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SOCIO-DEMOGRAPHIC AND GEOGRAPHIC PREDICTORS OF HEALTH CARE RECEIPT AMONG MOTHERS AND INFANTS IN CENTRAL PENNSYLVANIA AND NORTH CAROLINA

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ABSTRACT

One of the most important pathways to health is through health care. Yet disparities in health care remain a prevalent problem in the U.S. Prior research has established that socio-economic status (SES), race, and geographic location are predictive of health care receipt, but little research has explored the influence of these risk factors in relation to one another, especially among mothers and infants. In addition, little is known about the receipt of health care for mothers and their infants living in more rural areas. To extend previous research and address the dearth of research on health care for rural families, the focus of the present study was to examine the influence of a multitude of factors, including rurality, socio-economic status, and race, on maternal and infant health care services among a predominantly lower-income, non-metropolitan sample living in Pennsylvania and North Carolina. Findings indicated few differences in maternal and infant health care by rurality alone. As a whole, mothers and infants reported high frequencies of regular care. Risks associated with low socio-economic standing affected only White families living in more rural areas. These families were at risk for not receiving prenatal care or childbirth preparation services. Findings also indicated that families who are typically most at-risk were actually more likely to receive certain specialty health care services. For example, low-income families and Black families were more likely than families with higher economic standing and White families to receive post-birth home visits. No significant differences in infant well-care visits by income, race, or rurality were found. Mothers with an education beyond high school were almost twice as likely to report having a regular doctor for their child. Other significant predictors of maternal and infant health care receipt included factors that enabled or impeded receipt and factors that created a health care need. These factors included: personal transportation, travel time to reach the doctor, social support, maternal health risks, and whether the child was the mother's first-born. First-time mothers were significantly more likely to receive childbirth classes and parent education videos. This study demonstrated that although some health care disparities may still exist for lower-income families in non-metropolitan areas, receipt of maternal and infant health care services are greatly improving for at-risk families. The study substantiates the efforts of maternal and infant health care programming and financial supports that are currently being implemented at the federal, state, and local level.

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Introduction

Although the United States has the highest per capita health care expenditure of any country (Kaiser Foundation, 2007), significant health disparities have been documented among U.S. citizens. These disparities in health may reflect disparities in health care across population subgroups. With our nation's objective to eliminate health disparities among various sectors of our population by 2010 (U.S. Department of Health and Human Services (DHHS), 2000), continued research on disparities in health care utilization, especially in understudied populations, is necessary.

A review of the health care literature identifies several possible predictors of health care disparities, including socio-economic status (SES), race, and geography. SES, race, and geography create barriers to accessing health care that limit health care utilization. Socio-economic status (SES) and race are the most prominent sources of disparities cited in the existing literature (IOM, 2002; LaVeist, 2002; Phares et. al, 2004; Shavers, 2007), while geography is less noted. Geography is "the study of relationships between humans and their environment by emphasizing a spatial and environmental perspective at a variety of scales" (Strong, 1998); it analyzes how the relationship between humans and their spatial environment affects social and psychological development and family outcomes. Geography in this study attempts to capture a family's place within two contexts, their immediate context, location within their community, and their larger context, the state in which they live, and the way in which a family's place affects their health care utilization.

Although researchers operationalize SES in different ways, SES is typically a composite of educational attainment, employment or occupational status, and income/wealth that directly and indirectly affect an individual's ability to obtain health care required to achieve and maintain

good health. It is well established that those who have low SES, e.g., have low education, lack employment, or are in poverty, experience difficulties accessing health care (Alder & Newman, 2002; Andrulis, 1998). Education, employment, and income/wealth increase cognitive, social, and monetary resources for attaining health care services. Though education, employment, and income/wealth are correlated and may jointly contribute to health care disparities, they also may uniquely explain variance in health care disparities. Individuals with higher levels of education are more likely to be socialized to health-promoting behavior and to have the knowledge to utilize preventive, non-urgent health care services (Shavers, 2007). Higher levels of income/wealth allow individuals to pay for private health insurance or to pay out-of-pocket for health care services. Finally, higher occupational status and the associated income/wealth facilitate obtaining health insurance, which increases the ability of individuals to access and utilize health services (Andrulis, 1998). Without health insurance to cover a significant portion of health care costs, those who are uninsured receive less medical care and poorer quality care than those who are insured (Alder & Newman, 2002), and resort to using the hospital emergency room for their non-urgent health care needs (Andrulis, 1998).

In order to facilitate health care receipt for those who cannot afford it, and to ultimately reduce health disparities associated with low SES in our society, the federal government provides low-income families with health insurance in the form of Medicaid or SCHIP (State Children's Health Insurance Program), the state-run health coverage program for children. For many lower-income families, federally-funded health insurance is their primary means for health care, and government-sponsored health programs are their primary source for health care. Medicaid and SCHIP is a major resource for financing the health care of pregnant women, infants, and children (March of Dimes, 2007) and covers approximately 30% of 78.2 million children in our nation, or

"more than one in four children" (Kaiser Commission, 2007). Compared to the uninsured, Medicaid recipients have shown an increase in initiation of prenatal care, the number of prenatal care visits, and the average birth weight of their newborn (Andrulis, 1998). Hence, receipt of Medicaid is likely to positively influence health care utilization among low-income women and children living in more rural areas.

In addition to these individual level factors, SES shapes the surrounding social and economic conditions that dictate an individual's ability to acquire health services. For example, individuals who are of lower SES tend to live in poorer neighborhoods, where health care sources are more limited than in more affluent neighborhoods. As a consequence of individual and environmental effects of SES, persons of lower SES tend to have worse health (Adler & Newman, 2002; Blank, 1997; Deaton, 2002).

In addition to SES, race is consistently associated with health care disparities. For instance, race predicts whether a patient is likely to obtain regular medical care. In comparison to non-Whites, Whites are more likely to report having a routine source of care or a regular physician (Halfon, Newacheck, Wood, & St. Peter, 1996; Lewin-Epstein, 1991; Moore & Hepworth, 1994; Saha, Komaromy, Koepsell, & Bindman, 2002). The effect of race by itself is, however, somewhat unclear. Race overlaps significantly with SES (LaVeist, Keith & Guiterrez, 1995; Wen, 2007). Blacks, for instance, are disproportionately represented in low SES groups, and therefore, are likely to face barriers to health care access that are related to low SES. In some studies that have examined both race and SES, SES accounts for most, and sometimes all, of the variance in health care outcomes predicted by race (LaVeist, 1995; Wen, 2007). In other examinations, race disparities in health care persist even after accounting for SES (LaVeist, 1995, 2002).

Race also represents processes that are not always examined or readily understood. Debates abound as to whether race is a biological or social construct (e.g., Krieger, 1987), leaving many researchers to question the utility of race as an explanatory variable (e.g., Fullilove, 1998). Other factors associated with race such as ethnic/cultural preference or stigmatization may be influencing health care receipt. Individuals may not adhere to common Westernized health practices because of their ethnic and cultural beliefs, and therefore may not use certain health care services (LaVeist, 2002; Scheppers, van Dongen, Dekker, Geertzen, & Dekker, 2006). Other studies have documented race-based differential medical treatment (Gamble, 2002; Krieger, 2002; Schulman et al., 2002; Sleath, Svarstad, & Roter, 2002). As a result of differential medical (mis) treatment, researchers have argued that Black Americans have a deep mistrust of scientific medical institutions (Gamble, 2002), which is likely to result in lower health care utilization. Findings indicate that Black patients utilize health care more when they have Black physicians and tend to favor receiving health services from Black physicians (Saha, Komaromy, Koepsell, & Bindman, 2002). The fact that less than five percent of the total U.S. physician workforce is comprised of Black physicians (Saha, Komaromy, Koepsell, & Bindman, 2002) may influence the amount of care Blacks utilize. Whether due to its confound with SES, its correlation with cultural/ethnic preferences, or racial biases and discrimination, racial inequalities in accessing and utilizing health care have been well-documented but the reasons have not.

While the literature on health care disparities has focused on race and SES as risk factors for poor health care outcomes, less attention has been spent on the risk that geographic location poses to health care. Since health care is linked to health, and most health care is delivered at the local level, it is important for studies to include geographical location (Frist, 2005). A relatively

small body of literature has found differences in health and health care due to geographic location (e.g., Hillemeier, Weisman, Chase, & Dyer, 2007; Hughes & Rosenbaum, 1989; Long, King, & Coughlin, 2006). Most of these prior studies base geographic differences in residence along the rural-urban continuum. Research comparing general populations in rural and urban areas finds that rural residents have fewer preventive health care visits and worse health than urban residents (American Psychological Association, 1999; Agency for Healthcare Research and Quality, 2004; Chevarley, Owens, Zodet, Simpson, McCormick, & Dougherty, 2006; Foxhall, 2000; National Center for Health Statistics, 2006). Although previous research has highlighted geographic differences in health care receipt and health status, there is a lack of understanding regarding how geography relates to race and SES in explaining health care disparities and what aspects of geographic location are associated with reduced health care and poor health. This lack of clarity is due to the dearth of studies that have addressed the three concerns this current study explores.

First, little research has examined the relationship between geography, race, and SES in explaining health care disparities. Evidence suggests that geography is related to both race and SES, with non-metropolitan, rural states and areas having fewer black and Hispanic children and greater proportions of children living in poverty compared to large metropolitan areas (Chevarley et al., 2006; Probst, 2002). Two studies have found that the relationship between race and SES in predicting psychological health varies according to geographical area (Linn, Bagar Husaini, and Whitten-Stovall, R., 1990; Schwabe, & Kodras, 2000), but geographic location has not, however, been studied in relationship to race and SES in terms of maternal and child health care receipt. Individually, SES, race, and geography predict health care receipt and utilization. Their combined effect on health service receipt is, however, less known. Geographical location may

explain unique variance in health care disparities not explained by race and SES or may moderate racial and socioeconomic disparities in health care.

