including identified cases of sexually transmitted diseases, anemia, cardiac disease, lung disease, diabetes, chronic hypertension, pregnancy onset hypertension, eclampsia, incompetent cervix were analyzed. Clinically identified risk factors including signs for potential low birth-weight births, preterm births, preterm labor were studied. The aforementioned risk factors were

categorized into levels of risk —low, moderate, and high, for poor birth outcomes.

Consultation on the proper classification of the risk factors was provided by two physicians specializing in obstetrics and gynecology. Finally, birth-weight was studied as one outcome measure.

The second dataset was the 2000 Census data obtained from the United States Census Bureau. The Census Bureau serves as the leading source of quality data about the nation's people and economy. All data was aggregated to the zip code level. Variables studied consisted of four domains—descriptive/lifestyle, safety, access, and socio-economics. A reference list of the variables is listed in the appendix by domain and data source.

The third dataset was secured from the Texas Alcoholic Beverage Commission. These data was used to study the geographic location of facilities authorized to sell liquor for calendar year 2003 within the target area of the study and the relation to birth outcomes and infant mortality. Addresses of these facilities, including the zip code, were aggregated to the zip code level.

Finally, a dataset of faith-based organizations located in the specified target area for calendar year 2003 was secured from the Texas Comptroller's office. All organizations proposing to be a "faith-based" entity must claim a tax category through the Comptroller's office. These data were used to study the geographic location of faith-based facilities within the target area of the study and the relation to birth outcomes and infant mortality. Addresses of these facilities, including the zip code, were aggregated to the zip code level.

Measures

The two outcome measures for the study were birth-weight and infant death. Both variables were dichotomous. Birth-weight was described as normal — > 2500 grams, or low — < 2500 grams. Infant death was categorized as infant survivor – living through the first twelve months or an infant death – dying within the first twelve months. Variables included were divided into two categories – maternal characteristics and neighborhood characteristics.

Maternal characteristics consisted of six measures, all of which were categorical variables. Included in the study were race, age, education level, marital status, prenatal entry into care, and birth type.

Race was included as a measure and consisted of categories for Whites, Blacks, Hispanics, and Other. Age was divided into seven groupings— 0-14, 15-19, 20-24, 25-29, 30-34, 35-39 and 40-44. Education level was divided into five groupings based on years of formal education — 0-6, 7-8 (middle school), 9-11, 12 (high school diploma or equivalent), 13-14 (2 or more years of college). Marital status was dichotomous—either married or not married. Point of entry into prenatal care was divided into trimester groupings – 1st, 2nd, or 3rd. Birth type was categorized into four categories—singleton births, twins, triplets, and quadruplets.

Neighborhood characteristics consisted of six measures aggregated to the zip code level. Race was divided into four groupings—Whites, Blacks, Hispanics, and Other. Housing consisted of three variables—average household size, home owners, and renters. SES proxies consisted of median household income and education attainment. Standard living facilities, meaning that the facilities were compliant with code expectations, consisted of gas/electricity and plumbing. Primary means of transportation was also

included with three variables—motorized personal transportation, public transportation, and other. Contextual influences included two variables—facilities classified as faith-based organizations (churches) and entities licensed to sell liquor (liquor stores).

Upon receipt of three of the four individual datasets, Microsoft Office Excel 2007 was used to organize and arrange the data into manageable formats. These data were then imported into SPSS 16.0 for cleaning, coding and analysis. The remaining data, the linked birth and death records, were received already formatted in SPSS 16.0. The four datasets were merged into one large SPSS dataset. Multiple recoding procedures were performed to prepare the data for analysis. After data cleaning and recoding procedures were completed, univariate, bivariate, and multiple logistic regression analyses were performed.

Analyses

Univariate statistics were run to describe women delivering babies in Tarrant County between 2001-2003. The frequencies and percentages were reported for each variable, (N) = 73,095. Univariate statistics were run to describe residents and neighborhoods (zip codes) in Tarrant County between 2001 and 2003. The mean, range—minimum and maximum, and standard deviation was reported on each variable, (N) = 90.

The dependent variables were birth-weight and infant mortality. Bivariate statistics were run to assess two-way relationships between each independent variable and each dependent variable. Multivariate logistic regressions were run to explore relationships between independent variables and dependent variables while holding all other effects constant.

Variable groupings occurred with the maternal characteristic variables and the neighborhood characteristic variables. Where there were categorical variables, a reference group was identified. The maternal characteristics were divided into six groups—race, age, education, marital status, prenatal care entry, and birth type. The neighborhood characteristics were divided into six groups—race, housing, SES proxies, standard facilities, transportation, and contextual influencers.