Second, the use of the federal definition of "rural" in prior studies limits our understanding of what it is about rural residence, as compared to urban residence, that puts people who live in rural areas at risk for less health care. Though there are three slightly differing criteria, federal definitions of "rural" are based primarily on population density (Hall, Kaufman, Ricketts, 2006; Hart, Larson, & Lishner, 2005). According to the U.S. Census Bureau, rural is considered anything that is not an urbanized area (UA). UAs are based on population density, and include "core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile". The White House's Office of Management and Budget (OMB) designates metropolitan statistical areas (MSA) as one city with at least 50,000 residents or a central city and outlying counties that together consist of at least 50,000 residents regardless of total area population. Outlying counties do not require "metropolitan character" but are included if they are economically tied to the central counties, as measured by daily commuting of 25% of its residents. The Department of Agriculture's Economic Research Service assigns rural-urban continuum codes according to the level of "urbanization," i.e. based upon their population density, their proximity to large or small metropolitan areas, and the size of the largest adjacent city. The use of these operational definitions of rural in prior studies that demonstrate rural deficits in health care and health status reflects a narrow conceptualization that does little to elucidate what characteristics of rural residence, or (low) population density, are associated with health care receipt. By conceptualizing and operationalizing rurality as physical isolation, this

study expands upon the current conceptualization of rural residence and hopes to illuminate possible aspects of rural residence that may matter for health care receipt.

Third, rural versus urban residence may not be the only geographic predictor. Due to varying policies and programs, states differ on the amount and type of health care funding, programming, and support they offer their residents. For example, states decide whether to cover all low-income children (Hughes & Rosenbaum, 1989). Thus, state residence may contribute to existing geographic health care disparities. Yet state comparisons have received less attention than rural-urban comparisons.

In its discussion of rural locations, the literature points to some possible explanatory aspects of rural residence that may affect health care receipt. Families who reside in geographically rural areas face unique barriers that make them particularly vulnerable for reduced access to health care, and therefore may impact their ability to attain health care (Rural Women's Work Group, 1999; U. S. Department of Agriculture (USDA) Economic Research Service, 2007). One of the main barriers of rural residence revolves around geographic physical isolation. Unlike urban residents, people living in rural areas must contend with geographic isolation that is more inherent to rural existence. Geographic isolation and low population density may discourage physicians from setting up medical practices in rural settings. Compared to metropolitan areas, non-metropolitan areas generally have a lower supply of medical health services and doctors (National Center for Health Statistics, 2006; Rural Task Force, 2002). A decreased availability of medical providers reduces the number of people who can gain access to medical care in a geographical isolated area and therefore, may reduce the likelihood of attaining health services. A low supply of health care resources coupled with geographic isolation may force rural residents to travel longer and farther to get to medical care. A personal means of

transportation would likely facilitate obtaining health care and may even be more of a necessity in rural areas because rural areas do not have public transportation (Probst, Laditka, Wang, & Johnson, 2007). Findings of significant deficits in important correlates of health care access, such as income, education, employment, or health insurance, may also explain why areas that are more rural are worse off when compared to urban areas. Rural residents are more likely than urban residents to be impoverished, less educated, unemployed, and to be uninsured or underinsured (McGlaun & Cochran, 2007; USDA Economic Research Service, 2007).

Despite documented challenges in health care access for the approximate 50 million Americans who live in non-metropolitan areas (U.S. Census Bureau, 2000), little research has been conducted on maternal and infant health and health care outcomes in more geographically rural areas (Hillemeier et al., 2007). Because existing disparities in health and health care among the adult population may have their origins earlier in the lifespan (Dougherty, Simpson, & McCormick, 2006), the current study focuses on early maternal and infant health care receipt. Health care is important for all expecting mothers and their infants in order to increase the likelihood of healthy pregnancies and healthy birth outcomes, reduce the likelihood of disease onset and pregnancy/birth complications, and promote individual health throughout the life course. Unfortunately, the patterns of health and health care disparities among the general population persist among expectant mothers and infants; they experience racial, socio-economic, and geographic barriers to health care.

Disparities in U.S. infant mortality rates are particularly large for Black and low-income versus White and high-income families (Save the Children, 2006). Research finds patterns of racial differences in the initiation, frequency, and quality of pregnancy and pediatric health care (Hansell, 1991; LaVeist, 2002; LaVeist, Keith, & Guiterrez, 1995; Alexander & Cornerly, 1987;

Moore & Hepworth, 1994; Flores, Bauchner, Feinstein, & Nguyen, 1999; Lewin-Epstein, 1991; Halfon, Newacheck, Wood, & St. Peter, 1996). Black children are more likely to visit the hospital emergency room for sick care than White children (Halfon et al., 1996). Black women and children are disproportionately represented in lower SES groups, and thus face obstacles attaining health care related to lower SES. Lower SES families do not receive the same amount or same quality of care that higher SES families receive due to fewer tangible resources (Halfon, Newacheck, Wood, & St. Peter, 1996; Hansell, 1991; Yu, Bellamy, Kogan, Dunbar, Schwalberg, & Schuster, 2002; Zeni, Sappenfield, Thompson, & Chen, 2007).

The conditions associated with geographic health care challenges disproportionately affect women and children for a variety of reasons. First, women are more likely than men in rural areas to be in poverty (Rural Assistance Center (RAC), 2007; Rural Women's Work Group, 1999). Working women who become pregnant often stop working around the time of their delivery date and may suffer a lapse in pay, unlike working men. Rural women also have relatively low educational attainment, which correlates with lower income (Rural Women's Work Group, 1999). Second, because women are more likely to be poor, they are more likely to be dependent on Medicaid for health care coverage. Therefore, they are more reliant on state policies that determine the leniency of Medicaid programming eligibility and options (Hughes & Rosenbaum, 1989). Third, teenage pregnancy rates are often higher in rural areas than urban areas (Rural Women's Work Group, 1999; RAC, 2007). Teenage mothers are less likely to finish school than their non-expectant peers, and are more likely to be less educated, unemployed, and poorer than older mothers. Teenagers are also more dependent on others for transportation. Fourth, few medical resources and longer travel distances negatively impact pregnant women and infants, who require regular, frequent health care visits and who must often rely on others to

assist them in obtaining health care. As a result, socio-economic disadvantage, racism, and geography likely create multiple barriers for women and children to access health care.

Yet little is known about the specific circumstances of health care utilization for pregnant women and their children in rural areas and in states with predominantly rural counties. Information about these circumstances is a necessary prerequisite to the development of programs designed to reduce disparities in health care utilization and health outcomes. Therefore, the aims of this study are to:

1) Determine the kinds of health care mothers and infants in more geographically rural areas receive. More specifically, the study will determine whether pregnant women and infants have regular health care utilization, i.e., prenatal care and well-care (normative) visits, and what kinds of other health care they receive, e.g., specialty maternal health services such as breastfeeding help or home visits.
2) Analyze disparities in these types of health services. More specifically, to determine whether geographic location (non-urban, rural residence; state residence) matters in terms of maternal and infant health care receipt.
3) Determine whether rural disparities can be explained by SES or race differences. In other words, if residence in more physically isolated areas matters for health care utilization, is it due to the characteristics of the people that reside in more versus less rural areas? For example, families who reside in more rural areas may get less care, but the reason is because they are poorer. Or does physical isolation still matter for health care receipt after accounting for differences in SES and race?

4) Determine whether other characteristics of rural environments, such as travel time to the doctor, transportation, or level of social support, help to explain health care disparities.
5) Examine whether rurality interacts with SES and race in predicting disparities in health care receipt. For example, is the risk of nonreceipt of health care that is associated with SES greater for those who live in more rural versus less rural areas?

The current study will consider how characteristics of geography, race, and SES predict health care utilization for women and children. Unlike most prior research, this study takes into consideration that there may be other explanatory factors related to rurality that assist in attaining health services. In its simplest form, the definition of rural is that it is not urban, implying a notion of deficiency, yet there may be positive aspects of rural residence that have not been explored (Dougherty, Simpson, & McCormick, 2006). For instance, Mulder and colleagues (1999) stated that dense social networks are a common characteristic of rural life. Hence, there may be other factors characteristic of rural communities, such as close kinship ties, that may increase the likelihood of health care receipt or improved health, especially for pregnant women and infants. Few studies have taken such multiple predictors of maternal and infant health care utilization into account. Additionally, due to varying physical and social environments, individual states may differ on predictors of health care utilization. Therefore, the current study will also examine predictors of maternal and infant health care for each study state. Information on variables that uniquely predict health care for individual states would be useful for state health care policy.

The current study will use Andersen's behavioral model of health care utilization (1995) as a framework to examine predictors of maternal and infant health care receipt (see Figure 1).

Andersen's model suggests that health care utilization is a function of factors that individually, or jointly predispose, enable, or increase one's need to use health care (Andersen, 1995). Predisposing factors will include socio-demographic variables such as race, educational attainment, age, and state residence. Enabling factors will include income/needs ratio, employment status, health insurance status and health insurance type, relative geographic isolation, travel time to doctor's office, transportation means, and social support. Although it is assumed that all pregnant women and newborns have an inherent need for healthcare (LaVeist, 1995), mothers who have a history of health problems, or infants who experience health problems at birth, may be flagged for certain health care services more than mothers and infants who have not experienced health difficulties. Therefore, health risks will be considered a potential evaluated need factor that influences health care receipt. Additionally, women who are expecting their first biological child may perceive a greater need for health services. Women's parity, or whether the target child is their first, will be used as a perceived need factor that may predict health care receipt and utilization.

To better understand the risks associated with geography and the extent to which these risks affect race and SES disparities in health care receipt for pregnant mothers and their newborns, data from the Family Life Project will be utilized. The Family Life Project (FLP) offers a unique opportunity to address important questions about health care disparities and the extent to which disparities in health care may be greater or less than those in more urban areas. A joint-longitudinal research project of the Pennsylvania State University and the University of North Carolina at Chapel Hill that began following women shortly after the birth of a child, the FLP includes a large cohort that varies in relative geographic isolation (rurality), race, and SES. Because the FLP collected data from two different states (Pennsylvania and North Carolina) that

represent two of the four primary rural areas of the country, eastern Appalachia and the South, between and within state differences in maternal and infant health care receipt may be analyzed. Almost all the Black families in the FLP reside in North Carolina, and therefore, between state differences can only be made with White participants. In addition to these primary variables, the FLP collected data on other aspects of rural life that may affect health care receipt, such as travel time to the doctor's office, access to personal transportation, health insurance, and the presence of social support. Using the FLP data set, this study will examine predictors of health care receipt for mothers and infants living in non-metropolitan areas. More specifically, it will determine which aspects of geographical residence are associated with health care receipt and how race and SES relate to these associations.