CHAPTER 4

RESULTS

The study sample consisted of 73,095 mothers residing in ninety zip codes across Tarrant County (See Table 1 and Table 2). The sample consisted of 63% Whites, 13% Blacks, 20% Hispanics, and 3% Others. Across the zip codes, mothers residing in the target area reflected a mean of 78.60 for Whites, 9.23 for Blacks, 10.50 for Hispanics and 10.00 for Others. The extremes of population density demonstrated a maximum concentration of Whites with 97.5% in one zip code, while another zip code reflected a minimum of 0% Blacks. The three largest age categories were ages 20-24 with 28%, ages 25-29 with 27%, and ages 30-34 with 21%. Of the participants, 32% had obtained a high school diploma or a GED and 23% had more than two years of college. Of the study sample, 66% of participants reported being 'married'. Mothers entering prenatal care during the 1st trimester were 81%. Mothers entering prenatal care during the 2nd trimester were 15%. Mothers entering prenatal care during the 3rd trimester were 4%. Singleton births were given by 97% of the sample. Mothers carrying their fetus for 38 gestational weeks or longer, meeting and exceeding a full-term pregnancy was 69%.

Neighborhood characteristics had a sample size of 28,862 residents based upon workers older than 16 years of age. The average household size was 2.73 individuals per household. Of the described sample, residents declared to be homeowners, those purchasing or those that had purchased a home, 68% while 31% were renters. The average household income was \$44,300. On average, 76% of residents completed high school or high school equivalency requirements. Ninety-eight percent of residents had code level functioning facilities—facilities demonstrating compliance with the city codes.

The overwhelming majority, 94%, of residents used a mode of personal motorized transportation, e.g. automobile or motorcycle as a primary means of travel to and from work. Contextual factors of interest for the neighborhoods of study showed that the communities of study had an average of 29 liquor stores and 8 churches per zip code.

Table 3 presents three logistic regression models predicting the odds of low birth-weight versus normal birth-weight among women delivering babies in Tarrant County. . The first model shows the odds of giving birth to an infant with normal birth-weight for specified maternal characteristics,. The second model adds neighborhood characteristics. The third model presents the parsimonious model consisting of variables from Models 1 and 2.

In model one, significant Maternal Characteristics variables included—race, education, prenatal entry, and birth-type. When compared to Whites, all races—Blacks (OR 1.38, 95% C.I. 1.19-1.59), and Other were significantly and more likely to have a low birth-weight birth and those of Other race (OR 0.67 95% C.I. 0.58-0.78) were significantly less likely to have a low birth-weight birth. All education categories were significant. Mothers with two or more years of education beyond high school (OR 0.84, 95% C.I. 0.75-0.93) were significantly less likely to have a low birth-weight birth than those with less education. Single mothers (OR 1.38, 95% C.I. 1.29-1.48) were more likely to have a low birth-weight birth than mothers that were married. Late entry into prenatal care was significantly associated with the likelihood of delivering a low birth weight baby. Those entering care in the 2nd Trimester (OR 0.69, 95% C.I. 0.58-0.82) were less likely to have a low birth-weight birth. Mothers giving birth to twins were more likely to give birth to low birth-weight infants (OR 3.46, 95% C.I. <.001. - 3.46) than

singleton births. Age was not significantly associated with the likelihood of delivering a low birth weight baby.

In model two, significant variables included—Maternal Characteristics—race, education, marital status, and prenatal care. Race was the only significant Neighborhood Characteristic. When compared to Whites, Blacks (OR 1.41, 95% C.I. 1.22-1.63) and Hispanics (OR 1.04, 95% C.I. 1.01-1.07), were significantly more likely to have low birth-weight birth, while mothers of Other race (OR 0.67 95% C.I. 0.58-0.78) were significantly less likely to have a low birth weight baby. Mothers with two or more years of college education (OR 0.86, 95% C.I. 0.77-0.95) were slightly less likely to have a low birth-weight birth than mothers with less education.

The parsimonious model included Maternal Characteristic variables—race, education, marital status, prenatal care and the Neighborhood Effect variables—race. All variables in the model were significant. When compared to Whites—Blacks (OR 1.20, 95% C.I. 1.04-1.37) and Hispanics (OR 1.07, 95% C.I. 1.04-1.10) were more likely to have a low birth-weight birth than Whites, while mothers of Other race, and Other (OR 0.64, 95% C.I. 0.56-0.75) were significantly less likely to have a low birth-weight birth than Whites. Single mothers (OR 1.29, 95% C.I. 1.21-1.38) were more likely to have a low birth-weight birth. Late entry into prenatal care was significant and less likely to result in a low birth-weight birth—3rd Trimester (OR 0.78, 95% C.I. 0.65—0.94).

Table 4 presents three logistic regression models predicting the odds of infant death among women delivering babies in Tarrant County. The first model predicts the odds of women giving birth and suffering an infant death adjusted for specific maternal

characteristics. The second model adds neighborhoods characteristics. The third model presents the parsimonious model consisting of variables from Models 1 and 2.

In model one, significant variables include maternal race, education, prenatal entry, and birth-type. When compared to Whites, women of Other race (OR 2.27 95% C.I. 1.29-4.00) were more likely to suffer an infant death. Infant death was less likely among mothers completing high school (OR 1.56, 95% C.I. 1.11-2.18) and more likely among those not completing middle school (OR 1.99, 95% C.I. 1.28-3.09) Mothers giving birth to twins (OR .02, 95% C.I. <.001- 0.16) were more likely to suffer an infant death than singleton births. All other variable were not significant.