Multiple hypotheses will be tested, as follows:

1) In unadjusted bivariate analyses, race, income-to-needs ratio, and geographic isolation will individually differentiate maternal health care outcomes. Mothers who identify themselves as being Black, have lower income/needs, and are more isolated will be less likely to receive health care.

2) In chi-square analysis, differences in maternal health care according to geographic residential isolation will remain significant after adjusting for race and family income-to-needs ratio. Families whose residence is more physically isolated will demonstrate less health care receipt.

3) Using multiple regression analysis, geographic residential isolation will significantly predict both maternal and infant health care utilization, even after controlling for other predisposing and need factors, but race and multiple SES characteristics (education, marital status, employment status, and income-to-

need ratio) will partially explain (or mediate) the effect of geographic isolation on maternal and infant health care utilization.

4) Other enabling or disabling factors, such as health insurance, will further explain differences in receipt of maternal and infant health care services. Having health insurance, having personal transportation, less travel time to get to the doctor's office, and more social support will increase the likelihood that mothers receive regular and specialty health care services.

5) Relative geographic isolation, i.e., being more rural than others in a non-metropolitan area, will exacerbate race and income-to-need SES disparities. Black families and families with lower SES will be at an additional risk of not receiving health services if they are more geographically isolated. Black families with lower SES levels living in more rural areas will be at the greatest risk for not receiving health care. In other words, these variables will show interaction effects.

6) Finally, each study state (North Carolina and Pennsylvania) will demonstrate unique predisposing, enabling, and need predictors of health care utilization.

Literature Review

Risk factors for disparities in health and health care

Socio-economic status (SES), race, and geographic location create barriers to accessing health care. Each factor is reviewed below.

Socio-economic status. Socio-economic status (SES) is a commonly recognized predictor of health disparities. A wide range of poor health outcomes is linked to low socio-economic status (SES), including adult mortality (Deaton, 2002), neonatal mortality (LaVeist, 2002), infant low-birthweight, cardiovascular disease, hypertension, arthritis, diabetes, and cancer (Adler & Newman, 2002). The fundamental components of SES—education, employment, and income—involve direct and indirect access to resources that can help prevent or reduce the chances of disease or adverse health outcomes (Deaton, 2002; Hummer, 2005; Shavers, 2007).

At the individual level, SES directly contributes to health. Individuals with higher education typically have more exposure to information about health risks and more knowledge about the importance of preventive care and how to access health care information and resources (Adler & Newman, 2002; Shavers, 2007). Educational attainment is also highly correlated with employment opportunities and occupational status. The employed generally have better health than the unemployed (Adler & Newman, 2002). Those who are more educated are more likely to qualify and attain white-collar, professional employment that likely earns them a higher and more stable income. Higher-earning, non-service sector jobs are more likely to offer employees health insurance. In turn, health insurance increases the ability of individuals to access and utilize health care services (Andrulis, 1998). Employment and occupational status are also correlated with income. Income is a means to pay for better health care, better health coverage, better

nutrition, and better quality of life (Adler & Newman, 2002; Shavers, 2007). As a result of direct mechanisms, high SES supports better health outcomes.

At the contextual level, SES indirectly contributes to health. High SES, in particular high income, affords individuals better living environments. In contrast, poverty typically exposes individuals to suboptimal living conditions and environmental hazards that place impoverished individuals at risk for poor health outcomes, including poor housing and dilapidated neighborhoods, a lack of recreational facilities and nutritious food sources, and an abundance of liquor or tobacco stores (Adler & Newman, 2002; Blank, 1997). Even though the negative effects of SES on health occur at all levels of the socio-economic gradient, the burden is particularly great for those in poverty because of the associated environmental risks to one's health (Shavers, 2007). Poor environments tend to lack health care resources, especially options for quality, preventative care. Thus, SES also indirectly contributes to health outcomes via the environment.

The deleterious effects of substandard environmental conditions easily pass from mother to infant via environmental stress, poor nutritional intake, disease and illness. In this way, maternal health has been considered the causal link between social disadvantage and child health (Zuckerman and Kahn, 2000). In order to reduce the risk of poor health outcomes associated with social inequality that may begin early in life and can have lasting effects (Adler & Newman, 2002; Deaton, 2002; Dougherty, Simpson, & McCormick, 2006), preventative health care for low-income expectant mothers and their children is needed.

Yet access, utilization, and quality of health care vary for all individuals according to SES (Adler & Newman, 2002). Low SES is correlated with higher rates of preventable hospitalization rates (Andrulis, 1998) and the use of hospital emergency departments as usual

sources of sick care (Halfon, Newacheck, Wood & St. Peter, 1996). Receipt of maternal and infant health care is no exception. Parent educational level is directly proportional to the receipt of quality prenatal care (Hansell, 1991) and to the receipt of recommended preventive, well-child visits (Yu et al., 2002). In a study by LaVeist and colleagues (1995), income and health insurance status (whether patients had private insurance or not) accounted for the full race effect on the initiation of prenatal care. Quality of prenatal care was also found to favor mothers who had higher SES. Similarly, Zeni and colleagues (2007) found that low-income children and children without health insurance were more likely to not have a personal health care provider.

Access to health care is often viewed as the central link to socioeconomic disparities in health (Andrulis, 1998), therefore, this study attempts to explore the significance of SES indicators in maternal and health care receipt among more rural-dwelling populations. Some studies use one or two indicators of SES, such as education or family income (e.g., Lewin-Epstein, 1991), which may be sufficient, but multiple characteristics of SES may offer a more accurate and detailed understanding of the effect of SES (Shavers, 2007). While convenient, a composite measure of SES is not as useful to policy decisions because different policies may be needed to address different health issues related to education, employment, or income (Deaton, 2002). The current study includes maternal education, employment status, and household income/need ratio. It is expected that these factors will be positively associated with receipt of care for both mothers and infants.

Race. One of the most documented risk factors for disparities in health and health care access among women and children is race (Alexander & Cornerly, 1987; Flores, Bauchner, Feinstein, & Nguyen, 1999; Halfon, Newacheck, Wood, & St. Peter, 1996;Hansell, 1991; LaVeist, 2002; LaVeist, Keith, & Guiterrez, 1995; Lewin-Epstein, 1991; Moore & Hepworth,

1994). More often, non-White women and children are at a disadvantage when compared to White women and children. For example, when Buescher and Mittal (2005) compared rates of obesity, high blood pressure, high cholesterol, smoking, and self-reported health among women in North Carolina (2001-2003), they found that African-American women experienced a significantly dramatic increase in overall health problems over time compared to White women. According to Pennsylvania Department of Health (PADOH) statistics from 2004, Black residents compared to White residents experienced significantly higher rates of maternal death, infant death, LBW babies, teen pregnancies, teen births, and births to unmarried mothers. Significant differences in these maternal and infant health statistics were also found between Hispanic residents and non-Hispanic White residents. Using data from North Carolina between 1999 and 2003, Buescher and Mittal (2005) also found that rates of negative birth outcomes—low birth weight, neonatal (<28 days of age) deaths and infant (<1 year of age) deaths—increased with age among African American women, but decreased with age among white women.

Studies suggest that White mothers as compared to non-White mothers may have better access to services as they tend to actually receive prenatal care (PADOH, 2004), enter into prenatal care earlier (Mayberry, Mili, & Ofili, 2002) and obtain more doctor visits (LaVeist, Keith, & Guiterrez, 1995; Moore & Hepworth, 1994). Less than one percent of White residents in Pennsylvania (PA) had no prenatal care in 2004 whereas close to 4% of Black residents had no prenatal care in 2004 (PADOH, 2004). In a sample of Black and White mothers in Michigan, LaVeist and colleagues (1995) found no race differences in the initiation of prenatal care but found that Black women had fewer prenatal care visits. Moore and Hepworth (1994) had similar findings among a sample of Mexican-American women. Mexican-American mothers averaged fewer prenatal visits than non-Hispanic White mothers.

Minority children are also often at a disadvantage with regard to health care receipt. Studies suggest that non-White children do not have or do not obtain the same kind of health care that White children do. After controlling for language, marital status, urban versus rural residence, parity, age, infant health status, social risk, education, insurance status, and prenatal care use, Moore and colleagues (2005) found that infants of Mexico-born mothers were less likely to receive follow-up services compared to White, non-Hispanic infants.. Non-White children have fewer doctor visits and more time between visits than White children, even after adjusting for family income and education (Flores et al., 1999). Mexican-American children receive fewer immunizations than non-Hispanic White children (Moore & Hepworth, 1994).

Various studies have also established race differences in the quality of health care. Whether researchers operationalize health care quality as frequency and timing of health care (e.g., LaVeist, Keith, & Guiterrez, 1995; Moore & Hepworth, 1994) or having a regular source of care or a regular doctor (Halfon, Newacheck, Wood, & St. Peter, 1996; Zeni, Sappenfield, Thompson, & Chen, 2007), most find that non-White women and children typically experience health services that are less than adequate in comparison to White women and children (Halfon et al., 1996; LaVeist et al., 1995; Lewin-Epstein, 1991; Moore & Hepworth, 1994). LaVeist, Keith, and Guiterrez (1995) used the Kessner index to examine prenatal care among Black and White women. The Kessner index (see LaVeist et al. (1995) for further detail) inquires about the time of mothers' first prenatal visit, their gestational period, and the number of prenatal visits. LaVeist and colleagues concluded that Black women are less likely than White women to receive adequate prenatal care. Moore and Hepworth (1994) found similar results for Mexican-American Medicaid enrollees. Using a modified Kessner index, Mexican-American mothers experienced less adequate prenatal care in comparison to non-Hispanic White mothers. Hansell (1991) also

found that prenatal care quality according to the standards of the American College of Obstetrics and Gynecology varied by maternal race. Non-Hispanic White and Asian and Pacific Islander women were more likely to receive blood pressure exams and urine tests at their prenatal care visits than Hispanic White women. Rates did not significantly differ for Native American and Black women compared to Hispanic White women.