In model two, significant variables included—maternal race, education, prenatal entry, and birth-type. When compared to Whites, women of Other race (OR 2.30, 95% C.I. 1.29-4.08) were more likely to suffer an infant death. Mothers completing high school Mothers giving birth to twins (OR .02, 95% C.I. <.001— 0.16) were more likely to suffer an infant death than singleton births. All other variables were not significant.

In model three, the parsimonious model, significant variables included—maternal race, education, and birth-type. When compared to Whites, women of Other race (OR 2.69, 95% C.I. 1.54-4.69) were more likely to suffer an infant death. Mothers completing some high school (OR 2.02, 95% C.I. 1.50-2.74) and high school (OR 1.57, 95% C.I. 1.20-2.07) were significant and were more likely to have an infant death than those with some years of college. Mothers giving birth to twins (OR .02, 95% C.I. <.001— 0.15) were more likely to suffer an infant death than singleton births.

CHAPTER 5

DISCUSSION

In the United States, in 2006, 28,527 infants died before their first birthday, representing an infant mortality rate of 6.7 deaths per 1,000 live births. The leading cause of infant mortality was congenital anomalies, which accounted for 20 percent of deaths, followed by disorders related to short gestation, which accounted for another 17 percent of deaths (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2009).

The infant mortality rate began a substantial decline in the late 19th and early 20th century. Some factors in this early decline included economic growth, improved nutrition, new sanitary measures, and advances in knowledge about infant care. More recent advances in knowledge that contributed to a continued decline included the approval of synthetic surfactants and the recommendation that infants be placed on their backs to sleep. However, the decades-long decline in infant mortality began to level off in 2000, and the rate has remained relatively steady in the years since (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2009).

In 2006 in the U.S., the mortality rate among non-Hispanic Black infants was 13.8 deaths per 1,000 live births. This is two and one-half times the rate among non-Hispanic White and Hispanic infants (5.6 deaths per 1,000 live births and 5.5 deaths per 1,000 live births, respectively). Although the infant mortality rates among both non-Hispanic Whites and non-Hispanic Blacks have declined over the last century, the disparity

between the two races remains largely unchanged (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2009).

In the state of Texas, in 2006, the infant mortality rate was 6.2 deaths per 1,000 live births. The black infant mortality rate, 12.3 deaths per 1,000 live births continued to be considerably greater than the rate of whites 5.4 deaths per 1,000 live births and Hispanics 5.8 deaths per 1,000 live births. Congenital anomalies were responsible for 21.5 % of all infant deaths and Sudden Infant Death Syndrome (SIDS) claimed another 9.8%. Disorders related to length of gestation and fetal malnutrition claimed 13.3% of infant deaths and accidents claimed 4.4% of infant deaths. The majority (1,580; 63.8%) of infant deaths took place during the first 27 days of life, neonatal period (Texas Department of State Health Services, 2009).

In Tarrant County in 2006, the rate was 7.6 deaths per 1,000 live births. The rates for whites 6.7 deaths per 1,000 live births, for blacks 15.3 deaths per 1,000 live births and for Hispanics 5.9 deaths per 1,000 live births. Clearly the disparity is consistent with the national and state trends (Texas Department of State Health Services, 2009). Why on multiple levels does this disparity gap continue to exist?

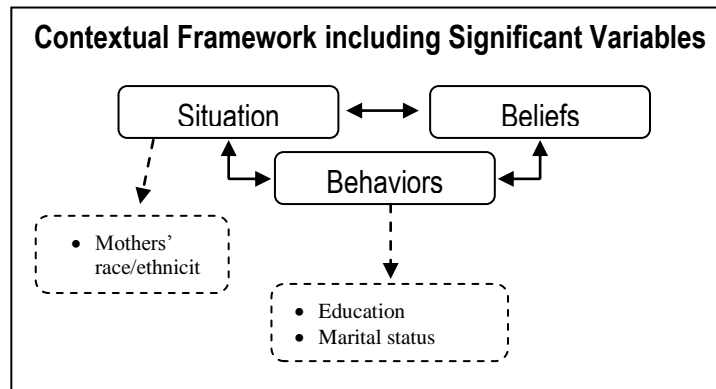
The literature suggests that new studies should explore several other domains, such as health behaviors, psychological factors, and perceptions of social ordering (Adler, N. et al, 1994.) An exploration of the ‘operational framework’ for this study reflects consistency with the aforementioned.

Disparity Conundrum

When considering the parsimonious variables for both models – birth-weight and infant mortality, the overarching findings suggest that minorities living in more affluent neighborhoods are at greater risk for poor birth outcomes. The idea of mothers’ race and ethnicity, education, marital status, point of entry into prenatal care and population density in the zip code in which they reside are significant variables when considering potential birth outcomes.

Infants do not get to choose their race or ethnicity. They do not get to choose the color of their eyes. They do not get to choose the color of their hair. They do not get to choose if their family is rich or poor. They do not get to choose how healthy or unhealthy their diet will be. They do not get to choose in which neighborhood they will reside. Their belief system is shaped by others. In some cases those ‘others’ may be family or people fulfilling the role of family. The amount of variance in terms of beliefs is infinite. Finally, in considering behaviors, frequently, there is a conflict between their ‘situation’ and their ‘beliefs. The behaviors that result frequently demonstrate patterns that are difficult to follow, let alone understand. For the social scientist studying at the macro level, the conundrum persists, especially when considering that improved education—SES, has an inverse relationship on the likelihood of a successful birth outcome. The parsimonious significant variables, when applied to the operational framework demonstrate that the critical factor to be explored further is perhaps the ‘beliefs’. But for now, the significant variables identified will be further discussed.

Figure 2.



Life course framework

The cause of the persisting racial—ethnic disparities in birth outcomes remains largely unknown. How do the significant results fit into a larger context? One framework being given great consideration by researchers currently is the *Life Course Perspective*. The life-course perspective allows us to reconsider the risk factors during pregnancy, e.g., SES, behaviors, prenatal care, stress, and infections, in the context of women's life-course health development. The impact of race on birth outcomes can also be better understood within this life-course framework. Lu and Halfon contend that these risk factors exert their influence over birth outcomes not only during pregnancy, but from early life and across women's life span. They further contend that the life-course context of these risk factors differ between Black and White women, resulting in differing levels of impact on their overall reproductive health (Lu, M. and Halfon, N, 2003).

The aforementioned was a great contribution to the discipline because it provides a biological science explanation for how stress impacts pregnant women. Simply stated the *Life Course Perspective* implies that the environment—neighborhood, especially if it is considered stressful to the pregnant women, may certainly be considered as a key factor in impacting birth outcomes. Halfon and Lu conclude by saying that future

research on health disparities should examine differential exposures to risk and protective factors not only during pregnancy, but over the life course of women.

Based upon the results in their study, the question arises, “how and for whom does neighborhood matter?” Throughout this study, education level has proven to be a significant variable, particularly those from the sample with 2 or more years of college. In relation to the operational framework, it goes without saying that higher levels of education better positions people to change their ‘situation’ in life. As referenced earlier, “situation” is one of the core components introduced in the operational framework for this study. Education is one of the key variables that has potential to change an individual’s life. The issues of risky behaviors, SES, employment opportunities and numerous other key components are all potentially influenced if an individual’s knowledge is improved, not to mention an actual vocational skill-set is enhanced. One could easily infer that improved education may result in an improved SES.

It is noted distinctly in the literature that the estimated direct effects of poverty upon infant mortality and low birth-weight are consistent. The poor outcomes seem to directly relate to access barriers. In addition to strategic placement of health care facilities, Gortmaker (1979) suggested income supports and employment programs are indicated as possible policy actions to reduce the disparity gap. As demonstrated by Brooks, many studies continue to show a strong inverse relationship between indices of social class and infant mortality (Brooks, C. 1980). With an improved SES, many Minorities have a desire to relocate to more affluent living environments. Frequently the neighborhoods that they are relocating to are neighborhoods where they are truly, once

again, a minority. Almost as a subcomponent of this variable is the issue of marital status.

Changes in the family structure are part of a process that now affects all racial and ethnic groups in the United States. Nationally, the birth rate among unmarried women has recently soared (Wilson, 1996). There is a positive association between education and marriage among African-Americans in part due to the extraordinary low rate of marriage among less educated black Americans, many of who are concentrated in inner-city neighborhoods. In this study, 66% of the sample reported being legally married. Race and ethnicity stratification was not conducted.

Inconsistent with the literature, the results of this study suggest that when social class improves, using 'education completed' as a determinant of social economic prowess, infant loss increases. Why is this and is it at all related to the neighborhoods in which the mothers reside?

The literature contends that to remain living in segregated, and in most cases low SES, neighborhoods is bad for overall health (Guest, Almgren, and Hussey, 1998). According to Finch, income inequality is unrelated to the probability of dying during infancy (Finch, 2003.) It seems that social challenges that have plagued the poor in this country continue to be present and continue to serve as motivators for those that can afford to pursue a new living environment. As mentioned in the literature, variables in the physical and social environments, such as crowding, pollution, and access to care continue to function as encouragers to those that obtain the financial resources to relocate (Stokols, 1992).

Many of the minorities are breaking the traditional social ordering pattern through education and demonstrative careers. All of the aforementioned is logical; nonetheless, even if there is a desire to relocate, educational and income attainments among blacks are not sufficient to facilitate access to better residential communities with lower-mortality rates (Guest, Almgren, Hussey, 1998). But what about the cases when they are actually able to relocate to more affluent neighborhoods?