Research has also demonstrated racial inequalities in whether a patient has a consistent medical provider. Having a regular doctor or provider is often considered an indication of healthcare access (Centers for Disease Control and Prevention, 1998) or an aspect of quality medical care (Zeni, Sappenfield, Thompson, & Chen, 2007). In comparison to non-Whites, Whites are typically more likely to report having a routine source of care or a regular physician (Halfon, Newacheck, Wood, & St. Peter, 1996; Lewin-Epstein, 1991; Moore & Hepworth, 1994; Saha, Komaromy, Koepsell, & Bindman, 2002). Black children are more likely to report using the emergency department as their regular source for sick care than White children (Halfon et al., 1996). Compared to White children, non-White (Black, Hispanic, and Native American) children average fewer doctor visits (Flores, Bauchner, Feinstein, & Nguyen, 1999). Nationwide, higher percentages of Black children, as compared to White children, experience no usual source of health care, reduced access to care, fewer medical visits in the past year, and more emergency department visits (National Center for Health Statistics, 2006).

Not all previous research on racial disparities have controlled for the potential confound of race and socio-economic status (SES), which are often highly correlated. A major explanation for racial health disparities has focused on SES (Kirby, Taliaferr, & Zuvekas, 2006; Williams & Collins, 2002) because racial minorities are disproportionately represented in the lower socio-economic strata of our society. Compared to Whites, Blacks experience large disparities in

SES—education, income, and employment (Shavers, 2007). Blacks traditionally have had lower levels of education and employment and higher rates of poverty than Whites (LaVeist, 2002).

As our nation grew, the need for free labor forced Blacks into slavery and the lowest socioeconomic echelon of society, characterized by little to no economic or educational opportunities, health risks and disease, poverty, and segregation (Krieger, 1987). Historically, Blacks have experienced racialized access to equal schooling, employment, health care, and housing. Persistent racial discrimination modifies the benefits of higher SES for Blacks so that within the same levels of education, income, and employment, race variations are prominent (Shavers, 2007). In 1978, the median income of Black families was similar to the median income of white families in the 1950s; in 1981, the income gap between white and Black families was still significant (Black families' median income had not significantly changed), even though the education gap between white and Black families had decreased (Cooper, 2002). In other words, Blacks, compared to whites, tend to experience diminishing returns on their education in the form of income and do not reap the same benefits from education or employment that Whites do.

Furthermore, as racial minorities increase their earning capacity, they do not reap the same health benefits as whites. Farmer and Ferraro (2005) analyzed the self-rated health of Black and white adults in the U.S. over a 20-year period. Even though Blacks initially reported better health than whites, they experienced no improvements in self-rated health despite increases in education levels. In fact, the largest gap in health between Black and white adult Americans occurred at the highest levels of SES (as measured by income and education). In another study, the probability of having an infant born with a low-birthweight significantly decreased for every unit increase of family income among white women, controlling for other covariates, however the same effect was not significant for Black women (Colen, Geronimus, Bound, & James,

2006). The researchers concluded that upward socioeconomic mobility seemed to help low-income white women but not low-income Black women. Altogether, racial minorities experience systematic inequalities across multiple contexts that contribute to low SES, and ultimately, poor health. Arline Geronimus' "weathering hypothesis" (Colen, Geronimus, Bound, and James, 2006; Geronimus, 1992) stipulates that the pattern of increasing disparity in poor infant health outcomes between white and Black women, evidenced in such studies by Buescher and Mittal (2005), Colen, Geronimus, Bound, and James (2006) and Geronimus (1992), can be attributed to the effects of cumulative social inequality experienced by Black women over time. Hence, observed racial disparities in health outcomes are due to racial inequalities in SES that are cumulative (Williams & Jackson, 2005).

Research has also indicated that racial identity often plays a significant role in patients' preferences and perceptions of healthcare; in turn, the health care they choose to receive (Saha, Komaromy, Koepsell, & Bindman, 2002; Whittle, Conigliaro, Good, & Joswiak, 2002). Some may prefer and trust only physicians of the same race. In unadjusted analyses, Saha et al. (2002) found that in contrast to Black adults who perceived their regular doctor to be of a different race, Black adults who perceived their physicians to be the same race were more likely to report receiving preventive care and always receiving the medical care they needed. Common racial identity is associated with a common history. For racial minorities, this history is riddled with events that have caused mistrust and division between whites and non-whites. The Tuskegee Syphilis Study is probably the most notorious example of medical maltreatment by white, university research scientists on primarily impoverished, illiterate, Black subjects. A travesty that is all too recent (only terminated in the early 70s), the incidence instilled fear and mistrust among racial minorities and poorer sectors of our society—a sentiment that likely was passed through

generations. Social circles that are unified by racial identity can influence utilization of medical care by passing on the fear, mistrust, skepticism, or actual negative experiences of others. Racial identity is also associated with ethnic and cultural identity. Some ethnic cultures have different ideas about medicine and health practices. For example, the Chinese practice health care that relies heavily on medicinal herbs, and thus, may not utilize typical Western health resources. In sum, one way race may influence health care receipt is through racial identity. Because people identify by race, the likelihood that patients willingly receive care and the frequency with which patients get care may vary by race.

Even in studies that control for SES, racial/ethnic disparities in health tend to persist. Blacks have been shown to have higher risks of health problems and mortality than Whites in analyses that have and have not been adjusted for income (Williams & Jackson, 2005; Zhou, 2008). Mother's education and household income were shown to reduce racial disparities in childhood vaccinations but not fully account for the differences (Wooten, Luman, & Barker, 2007). These findings suggest that race and SES may be independently associated with some health care outcomes (Shavers, 2007). In the current study, both race and SES characteristics will be examined.

Geographic location. Even though nearly one quarter of our nation's population lives in non-metropolitan, rural areas (U.S. Census Bureau, 2000), a relatively small, albeit growing, body of literature has examined health disparities related to geographic location. The literature on rural environments indicates that rural residents are at-risk for poor health outcomes due to low SES (National Center for Health Statistics (NCHS), 2006; Rural Task Force, 2002). Industries and job opportunities have moved to more urban areas or overseas. With the availability of jobs dwindling, more young adults leave their rural hometowns seeking better

education and employment possibilities and leave behind older populations and a less educated, lower-earning, child-bearing population (NCHS, 2006; Rural Task Force, 2002). Faced with a dearth of opportunities and economic disadvantage, many rural residents are at risk for depression, substance abuse, extreme poverty, and other threats to their overall health and well-being (National Center for Health Statistics, 2006; Rural Task Force, 2002). Mental and physical health problems are more common in rural areas than in urban areas (Foxhall, 2000; National Center for Health Statistics, 2006). As a result, children living in non-urban, rural areas are experiencing severe declines in economic and social capital and face risks to their healthy development (Dougherty, Simpson, & McCormick, 2006; Rural Task Force, 2002). Living in a rural area of the U.S. was found to be a significant risk factor for childhood obesity (Lutfiyya, Lipsky, Wisdom-Behounek, & Inpanbutr-Martinkus, 2007).

The health of rural women and infants also seem to be at risk, though there is some evidence to suggest otherwise. Rural teens have a 30-40% higher rate of pregnancy than their urban counterparts (Mulder et al., 1999). Rural women have poorer maternal health than do their urban counterparts, and rates of fetal, infant, and maternal mortality are higher in rural areas (Mulder et al., 1999; Hughes & Rosenbaum, 1989; U.S. Congress, 1990). Low-birthweight (LBW) and preterm birth rates are also reportedly higher in rural areas than in urban areas (U.S. Congress, 1990). In contrast, an analysis of infant health outcomes in central Pennsylvania showed that residence in more rural areas was not a significant risk factor for preterm birth or low birthweight when compared to residence in urban areas (Hillemeier, Weisman, Chase, & Dyer, 2007). Therefore, more research on early health care utilization as a possible mechanism for health disparities (or lack of health disparities) associated with rurality is warranted.

Although health risks are generally high, and approximately 30% of American women live in rural areas (American Psychological Association, 1999), little research has examined maternal and infant health care in rural environments (Dougherty, Simpson, & McCormick, 2006). Rural women may have trouble accessing health care due to their geographic location (Honadle, 1983; Hughes & Rosenbaum, 1989; Rural Task Force, 2002; Rural Policy Research Institute, 1999). According to a national health report by the National Center for Health Statistics (2006), the supply of pediatricians declines markedly as the level of urbanization decreases. As a result, more rural residents leave their rural community in search of care they cannot obtain locally (U.S. Congress, 1990). One study found that women from communities in which the ratio of obstetric care providers to number of births were low were less likely to have their babies locally than women who were from communities with a higher ratio of obstetric care providers to number of births (Nesbitt, Connell, Hart, & Rosenblatt, 1990). Geographic isolation and a scarcity of health care resources may also mean that health services in rural areas are more expensive and require a significant amount of travel time (Honadle, 1983; Rural Task Force, 2002; Rural Policy Research Institute, 1999). Longer distances and a lack of reliable transportation or public transportation may prevent rural families from accessing needed services for their children (Kohler et al., 2003; Perroncel, 2000).

As such, the health and development of rural women and children are at risk. E early health care for both the mother and her infant are especially important factors to a child's successful development. Yet more research on the actual receipt and utilization of health care is needed. Understanding what services are received by rural families in areas where health services may be limited can greatly contribute to understanding geographic disparities in health.

Furthermore, geographic location must be considered when evaluating disparities in health care because most health care is delivered at the local level (Frist, 2005).

Relationship between SES, race, and rurality

"Rural settings have unique sets of dampening and multiplier effects that must be considered when dealing with public health problems, even those that are largely rooted in population composition" (Phillips & McLeroy, 2004, pg. 1662). For people living in rural environments, barriers inherently associated with rurality may exacerbate existing barriers in health care access related to SES or race. In other words, disparities in health and health care may be worse for families in poverty or for Black families if they are geographically isolated. There is evidence to suggest that geographic location, SES, and race are correlated.

Rural areas have high poverty rates; higher than in urban areas (Rural Task Force, 2002). Currently over half the children in rural areas live below 200% of the poverty threshold in contrast to 37% in urban areas (Rivers, 2005). Compared to more urban areas, rural areas lack economic infrastructure (Rural Task Force, 2002) and the employment opportunities that follow. The majority of poor people from rural areas have at least one adult who is employed; at times, even two, yet they are still poor (Dolan et al., 2003; Rural Task Force, 2002; Summers, 1997). Moreover, individuals in rural areas are more likely to work jobs (e.g., manual labor, part-time, service, or temporary/seasonal) that do not provide health insurance benefits (Kuttner, 1999). Industries that are more likely to offer employment benefits such as health insurance are more centralized in urban areas (Rural Task Force, 2002). Therefore, many rural residents are forced rely on public health insurance. "In 2004, about one in three rural children and one in ten rural adults received their health insurance through public coverage (either Medicaid or the State Children's Health Insurance Program (SCHIP)" (Long, 2006, p. 575). Among the poor who live

in non-metropolitan communities, 13% of them are White, while 33% of them are Black (Probst, 2002).