The target population of this study that have elected to pursue some degree of higher education, though they may make progress in terms of eventually improving their SES, few strides may be made with improving their overall all health let alone, improving the likelihood of a healthy normal birth outcome. In fact, some may argue that they may increase the likelihood of a poor birth outcome; and, the data in this study supports that claim.

As referenced in the Literature Review, African Americans often live in high-poverty neighborhoods despite changes in socioeconomic status. Jargowsky (1997) reported that the prevalence rate of African Americans living in extreme poverty neighborhoods was proliferated between 1980 and 1990. It is estimated that 50% of those living in impoverished neighborhoods were non-Hispanic blacks. Consequently, they were at higher risk of poor health outcomes than other racial and ethnic groups (Laveist, 1989; Palpacek, 1996). Also, early research in infant mortality focused on individual factors (such as smoking, prenatal care, parity, and age). Emerging research in infant mortality shifted focus from investigating individual factors to social and ecological factors (such as neighborhoods), i.e., *the Life Course Perspective*. According to the results, further discussion of population density is imminent.

The state of a neighborhood is a strong predictor of health outcomes, particularly birth outcomes. Poverty, socioeconomic status, and residential segregation strongly influence adverse birth outcomes (Jargowsky, 1997; Laveist, 1989; Palpacek, 1996, Collins, Hawkes, 1997; Sims, Sims, Bruce, 2007.) But, what about racial and ethnic density within neighborhoods is significant? The results of this study demonstrate a level of significance.

Researchers in Chicago found that residents living in impoverished neighborhoods were at higher risk of postneonatal mortality than those living in impoverished neighborhoods. Furthermore, the infant mortality rate for blacks and whites in poor neighborhoods were the same. However, infant mortality rate for blacks in non-poor neighborhoods was two times greater than for whites (Papalcek et al, 2002). Though the exploration of individual neighborhood characteristics was not as extensive as the study being referenced, the overall findings imply consistency with Paplcek et al.

Does it matter if minority mothers or soon to be mothers reside in neighborhoods that have large numbers of the same race and ethnicity groups? As previously stated, for whom does neighborhood matter? In Tarrant County, it matters for Hispanics and Blacks. The notion of residential segregation is significant. In areas where there is a high concentration of high race and ethnicity groupings, the likelihood of a normal birth outcome is greater, particularly with Hispanics.

In the literature, residential segregation is defined as “the degree to which two or more groups live separately from one another, in different parts of the urban environment” (Masey et. al., 1987, p.34). Laveist (1989) concluded that residential segregation is the main underlying factor accounting for racial disparities in infant

mortality. Polednak (1991, 1996, 1997) also concluded similar findings as Laveist (1989, 1993), suggesting segregation as the predictor of infant mortality. The degree of residential segregation is directly related to adverse health outcomes among blacks; however, whites are not as affected as blacks despite the extent of residential segregation (Laveist, 1989; Laveist, 1993). Masey and Denton (1993) noted that residential segregation and poverty are the main factors for sustaining of poverty in African American communities. They argue that the interaction of residential segregation and poverty, and additionally economic isolation leads to neighborhood effects of destructive behaviors to individuals and to the community. Strait (2006) suggested that there was a relationship between infant mortality and neighborhood-level poverty, after adjusting for high-risk mortality behaviors, family income, and the level of racial segregation.

If the literature suggests that all of these social determinants having negative impacts on birth outcomes, then why do the results of this study suggest that outcomes for African Americans and Hispanics are better in Fort Worth if the families stay in neighborhoods that are consistent with all that has been described as ‘risky’? Perhaps an explanation of social support is warranted. This was not the focus of this study, but clearly further research in this area is needed.

Finally, the issue of late entry into prenatal care is significant and continues to be a challenge. Good health begins even before birth. Timely prenatal care is an important preventive strategy that can help protect the health of both mother and child. Nationally, entry into prenatal care during the first trimester has been increasing, reaching 83.2 percent of pregnant women in 2005 (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau,

2009). A small proportion of women (3.6 percent) did not receive prenatal care until the third trimester, or did not receive any at all. This was more common among non-Hispanic Black and Hispanic women, as well as those who were younger, unmarried, and less educated (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2009). Reality is that many of the women in Tarrant County are very similar to women around the country.

Implications

Inferences from the study may be categorized and applied in two areas—practice and policy. In terms of practice, the findings suggest that there is an inherent value in the stabilization of a social support system for pregnant women.

In spite of what the literature suggests, in Tarrant County, it seems that birth outcomes could be impacted in a positive way, if minority women in the area of study remain in neighborhoods that are dense with other people that are of the same ethnicity. The degree to which a fully intact social support system is available is important. Living in an environment that mirrors, at least two components from the operational framework – situation and behavior, fosters the possibility of improved birth outcomes. Logically speaking, pregnant women that are surrounded by other people that look like them, talk like them, and have traveled a similar journey in life are less stressed. So, the idea of staying in “the hood” even after one has improved their plight in life may be beneficial. Providers should be aware of that ‘the neighborhood’ in which a patient resides is a factor that should be considered during the delivery of prenatal services. Questions during the examination should include assessment of perceived stress so that the practitioner gets a sense of environmental risk exposure. Making negative assumptions because of neighborhood characteristics that may or may not be factually based could lead to missed

opportunities to aid the client during the provision of perinatal services. If in fact it is deduced that the neighborhood and a cumulative of other risk factors places the client into the high risk category during pregnancy, alternative models should be considered for prenatal care, e.g. the Centering Pregnancy model.

Centering Pregnancy is a new and innovative model of prenatal care that is offered in a support group setting. The three major components of care—health assessment, education, and support, are all offered. The group consists of 10 to 12 participants that meet roughly once per/month during the pregnancy through postpartum. The provider does the regular prenatal examinations in an adjacent room to where the group is meeting. Simultaneously, as mentioned, the group completes assessments and participates in educational activities. The entire concept focuses on fostering a strong social support group for the pregnant and parenting parents.

In terms of policy implications, the United States is experiencing health care reform like never before in the history of the country. Prior to health care reform, the government attempted to stimulate the economy through various financial stimulus packages and tax credits. Perhaps the idea of tax credits for minorities that meet home financing requirements, but elect to buy, build, or purchase a home in areas that are less affluent. This could both serve as a stimulant for the economy and may have a positive impact on birth-outcomes, thus reducing medical costs around the nation. Future research should focus on the identification of alternative models of prenatal service provision that supports the social support concept. Creative tax credits for potential homeowners in non-affluent communities should also be further explored.

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APPENDIX A

Table 1.
 Univariate statistics describing residents and neighborhoods (zip codes) in Tarrant County, TX between 2001 – 2003 (N = 90)

Variables	Mean	Minimum	Maximum	Std. Deviation
Population				
% White	78.60	24.50	97.54	17.40
% Black	9.23	0.00	57.21	12.75
% Hispanic	10.50	1.21	42.27	6.95
% Other races	10.00	.00	70.05	11.59
Total Population	(n) = 90			
Neighborhood Characteristics				
Avg. Household size	2.73	1.55	3.80	.35
Home owners	68.05	.00	100.00	21.59
Median Household Income (\$)	44,300.00	18,161.00	130,655.00	16330.01
Education Attainment*	75.98	34.21	100.00	16.62
% Renters	31.95	.00	100.00	21.59
Gas	40.73	.00	125.86	34.57
Electricity	58.31	17.74	100.00	18.09
Plumbing	98.91	60.00	114.29	5.26
Motorized Transportation (drive car/ride motorcycle)	94.10	75.34	100.79	3.93
Public Transportation (bus or rail)	.59	.00	8.42	1.25
Other (walk, bicycle, other)	2.67	.00	24.07	3.69
Liquor Stores	29.51	.00	168.00	34.90
Churches	8.99	.00	57.00	10.00
Workers >16 yrs of age	(n) = 28,862			

* Percent of adults over 18 residing in census tract who have completed high school

Table 2.

Univariate statistics describing women delivering babies in Tarrant County, TX between 2001 – 2003 (N =73,095)

Variables	Frequency	Percentage
Race		
Whites	46,710	63.14
Blacks	9,889	13.37
Hispanics	14,974	20.24
Other	2,403	3.25
Age		
0 – 14	183	0.25
15 – 19	9,598	12.98
20 – 24	20,608	27.86
25 – 29	20,000	27.04
30 – 34	15,689	21.21
35 – 39	6,560	8.87
40 – 44	1,265	1.71
45 or older	73	0.10
Education		
0 - 6 years	5,621	7.60
7 - 8 (middle school)	2,198	2.97
9 - 11 (some high school)	15,090	20.40
12 (High School Diploma)	23,554	31.84
13-14 (2 years of college)	10,282	13.90
More than two years of college	16,674	22.54
“missing value”	557	0.75
Marital Status		
Married	48,872	66.06
Not Married	25,090	33.92
Status Unknown	14	0.02
Point of entry into prenatal care		
1 st Trimester	59,795	80.83
2 nd Trimester	11,227	15.18
3 rd Trimester	2,954	3.99
Birth type		
Singleton	71,740	96.98
Twins	2,151	2.91
Triplets	81	0.11
Quadruplets	4	0.01
Birth-weight		
Low	5,831	7.88
Normal	68,064	92.01
Gestation estimate in weeks		
< 20 Weeks	67	0.10
21 – 37 Weeks	13,801	18.64
38 – 45 Weeks	50,878	68.78
(n) = 73,095		

Table 3.