Although more research is needed, some evidence of health disparities associated with race and geographic location has been found. Mulder et al. (1999) found that infant mortality rates are twice as high for African-American teens in rural environments than for their urban counterparts. One of the mechanisms for racial disparities in poor health outcomes among older adults is attributed to geographic location. Older African Americans who have worse health than older whites are more likely to live in areas where there is particularly poor service (Kaneda & Adams, 2008). Hence, where women of childbearing age live may be an important reason why racial disparities in maternal and infant health care persist. Yet the Rural Task Force (2002) reported low rates of early prenatal care visits among rural women, especially among rural, minority women. Rural, minority women had the lowest frequencies of early prenatal care. Poor birth outcomes could be circumvented by early medical attention to childbearing women.

Few studies have looked at the interactive effects of race, class, and place of residence. Linn, Bagar Husaini, and Whitten-Stovall (1990) found that Blacks are significantly more depressed than Whites, but only among the low-income group living in rural areas. Analyzing psychological distress, Schwabe and Kodras (2008) find significant interactions between race, class, and place of residence in four U.S. communities. Essentially, the log likelihood of psychological distress are greater for Blacks than they are for Whites and the log likelihood decrease with increases in levels of SES, but the degree of this relationship varies by geographic place of residence. Similarly, the current study expects the relationship of SES and race to maternal and infant health care to vary according to rural/urban (more rural/less rural) differences in terms of health care receipt.

Andersen's model of health service utilization

A model that has been widely used in health service research to measure health care use is Andersen's behavioral model, originally developed in the 1960s. Andersen's model suggests that health care utilization is a function of characteristics that predispose and/or enable an individual to use health care. In addition, an individual's need for health care also influences their health care use. Andersen (1995) states that these predisposing, enabling, and need conditions can either make an independent contribution or may suggest a causal ordering in predicting use. Predisposing factors include demographic characteristics such as age and gender that would dictate a person's biological need for particular health care, social structure variables such as education or ethnicity that determine one's placement in society and one's ability to cope or deal with health problems, and health beliefs that would influence one's perceptions of health services. Enabling conditions include both community and personal factors that increase one's potential for realizing health care use. They might include the availability of community health resources, income, health insurance, transportation and travel time, and social relationships. Need includes both perceived and evaluated need and captures how individuals or professionals evaluate their health status and states of pain or illness, and whether they determine these experiences to be sufficient to obtain health care (Andersen, 1995). Together, these factors have the ability to explain or predict use, but will differentially predict according to the type of care analyzed (Andersen, 1995). For instance, dental care utilization, which is an important but more discretionary health service, may be more dependent on predisposing and enabling factors than emergency hospital care, which would be more dependent on need factors (Andersen, 1995). This study will use Andersen's model to categorize possible predictors of maternal and infant health care. Other independent variables besides race, SES, and geography are discussed below.

Predisposing predictors of health care receipt

Maternal age. The age of the expecting mother could significantly influence the amount of health care she receives and the amount of health care she tries to attain for her child. Older mothers have more life experience, and may be less likely to be a new mother; therefore, they may seek less health care than younger mothers. In contrast, older mothers may receive more health care due to their age or due to the fact that they are likely to have more education, and therefore, may have more knowledge of the importance of health care and how to attain it. Likewise, older mothers are more likely to have higher incomes; therefore, they can afford more health care or health care insurance. Due to their age, young mothers are more likely to be lower-income, and can consequently qualify for government insurance and health services that may equalize disparities in health care receipt due to SES or health insurance. Hence, age may significantly predict health care receipt, but much to the extent that it is highly correlated with parity and SES.

Enabling/Impeding Factors

Personal transportation and distance. Although not much literature has examined transportation and distance traveled in the receipt of health care, having transportation may be especially important to families who live in more rural areas, especially if they have to travel great distances to get to their doctor or to obtain basic and/or specialty care (Hughes & Rosenbaum, 1989). One recent study found that rural residents did indeed have to travel farther for health care than urban residents (Probst, Laditka, Wang, & Johnson, 2007). Thus, personal transportation and/or shorter distance to medical facilities would enable health care. The same

study also found race differences in travel time. Even though the distance traveled did not vary by race, African Americans spent more time traveling than whites.

Social support. Rurality is considered a physical barrier to health care, and therefore is framed as a risk factor to the receipt of health services. In one respect, families who are more geographically isolated may be more socially isolated as well. Social isolation has been found to be a negative predictor of health (Adler & Newman, 2002).

Yet social support may be one characteristic of rural environments that poses a protective buffer to families at risk of few health care services. Rural environments are often characterized by small communities that consist of smaller pockets of "neighborhoods", where residents have intimate knowledge of fellow residents and maintain close kinships. The small size of these rural towns may lend itself to building and fortifying a strong social support network that reinforces positive interaction. Because of strong social support, rural neighbors may come to the aid of their fellow neighbor and help to ensure the health and safety of both their fellow resident and their community. Making sure a pregnant mother or her child gets health care would not be beyond the scope of an intimate network of friends, family, and loved ones. Rural communities are also characterized by a strong emphasis on the family. As a potential facilitator to health care receipt for rural families or a protective factor against poor health outcomes (Kaneda & Adams, 2008), social support will be used as a predictor in this study.

Health insurance. As previously discussed, health insurance facilitates receipt of health care. The uninsured receive less medical care and poorer quality care than those who are insured (Adler & Newman, 2002). Whether or not families have health insurance coverage exaggerates socio-economic differences in the receipt of health care because families of high SES are more likely to have health insurance, can afford health insurance, and can afford better health

insurance. More than 60% of the uninsured are low-income families; 40% of those who have not graduated high school are uninsured (Adler & Newman, 2002). Most high SES families who work have employer-provided, private insurance (versus public insurance), and therefore may have more options in choosing their health care providers given their type of insurance. Typically, private insurance allows their members to choose among medical professionals, including specialists. Hence, those with private insurance may have better quality care accessible to them. Furthermore, those specialists and certain medical providers may not accept public insurance. Ultimately, through health insurance, socioeconomic disadvantage can drastically reduce the quality of care, the kinds of specialty healthcare, and the types of prescription medications that low-income families can access (Kuttner, 1999).

Although government-sponsored health insurance programs are a primary source of health insurance and obtaining health care for low-income families, pregnant women, and children in the U.S., no-cost health insurance programs do not exist without issues. First, not all low-income families are eligible for Medicaid. Second, not all eligible families are enrolled in Medicaid. Third, Medicaid enrollment does not guarantee access to health care.

General eligibility for Medicaid is determined by certain eligibility requirements, income, and resources. Pregnant women are automatically eligible for Medicaid but their final eligibility status rests on their income and household size, in comparison to income limits (Department of Public Welfare (DPW), 2005; U.S. Department of Health and Human Services (DHHS), 2007). No other personal resources, such as bank accounts (checking or savings accounts), stocks and bonds, or life insurance, are considered. The federal government requires states to cover pregnant women whose household income falls at 133% of the Federal Poverty Income Guidelines (FPIG), but states may ultimately determine specific eligibility guidelines (Gavin, Adams,

Manning, Raskind-Hood, & Urato, 2007; U.S. Department of Health and Human Services, 2007). For most states, Medicaid eligibility for pregnant women is based on 185% of the FPIG (Gavin et al., 2007), including the states examined in this current study (North Carolina and Pennsylvania). For 2004 (relevant for the current data set), 185% of the FPIG translated to $1,926 a month for a family of 2 (the pregnant woman and her unborn child) and $2,416 a month for a family of 3 (e.g., the pregnant woman, her spouse or live-in partner, and her unborn child) (DPW, 2005). The same coverage applies to infants up to age 1, although if the pregnant mother was Medicaid eligible at the time of the child's birth and the child lived with the mother, her child is automatically covered by Medicaid up to age 1 (DPW, 2007).

Expectant mothers and families who earn more than 185% of the FPIG do not qualify for no-cost health insurance. In 2004, once the child reached age 1, the percentage at which the family could qualify for Medicaid for their child dropped to 133% of the FPIG. Essentially, families whose children (aged 1-6) qualified for Medicaid had to be even more impoverished (see Figure 2). The eligibility guidelines pose a unique dilemma for low-income families who work as they usually earn too much to qualify for subsidized health care (Medicaid) but do not receive health insurance from their employer and cannot afford to pay the high premiums for independent insurance coverage (Kuttner, 1999).

State-run health insurance programs are meant to cover the children of working families who do not qualify for Medicaid but have no other insurance. In other words, if the mother was not covered by Medicaid while pregnant, and the infant's (below the age of 1) family falls above 185% of the FPIG, then just the *infants* qualify for state medical assistance. Commonly, this health coverage program is known as SCHIP, although each state may refer to it differently

because each state runs its own assistance program with separate guidelines, as is described later using the two primary states of interest in this current study.

The second problem with public health insurance surrounds actual enrollment in Medicaid/SCHIP. Despite broadened coverage of government-sponsored health insurance, not all eligible families are enrolled (Kuttner, 1999; Newacheck, Pearl, Hughs, & Halfon, 1998). For instance, in Centre County, Pennsylvania, only 34% of children eligible for the State Child Health Insurance Program (SCHIP)—the government-sponsored health insurance program for children from lower-income families—were enrolled in February of 2002 (Kohler et al., 2003). Lapses in enrollment could also occur prior to pregnancy, making it difficult for pregnant mothers to initiate care. Gavin and colleagues (2007) compared Medicaid enrollment before pregnancy across eight states before and after implementation of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996, which imposed work sanctions and time limits on Medicaid beneficiaries. Pre- and post-PRWORA comparisons demonstrated a significant negative effect of welfare reform on Medicaid enrollment and initiation of prenatal care at first trimester for women who were eligible for welfare. Although families who qualified for welfare retain Medicaid eligibility, under PRWORA, they were no longer automatically enrolled in Medicaid (Gavin et al., 2007). Therefore, enrollment is an additional step for those who qualify. Studies done with focus groups have offered some additional explanations for the division between Medicaid eligibility and enrollment. Many who are eligible do not know they are eligible; many are deterred by complex enrollment procedures; several, in particular ethnic minorities, have difficulty with the language barrier (Perry & Paradise, 2007). A significant number of families living in poverty simply have little or no access to subsidized health

insurance programs (Blank, 1997). This may apply in particular to rural populations, who are geographically isolated and may have fewer government resources nearby.