Results of logistic regression analysis predicting the odds of low birth weight (1500g to 2500g) vs. normal birth-weight (>2500g) among women delivering babies in Tarrant County, TX between 2001 – 2003 (N =73,095)

Variables		Model 1 Maternal Characteristics OR (95% CI)	p-value	Model 2 Maternal Characteristics and Neighborhood Characteristics OR (95% CI)	p-value	Model 3 Parsimonious Model OR (95%)	p-value
Maternal Characteristics							
Race	White	---	---	---	---	---	---
	Black	1.38 (1.19—1.59)	0.000	1.41 (1.22—1.63)	0.000	1.20 (1.04—1.37)	0.011
	Hispanic	0.93 (0.86—1.01)	0.062	1.04 (1.01—1.07)	0.013	1.07 (1.04—1.10)	0.000
	Other	0.67 (0.58—0.78)	0.000	0.73 (0.62—0.85)	0.000	0.64 (0.56—0.75)	0.000
Age	0 – 14	---	---	---	---	---	---
	15 – 19	0.80 (0.32-2.00)	0.625	0.79 (0.32-2.00)	0.619		
	20 – 24	0.89 (0.35—2.24)	0.804	0.90 (.36—2.24)	0.813		
	25 – 29	0.89 (0.36—2.25)	0.809	0.89 (.36—2.24)	0.810		
	30 – 34	0.91 (0.36—2.30)	0.845	0.90(.36—2.26)	0.829		
	35 – 39	0.70(0.28—1.76)	0.444	0.69(.27—1.73)	0.425		
	40 – 44	0.60(0.23—1.54)	0.289	0.60(.23—1.52)	0.276		
Education	0 - 6 grades	---	---	---	---	---	---
	7 - 8 (middle school)	0.56 (0.46—0.66)	0.000	0.59 (0.49—0.71)	0.000	0.67 (0.57—0.80)	0.000
	9 - 11 (some high school)	0.66 (0.60—0.73)	0.000	0.70 (0.63—0.79)	0.000	0.82 (0.74—0.90)	0.000
	12 (High School Diploma)	0.76 (0.69—0.83)	0.000	0.79 (0.72—0.87)	0.000	0.90 (0.82—0.97)	0.009
	13-14 (2 years of college)	0.84 (0.75—0.93)	0.001	0.86 (0.77—0.95)	0.005	0.95 (0.86—1.05)	0.307
Marital Status	Married	---	---	---	---	---	---
	Single	1.38 (1.29—1.48)	0.000	0.74(0.69—0.79)	0.000	1.29(1.21—1.38)	0.000
Prenatal Entry	1 st	---	---	---	---	---	---
	2 nd	0.69 (0.58—0.82)	0.000	0.69 (0.57—0.83)	0.000	0.64 (0.53—0.76)	0.000
	3 rd	.083 (0.69—1.01)	0.065	0.84 (0.69—1.02)	0.071	0.78 (0.65—0.94)	0.010
Birth Type	Single	---	---	---	---	---	---
	Twins	3.46 (<.001.— 3.46)	0.999	3.52 (<.001.— 3.52)	0.999		
	Triplets	1.56 (<.001.— 1.56)	0.999	1.58 (<.001.— 1.58)	0.999		
	Quadruplets	2.30 (<.001.— 2.30)	0.999	2.32 (<.001.— 2.32)	0.999		

Table 3. – Continued

Results of logistic regression analysis predicting the odds of low birth birth-weight (1500g to 2500g) vs. normal birth-weight (>2500g) among women delivering babies in Tarrant County, TX between 2001 – 2003 (N =73,095)

Variables		Model 1 Maternal Characteristics OR (95% CI)	p-value	Model 2 Maternal Characteristics and Neighborhood Characteristics OR (95% CI)	p-value	Model 3 Parsimonious Model OR (95%)	p-value
Neighborhood Characteristics							
Race	White			0.99 (0.98—1.00)	0.138	0.99 (0.98—1.00)	0.062
	Black			0.99 (0.98—1.00)	0.094	0.99 (0.98—1.00)	0.101
	Hispanic			0.98 (0.95—1.00)	0.056	0.99 (0.98—1.00)	0.004
	Other			0.99 (0.97—1.01)	0.430	0.99 (0.98—1.00)	0.089
Housing	Average Household Size			1.05 (0.82—1.34)	0.703		
	Homeowners			1.00 (1.00—1.00)	0.606		
	Renters			1.00 (1.00—1.00)	0.399		
SES Proxies	Median Household Income			1.00 (1.00—1.00)	0.900		
	Education Attainment			1.00 (.099—1.02)	0.478		
Standard Facilities (Code Compliance)	Gas/Electricity			1.00 (1.00—1.00)	0.297		
	Plumbing			1.02 (0.98—1.05)	0.383		
Transportation	Motorized Transportation			1.00 (0.97—1.04)	0.834		
	Public Transportation			1.09 (1.01—1.17)	0.028		
	Other Transportation			1.00 (1.00—1.00)	0.370		
Contextual Influencers	Churches			1.00 (1.00—1.01)	0.336		
	Liquor Stores			1.00 (1.00—1.01)	0.631		
		R ² = 92.7		R ² = 92.7		R ² = 92.1	
		-2 Log likelihood 34965.504		-2 Log likelihood 34916.458		-2 Log likelihood 39149.762	

Table 4.

Results of logistic regression analysis predicting the odds of infant death among women delivering babies in Tarrant County, TX between 2001 – 2003 (N =73,095)

Variables		Model 1 Maternal Characteristics OR (95% CI)	p-value	Model 2 Maternal Characteristics and Neighborhood Characteristics OR (95% CI)	p-value	Model 3 Parsimonious Model OR (95%)	p-value
Maternal Characteristics							
Race	White	---	---	---	---	---	---
	Black	1.25 (0.72—2.15)	0.429	1.28 (0.74—2.22)	0.386	1.31 (0.76—2.25)	0.337
	Hispanic	1.18 (0.92—1.52)	0.189	0.89 (0.82—0.98)	0.016	0.94 (0.86—1.02)	0.144
	Other	2.27 (1.29—4.00)	0.004	2.30 (1.29—4.08)	0.005	2.69 (1.54—4.69)	0.001
Age	0 – 14	---	---	---	---	---	---
	15 – 19	1.44 (<.001—1.44)	0.997	1.56 (<.001—1.56)	0.997		
	20 – 24	1.51 (<.001—1.51)	0.997	1.54 (<.001—1.54)	0.997		
	25 – 29	1.25 (<.001—1.25)	0.997	1.93 (<.001—1.93)	0.997		
	30 – 34	1.04 (<.001—1.04)	0.997	9.87 (<.001—9.87)	0.997		
	35 – 39	1.16 (<.001—1.16)	0.997	1.11 (<.001—1.11)	0.997		
	40 – 44	1.05 (<.001—1.05)	0.997	1.00 (<.001—1.05)	0.997		
Education	0 - 6 grades	---	---	---	---	---	---
	7 - 8 (middle school)	1.99 (1.28—3.09)	0.002	0.82 (0.38—1.75)	0.602	1.00 (1.28—3.09)	0.998
	9 - 11 (some high school)	0.86 (0.41—1.83)	0.699	1.53 (1.08—2.20)	0.015	2.02 (1.50—2.74)	0.000
	12 (High School Diploma)	1.56 (1.11—2.18)	0.010	1.35 (1.00—1.81)	0.050	1.57 (1.20—2.07)	0.001
	13-14 (2 years of college)	1.34 (1.00—1.80)	0.051	1.26 (0.90—1.77)	0.172	1.34 (1.00—1.80)	0.078
Marital Status	Married	---	---	---	---	---	---
	Single	0.71 (0.57—0.88)	0.002				
Prenatal Entry	1 st	---	---	---	---	---	---
	2 nd	1.86 (0.99—3.50)	0.055	1.85 (0.98—3.49)	0.056	1.77 (0.94—3.33)	0.076
	3 rd	1.14 (0.59—2.25)	0.698	1.14 (0.58—2.24)	0.704	1.13 (0.58—2.23)	0.716
Birth Type	Single	---	---	---	---	---	---
	Twins	0.02 (<.001—.160)	0.000	0.02 (<.001—.160)	0.000	0.02 (<.001—.015)	0.000
	Triplets	0.08 (0.01—0.83)	0.034	0.08 (<.001—.83)	0.035	0.08 (0.01—0.76)	0.028
	Quadruplets	0.36 (0.03—4.02)	0.408	0.33 (.03—3.70)	0.366	0.32 (0.03—3.55)	0.354

Table 4. – Continued

Results of logistic regression analysis predicting the odds of infant death among women delivering babies in Tarrant County, TX between 2001 – 2003 (N =73,095)

Variables		Model 1 Maternal Characteristics OR (95% CI)	p-value	Model 2 Maternal Characteristics and Neighborhood Characteristics OR (95% CI)	p-value	Model 3 Parsimonious Model OR (95%)	p-value
Neighborhood Characteristics							
Race	White			1.01 (0.97—1.05)	0.677		
	Black			1.00 (0.96—1.05)	0.876		
	Hispanic			1.00 (0.93—1.09)	0.946		
	Other			1.02 (0.96—1.08)	0.592		
Housing	Average Household Size			0.54 (0.26—1.15)	0.112		
	Homeowners			1.00 (1.00—1.00)	0.851		
	Renters			1.00 (1.00—1.00)	0.424		
SES Proxies	Median Household Income			1.00 (1.00—1.00)	0.366		
	Education Attainment			0.98 (0.95—1.02)	0.350		
Standard Facilities (Code Compliance)	Gas/Electricity			1.00 (0.99—1.01)	0.830		
	Plumbing			0.93 (0.86—1.01)	0.085	0.95 (0.89—1.01)	0.121
Transportation	Motorized Transportation			1.10 (0.90—1.34)	0.376		
	Public Transportation			1.10 (0.87—1.38)	0.436		
	Other Transportation			1.12 (0.88—1.42)	0.363		
Contextual Influencers	Churches			1.01 (1.00—1.03)	0.119		
	Liquor Stores			1.00 (1.00—1.00)	0.513		
		R ² = 99.3		R ² = 99.3		R ² = 99.3	
		-2 Log likelihood 5649.232		-2 Log likelihood 5632.754		-2 Log likelihood 5669.093	