The third issue surrounds access to care for Medicaid enrollees. Past research suggests that having health insurance increases the likelihood of care and enables individuals to obtain better health care (Kuttner, 1999; Newacheck et al., 1998). Hence, Medicaid/SCHIP beneficiaries would fare better when compared to those without insurance but would fare worse when compared to those with private insurance. Even though government-sponsored health insurance programs cover the cost of healthcare, there are mixed findings when examining access to health care under Medicaid (Long et al., 2006). Dubay, Joyce, Kaestner, and Kenney (2001) analyzed national data from the Natality Files on low SES women. They found that rates of late initiation of prenatal care decreased from 1980-1986 to 1986-1993 among both white and Black women, but found no significant change in LBW rates. They concluded that Medicaid expansion improved access to prenatal care for low-income women but that access did not necessarily lead to better health outcomes for low-income women. Another study found that both White and Mexican-American mothers who received Medicaid in Arizona received fewer adequate prenatal visits than the national average (Moore & Hepworth, 1994). It is unclear whether the implications may be due to income, state-level differences, or differences in the type of health insurance coverage.

Long, King, and Coughlin (2006) analyzed adult Medicaid beneficiaries and privately-insured, low-income adults in both metropolitan and non-metropolitan areas. The researchers showed that Medicaid controlled for the significant urban-rural differences in access to care that was experienced by low-income adults without Medicaid. In other words, access to care in both metropolitan and non-metropolitan areas was comparable for Medicaid recipients but not

comparable for low-income adults with private insurance. Yet when they analyzed according to health insurance type, they initially found that those with Medicaid have worse access to health care than those with private insurance, in both urban and non-urban regions. However, after controlling for individual characteristics, most of the health care discrepancies disappeared. Interestingly, Medicaid recipients were still at a significant disadvantage for not having a usual source of care compared to privately-insured, low-income adults, but only for those living in non-metropolitan counties. Hence, rural populations are still at risk for not receiving health care, even with Medicaid.

The gravity of this risk is more severe for expecting mothers and infants, who need a greater frequency of care. Mothers' unmet health service needs are likely to contribute to poor developmental child outcomes. In addition, unmet health service needs early on may impact later health care receipt. Moore and colleagues (2005) found that immigrant (Mexico-born) families who did not experience home visits from the community health nurse or experienced inadequate prenatal care were less likely to use follow-up services (a developmental clinic), even after controlling for language, demographics, and SES. The current study will examine whether Medicaid receipt predicts maternal health care and the frequency of infant health care for families residing in non-metropolitan locations. Because so many families would not have health care coverage without government medical assistance, having Medicaid/SCHIP is expected to serve as a protective factor against not receiving health care.

Availability of health service providers/doctors. The availability of health care programs should be examined. If health care services are not readily available, then health insurance, even government-sponsored Medicaid/SCHIP, does little to protect against the risk of not receiving

care. Thus, programs for Medicaid-eligible, rural, pregnant women and infants in the states of interest will be researched.

Need factors

Parity/birth order. Multiple parity has been identified as a risk factor for fewer (few to none) prenatal care visits among inner-city women who gave birth at a hospital (Melnikow, Alemagno, Rottman, & Zyzanski, 1991) and reduced quality of prenatal care (Hansell, 1991). Women who have already birthed a child may be less inclined to utilize maternal health services that prepare them for the birthing process, labor, and the care of their children because of the knowledge they have gained from prior experience. In contrast, those who have not gone through the experience of being a parent are more likely to seek information and assistance regarding pregnancy, birth, and child rearing. Parity, or in this study, whether or not the target child was the mother's first-born child, was added as a predictor to the analysis of health care receipt because new mothers may be more likely than mothers who have already had children to seek certain kinds of healthcare, such as childbirth classes, or may be more anxious/eager to take their children to the doctor's office because they lack the experience, and hence, knowledge of mothers who have already had children. Also, first-time mothers only have one child to manage, therefore, the frequency of health care receipt may also be related to the amount of time and availability uniparous mothers have in comparison to multiparous mothers.

Previous health history. Mothers who have a history of health problems (e.g., diabetes or anaemia) or have experienced prior health problems during previous pregnancies (e.g., gestational hypertension) have an increased risk of preterm delivery, LBW, and neonatal mortality (Chen, Wen, Yang, & Walker, 2007; Roy, Baruah, Kumar, Malhotra, Deorari, & Sharma, 2006); therefore, may be flagged for extra health services, such as home visits (Dee,

home health nurse, telephone conversation, July 17, 2006). Also, infants who are born premature, low birth-weight (LBW), or experienced other difficulties at birth, may require follow-up medical care and more frequent doctor visits. Their previous health problems or current health status puts them at a higher health risk and a higher likelihood to receive health care services. Hence, this study will determine a high health risk subsample and whether they differentially receive health care. It will also determine whether the subsamples of high-risk mothers and infants significantly differ from the larger sample on socio-demographic characteristics.

State residence

Past research has looked within state to examine differences in health care. State as a measure of geographic location can provide context to environmental conditions that may affect health care utilization (Shavers, 2007). Additionally, because federal programs are administered by each individual state, both coverage (eligibility) and programming may vary according to state. States tend to differ on health care policies, funding, and eligibility, along with the kinds of health care programming available to families. Therefore, state differences are expected to predict types of health care receipt, and within state, unique predictors of health care are expected.

Study data come from families in rural regions of two states, Pennsylvania and North Carolina. In 2004 (this study uses data from 2004), infants of families between 185% and 200% of the FPIG living in these states qualified for no-cost medical assistance (see Figure 2). Pennsylvania kept the name “CHIP”, or Children’s Health Insurance Programs, while North Carolina called it “Health Choice”. Infants of North Carolina residents above 200% of the FPIG were ineligible for Medicaid or CHIP (Susan, North Carolina eligibility service agent, telephone

conversation, June 30, 2006). In contrast, Pennsylvania residents who fell between 200%-235% of the FPIG qualified for low-cost CHIP (Figure 2). This meant that the families would have to pay a minimal amount for health care coverage.

Recently, both North Carolina and Pennsylvania have been expanding their health assistance coverage to include more children that need medical care and assistance. Therefore, income guidelines have changed slightly. For instance, in North Carolina, children ages 1-5 whose family income limit falls between 185% and 200% of the FPIG are now considered Medicaid eligible and fall under a new category called "Expanded Medicaid" (Susan, North Carolina eligibility service agent, telephone conversation, June 30, 2006). According to Susan, the North Carolina eligibility service agent I spoke with, this action frees up more money for Health Choice. In Pennsylvania, Governor Edward G. Rendell has expanded CHIP to cover all uninsured children who do not qualify for Medicaid, regardless of family income (Pennsylvania's Children Health Insurance Program, 2007). At the end of 2007, federal funding for SCHIP was extended through March of 2009 (Children's Defense Fund, 2007). For pregnant women, eligibility for medical assistance is still based on 185% of the FPIG. In 2007, the income limit is $2,111 for a family of 2 and $2,648 for a family of 3 (Pennsylvania DPW, 2007). Presumably, more children will be covered, and in turn, more children will receive preventative health care. Yet, according to current media campaigns, the number of uninsured children has increased steadily over the years, and 12.1% of children in the U.S. (1 in 8 children) remain uninsured (Children's Defense Fund, 2007).

Significant state differences in health care receipt between Pennsylvania and North Carolina are expected because of the difference in 2004 eligibility guidelines and because health care programs and efforts to enroll mothers and infants in health care programs reasonably vary

by state. Although this study will be unable to determine whether significant state differences are a reflection of differences in state health care policies, differences in public health care programs available to residents, or differences in the efforts of government health agencies, it is believed that state differences are worth analysis and may better inform future health care policy.

Method

Participants

Complex sampling procedures were used to recruit mothers who had just given birth for a larger study, the Family Life Project (FLP), from three contiguous counties in eastern North Carolina—Sampson, Wayne, and Wilson—and three contiguous counties in central Pennsylvania—Blair, Cambria, and Huntingdon. The study oversampled for a representative sample of low-income families, and over-sampled African-American families in NC but did not over-sample in PA as the target communities in PA were >95% White. A weighted probability sample of the seven hospitals in the target counties of PA was taken because the number of babies born in all seven target hospitals far exceeded the number needed for the project. All three target county hospitals in NC were used for recruitment. Additional NC families (approximately 15%) were systematically recruited through nearby county courthouse birth records and by phone.

Seventy-two percent of the 5471 women who gave birth to a child during the recruitment period were deemed eligible for the FLP study. Eligibility was defined by residence in the target counties in NC and PA with plans to stay in the area for at least 3 years and by English as the primary spoken language. Sixty-eight percent of eligible families agreed to be considered for the study; 58% of them were invited to participate. Invitations were based on sampling measures to ensure over-sampling of African-American families in NC and low-income families in both states. Families were considered low-income at recruitment if they reported one of the following: household income <200% of the federal poverty line, use of social services available to low-income individuals (e.g., WIC, food stamps), or head of the household having less than a high school education. Families reporting none of these criteria were considered not low-income.

Eighty-two percent of invited families agreed to participate in the longitudinal study, which required home visits and interviews when their child was 2-, 6-, 15-, 24-, and 36-months-old. A final total of 1292 families agreed to participate and were seen at the 2 month visit. A total of 1204 primary caregivers were interviewed at the second wave of data collection when the target child was six months old. Participants were compensated for their time and were treated in accordance to the "Ethical Principles of Psychologists and Code of Conduct" (2002).

The majority of the sample was either White (Caucasian) or Black (African American). Six respondents identified their race as something other than white or black: one American Indian, one Chinese, one Filipino, two other Asian, and one Guamanian or Chamorro. To simplify analysis, these six participants were dropped. Thus a total of 1286 primary caregivers from FLP's first visit (when infants were two months old) and 1198 primary caregivers from FLP's second visit (when infants were six months old) were included in this study's sample. There were 757 white respondents (59%) and 529 black respondents (41%). Of those who reported their race to be either black or white, 21 reported their ethnicity to be Hispanic. Fourteen were white Hispanic and seven were black Hispanic. Because less than 2% of the sample reported Hispanic ethnicity, this study only analyzed racial variability. All participants for this study will be considered as either White or Black. The FLP included only participants for whom the primary language in the home was English.

All but five of the primary caregivers (99.6%) interviewed at the first wave of data collection were the biological mother of the target child. At the first visit, four of the primary caregivers interviewed were the maternal grandparent of the target child and one respondent was an (unspecified) adult relative. There were 12 primary respondents that had changed from the 2 month home interview to the 6 month home interview. At the 6 month interview, 3 reported

being the child's biological parents, 2 were the foster parents, 4 were the maternal grandparents, and 3 were the paternal grandparents. Again, nearly all the primary respondents interviewed at the 6 month home visit were the child's biological mother. Therefore all respondents will be treated as the child's mother for the purposes of this study.

Table 1 displays demographic characteristics of the study sample. Primary respondents' mean age was 26 years (*SD* = 6.03). Approximately 28% received their high school diploma while only 9% of the sample attained their college degree. Forty-one percent of the sample (*N* = 527) reported that they were employed. The mean income-to-need ratio was 1.86 (*SD* = 1.72), with 737 families (62% of the sample) at or below 185% income-to-need ratio, i.e., income adjusted for family size. Among the sample, 517 respondents (40%) lived in Pennsylvania while 769 respondents (59.5%) lived in North Carolina. Approximately 59% of the sample (*N* = 757) reported their race as white while 41% (*N* = 529) reported their race as black. The majority of the blacks in the sample lived in North Carolina (*N* = 510 or 96.4%). Fifty percent of the sample (*N* = 643) indicated that their marital status was married. Most respondents reported having an average of two children, with four people total living in the home. Approximately 40% (*N* = 509) of the primary respondents reported that the target child was a first-born child.

Procedure

Preliminary contact information was gathered from the families at recruitment. Families were contacted prior to each home visit in order to schedule according to the families' convenience. Home visits lasted approximately 2-3 hours. During the home visits, the primary caregiver was interviewed and data collectors directly keyed responses into a computer. Mothers were administered a literacy test, the K-FAST (Kaufman Functional Academic Skills Test). Those who passed this test were presumed to be reading at an 8th grade reading level or beyond

and were given the option of answering the questionnaires on the computer independently; otherwise questionnaires were read aloud and the data collector keyed responses.

As part of the larger FLP study, mothers were asked several sets of questions concerning demographics, financial and social resources, family history, education and work experience, health care, relationships, and parenting. In between the home visits, short telephone interviews were conducted with the participants in order to update information on the status of the mothers' relationships, employment, health, and childcare. Data for this study were collected at the first and second home visit in a series of five home visits. At the first visit, children averaged 2.66 months (*SD* = 1.29) and at the second visit, children averaged 7.74 months (*SD* = 1.48). The 2- and 6-month home interviews included questions about the mother, her child, the household, and health care services.

Measures

Predisposing Characteristics

Primary caregivers answered questions on socio-demographic characteristics, including age, race, state residence, number of children and socio-economic status, namely, educational attainment, employment status, and household income. Most socio-demographic information was collected at the 2-month home visit and would be considered a predisposing factor according to the Andersen model (Andersen, 1995). Socio-economic status (SES), however, overlaps as a predisposing characteristic and an enabling characteristic because at least two of its common indicators—income and employment status—would be considered personal resources that may enable the utilization of health services. In the FLP, a total household income estimate was approximated from both primary and secondary caregivers' income sources as well as any income from any other household members. This total was divided by the federal poverty

threshold, which is adjusted for number of persons in the home, to compute an income/need ratio. The income/need ratio is used in this study as a measure of the family's income and poverty level. This study chose to keep each SES indicator—maternal education, family income/need ratio, and employment status—separate to be able to determine their independent effects on health care.

Enabling Characteristics

Rurality-geographic isolation. The current study is interested in the impact that rurality has on maternal and infant health care receipt and utilization. Rurality is primarily conceptualized as a physical barrier that may pose problems to expecting mothers and families with infants seeking health care. Therefore, the current study uses a family's geographic residential isolation as the primary measure of their rurality.

Geographic isolation (often referred to as "rurality" in this study) is based upon Global Positioning Systems (GPS) coordinates and Geographic Information Systems (GIS) maps. Individual physical distances (in meters) between each subject's residence and ten community assets were measured. The ten assets included the nearest supermarket, elementary school, high school, library, doctor's office, fire station, gas station, public park, freeway on-ramp, and county seat. Distances were calculated by superimposing 400 x 400 meter grids onto each of the study's six counties. Factor analyses suggested combining the individual distances into a global index of rurality ($\alpha = 0.88$; Range = 783 – 33,181 meters). Thus, the mean distances across all 10 measurements were calculated, and a log transformation of these scores was used to correct for non-normal distribution.

Other characteristics may also contribute to a family's physical isolation and may be a physical barrier to health care receipt. Actual time traveled to reach necessary places such as the doctor's office or hospital may hamper health care utilization, or may only be problematic given transportation issues. Therefore, travel time to reach the doctor's office was considered, as well as the primary means of transportation. Respondents reported on the time traveled to reach the doctor's office in hours and minutes. Respondents also reported on their primary means of transportation, with options including personal vehicle, other person's vehicle, bus, taxi, or walking.

Rurality-psychosocial/social support factors. The Family Life Project included a modified, shortened version of the Questionnaire of Social Support (QSS). The QSS originally consisted of 37 items, to which Keith Crnic (2004), a FLP investigator, combined item pairs to create 16 questions. The 16-item scale asked respondents to rate their satisfaction regarding four areas of social support: community, friendship, family, and intimate relationships, and included one global satisfaction item. Scoring was based on a Likert scale of very dissatisfied to very satisfied, and included a "Not applicable" (NA). Items that were marked "NA" or "Don't Know" were considered missing.

Health insurance. At the 2 month home visit, participants were asked whether they or anyone in their household had received Medicaid or SCHIPS since the target child's birth and whether they were currently enrolled. At the 6 month home interview, participants were asked whether every member of the household (including themselves and their infant) had insurance and what type of insurance it was. Type of insurance was collapsed into government-sponsored health insurance and employer-provided private insurance.

Need Characteristics

Maternal health history. Mothers answered questions at the 2 month home visit about their health history—whether or not they were ever diagnosed with diabetes, high blood pressure, cancer or malignancy, seizure disorder, depression, or mental illness. Mothers also were asked about their health during pregnancy—whether or not they experienced bleeding or spotting, excessive nausea, weight loss greater than 10 pounds, a serious infection, high blood pressure, convulsions, a serious accident, emotional problems, depression, or anxiety, or any other illnesses requiring medical care while pregnant. Each health problem was dummy-coded according to whether or not the respondent reported having that particular health problem. A health risk index was also created from the count of dummy-coded health problems to measure the total number of health risks mothers experienced.

Infants' health at birth. Respondents answered questions concerning their newborn's health at birth. Mothers reported on infant weight at birth, whether the infant was born premature, any difficulties the infant experienced at delivery, and whether the infant was admitted to Neonatal Intensive Care Unit (NICU). Possible birth difficulties included: fetal distress (decelerations in the heart rate which require constant monitoring); breathing difficulties; congenital malformations or birth defects (such as blindness, cerebral palsy, cleft lip, cleft palate, deafness, hydrocephalus, liver disease, or spina bifida); or some other difficulty at birth. A health risk index was also created from the total number of health problems reported at birth and whether the infant was born premature or with low birthweight (weighed <2500 grams).

Dependent Variables

Prenatal and postpartum care. At the initial visit (when the child was 2 months old), mothers were asked if, and for which trimester, they had received prenatal care and about the kinds of health services they received since becoming pregnant with the child enrolled in the study. Types of services included medical care (1 item), pregnancy-related (3 items), parenting-related (3 items), mental health (2 items), and basic needs (3 items). Specifically, they asked whether the mother received a pediatrician, childbirth classes, home visits while pregnant, post-birth home visits, breastfeeding assistance, parenting classes, parenting videos, personal counseling, crisis help, a case manager, and food bank or emergency loan assistance. For each item, the respondent reported whether they had received the service. If so, they were also asked to identify the service provider and rank how helpful the service was, choosing either not at all, somewhat helpful, or very helpful. The measure was developed specifically for the FLP.

Pediatric care. Information regarding the child's pediatric care and health care providers was obtained when the child was six-months-old. Questions inquired about where the child obtained care, whether the child had someone they considered to be their regular doctor, the frequency of sick, well, and emergency visits, and the experience of physician-related barriers to care, such as long appointment wait times.

Several of the pediatric care questions used in the Family Life Project were derived from the Medical Expenditure Panel Survey (MEPS) of the Agency for Health care Research and Quality (1996) as well as from the Legacy for Children study (Centers for Disease Control and Prevention, 2005). MEPS inquires about specific health services that Americans use, their frequency of use, the cost of services, how they are paid for, and the cost, scope, and breadth of private health insurance. The Legacy for Children study is a set of randomized, controlled, and

longitudinal studies launched by the Centers for Disease Control and Prevention to examine the potential for improving child outcomes through parent programs designed to promote self-efficacy and a sense of community. These studies were targeted at urban families whose children would be expected to fall below national means of developmental outcomes.

The pediatric care questions used in the current study from the MEPS inquired about the frequency of doctor's office visits. MEPS questions were modified to apply to a 6-month-old infant rather than an adult or older child. Questions adapted from the Legacy of Children study inquired about a regular health care provider for the target child, and whether the source of health care was a private doctor's office, a hospital outpatient clinic, a migrant clinic, a health department clinic, a community health center, a hospital emergency room, an urgent care center, or another type of place. Other questions concerning the continuity of care were created specifically for the FLP, e.g., questions concerning the frequency of seeing the same doctor.

Analysis Plan

Select predictor variables had to be transformed or collapsed into new variables before proceeding with analyses. Using the mean and median level of education, maternal educational attainment was collapsed into a dichotomous variable of those who had obtained up to a high school education or high school equivalency and those who had obtained an education beyond high school. A dichotomous variable using 185% of the family income/need ratio was created to indicate whether or not the family was living at or below the 185% income-to-need ratio. The 185% threshold was chosen because the federal government uses this percentage to determine medical assistance eligibility for pregnant women. In consideration of the primary measure of rurality—geographic residential isolation—both the raw and logged variables were examined. The histogram of the raw geographic isolation variable showed that data was non-normally

distributed and negatively skewed. A mid-cutpoint dichotomizing low and high geographic isolation showed two uneven groups and exaggerated distances between data points. Comparison of a median split for the raw and logged geographic isolation variables demonstrated similar bivariate findings. In accordance with other Family Life Project studies (e.g., Flower, Willoughby, Cadigan, Perrin, Randolph, and The Family Life Project Investigative Team, 2008), this study used the logged geographic isolation variable that corrected for non-normal distribution. Travel time to reach the doctor's office in hours and minutes was transformed to total minutes. Primary mode of transportation was collapsed and transformed into a dichotomous variable to indicate whether or not the primary respondent had a personal vehicle as a means of transportation.

Even though the pre- and post-natal "need" element of Andersen's model is assumed for our sample of mothers and their newborn infants (LaVeist, 1995), the health risk status of mothers and infants will be considered in analysis. If mothers and infants with high health risk (or multiple health risks) show selectivity in health care receipt and there are no significant associations between health risks and socio-demographic characteristics, then the study will omit this high-risk subpopulation to avoid selection bias in the dependent variables. However, if there is a significant association between health risks and socio-demographic characteristics, then maternal and infant health risk will be used as a control variable (i.e., will be entered at the first step of hierarchical regression analysis) in predicting health care receipt.

Relationships between geography, income/need, and race were analyzed to determine whether there were differences in the proportions of families living in more versus less rural areas according to race and economic standing and whether there were differences in the

proportions of families living in Pennsylvania versus North Carolina by race, economic standing, and geographic isolation.

Frequency data on the receipt and utilization of healthcare by mothers and infants are presented and used to determine whether disparities in health care exist. Only the health care measures with enough variance were analyzed. Once the health care outcome variables were determined, analyses to test the study's hypotheses were conducted. First, chi-square analyses were performed to test for individual differences by race, income/need ratio, and geography in maternal and infant health care receipt and utilization. It is hypothesized that race, SES (income in particular), and rurality (geographic isolation) and state residence will significantly differentiate the likelihood of receiving maternal and infant health care. Those who are Black, have lower income/need, or are more geographically isolated will be more likely to experience health care deficits. Given prior literature indicating significant correlations between race, socio-economic standing, and geography, chi-square analysis was also used to test whether the significant differences that were found mattered across socio-demographic characteristics, or whether the differences were significant for some groups of people and not others. In other words, for whom are the differences relevant? Adjusted bivariate analysis will help determine whether race differences in maternal or infant health care exist across income/need and rural/urban differences; whether income/need differences in maternal or infant health care exist across race, rural/urban, and state differences; whether significant rural/urban (geographic isolation) differences in maternal or infant health care exist across race, income/need, and state differences; and whether significant state differences in maternal or infant health care exist across income/need and rural/urban differences. It is expected that socio-economic and racial disparities in health care will be significant for both more and less rural residents, and socio-

economic disparities will be significant for those in either state. It is also expected that geographic isolation differences will be significant across race and state, but when considering household income/need levels, geographic isolation differences will be significant for those who have lower household income/need. In other words, rural isolation will be detrimental for families regardless of race or state residence; rural isolation will only be detrimental for families with lower income/need levels. Those who are not economically poor will not experience deficits in regular and specialty health care services.

Diminishing cell sizes restricted more complex chi-square analyses of outcome variables that adjusted for multiple factors. Therefore, to measure the influence of multiple predictors, including other components of SES, and to adjust for other covariates, multivariate regression analysis was performed. Logistic regression was used for all dichotomous outcome variables.

As previously discussed, this study used Andersen's (1995) model of health care utilization as an organizing framework for regression analysis predicting early health care receipt by rural mothers and infants. Following the Andersen model, predisposing variables included binary variables indicating race (black = 1, white = 0), maternal education (beyond high school education = 1, high school education/equivalency and below = 0), and maternal age. Enabling (or disabling) factors included income/need ratio (below 185% of the poverty level = 1, above 185% of the poverty level = 0), employment status (employed =1, not employed = 0), Medicaid status (received Medicaid = 1, did not receive Medicaid = 0), rurality (high rurality = 1, low rurality = 0), travel time to the doctor's office, and access to personal transportation (personal vehicle = 1, no personal vehicle = 0). In the analysis of infant health utilization, type of health insurance compared government-sponsored insurance (Medicaid or SCHIPs) to employer-provided, private insurance (Private insurance = 1, Medicaid/SCHIPs = 0). Need variables included parity (1st

biological child = 1, not 1st biological child = 0) and the number of health risks experienced by mothers or infants[1].

The first set of regression analysis used hierarchical regression analysis to test for the existence of rural differences in maternal and infant health care receipt, controlling for predisposing, enabling, and need characteristics. The first step established geographic differences in maternal and infant regular and specialty health care. It is hypothesized that greater rurality, i.e., greater isolation, will reduce the likelihood of health care receipt and utilization. Then predisposing and need characteristics were added to the model to test whether differences in geographic isolation remained significant once predisposing and need covariates were entered into the model. The next step tested whether SES and race variables explained significant differences by geographic isolation.[2] SES and race are expected to partially explain the effects of geographic isolation on health care. The next stage of the multivariate analysis added enabling variables to the model (personal transportation, travel time to the doctor, social support, and health insurance). Enabling characteristics are expected to further explain geographic differences.

The last set of regression analysis performs state-specific analysis of all predictor variables. This analysis will offer information regarding unique predictors of health care service utilization particular to each study state (Pennsylvania and North Carolina), relevant for state health care policy and programming.

[1] Explanation of why a risk index was used over risk status is given in the Results section.
[2] Despite the fact that Andersen (1995) may consider income and employment enabling factors, the binary variables of income/needs ratio and employment status were added to this step in order to keep SES components together and better determine whether SES explains the effects of geographic residential isolation.

Results

Preliminary Findings

Dependent variables

Maternal health care descriptives. Maternal health care frequencies demonstrated that few mothers were at risk for not receiving prenatal care. Approximately 1% (N = 16) reported that they received no prenatal care during their pregnancy. Approximately 8% (N = 98) received prenatal care late in their 2nd or 3rd trimester. Approximately 87% (N = 1109) of mothers reported that they received prenatal care in all trimesters.

Frequencies of specialty health care services demonstrated some variability. Approximately 20% of the participants (N = 251) reported receiving childbirth classes. Approximately 17% (N = 214) received home visits when they were pregnant and approximately 33% (N = 420) received home visits after their baby was born. Approximately 28% of mothers in the sample (N = 364) reported receiving parenting videos. Only 7.5% (N = 96) of sample mothers reported utilizing parenting classes. Approximately 29% (N = 365) received breastfeeding help. Only 4% of sample mothers received personal counseling, crisis helpline assistance, emergency loans, or food from a food bank since becoming pregnant.

Analysis on the lack of prenatal care, use of parenting classes, mental health services, emergency loans, and food bank use will not be conducted due to their limited variability. Thus, disparities in the receipt of prenatal care throughout the duration of the pregnancy, childbirth classes, pregnancy and post-partum home visits, parenting videos, and breastfeeding assistance will be analyzed. Frequencies of these services are displayed in Table 2.

Infant health care descriptives. Frequencies of health care variables for infants demonstrated little risk of infants not having a pediatrician or regular health care source. Only 6

out of the 1286 study participants reported not having a pediatrician at the 2 month home visit. Ninety-nine percent of the primary caregivers reported having a particular practice, clinic, or health center that they usually took their child to for routine medical care. Approximately 95% listed their regular practice as a private doctor's office or clinic. Health care frequencies, however, did show some risk of infants not having a regular doctor at their primary health care source. Approximately 70% of mothers in the sample said that there was a doctor at their health care practice that they considered to be their child's physician (i.e., a regular doctor for their child).

By the age of six-months, the children in the study went an average of two times to a doctor's office or clinic because of a sickness, an injury, or an accident, and an average of four times for a well-visit or routine check-up (Table 3). An average of four well-child visits is appropriate for children six months of age[3], according to the guidelines provided by the American Academy of Pediatrics (2008). Approximately 65% of the respondents reported that their child had never gone to the emergency room (ER) and less than 5% reported an ER or urgent care visit three or more times (Table 4).

Having a regular physician and the frequency of well-care visits will be analyzed as regular health care utilization for the infants in the study sample.

Predisposing predictor characteristics

Race. As previously stated, 96% percent of the FLP respondents who self-reported their race as Black resided in North Carolina. Hence, race comparisons were made using only North Carolina residents. Within North Carolina, 259 respondents (33.7%) were White while 510 respondents (66.3%) were Black. T-test and chi-square analyses showed that Blacks in our

[3] If including the evaluation recommended within 3-5 days of birth, or within 48-72 hours after hospital discharge, the recommended number of visits would be five for a six-month old.

sample, in contrast to Whites, were significantly more likely to be lower-income (80.9% vs. 47.0%, χ^2 (1, N = 769) = 85.17, p < .001), less educated (63.1% vs. 42.1%, χ^2 (1, N = 769) = 30.9, p < .001), unemployed (61.6% vs. 57.2%, χ^2 (1, N = 769) = 15.71, p < .001), and live in less rural areas (56.7% vs. 40.2%, χ^2 (1, N = 769) = 85.17, p < .001).

Socio-economic indicators. As previously stated in the Method section, this study uses an income/need ratio that is based on household income and adjusted household need according to the Federal Poverty Income Guidelines (FPIG) as an indication of family income or poverty level. The mean income/need ratio for this study's sample was 1.86, *SD* = 1.72. Approximately 62% of the sample had an income/need ratio ≤ 185% (the threshold at which families qualify for Medicaid assistance), while 38.5% had an income/need ratio greater than 185%. Of the 38.5% with an income/need above 185%, approximately 4% fell between 185-200%, 7% were between 200-235%, and approximately 28% were above 235%.[4] The median adjusted family income/need ratio fell below 185% at 1.43 or 143%.

As previously stated, approximately 41% (N = 527) reported that they were employed and approximately 52% (N = 672) had a high school education or below while approximately 48% (N = 614) reported some education beyond high school. Mothers with a higher income/need ratio were more likely to be better educated (χ^2 = (1, N = 1199) = 178.95, p <.001) and employed (χ^2 = (1, N = 1199) = 72.81, p <.001).

Enabling predictor variables

Rurality-geographic isolation. The primary measure of rurality used in this study was the FLP's measure of relative geographic isolation that was based on Global Positioning Systems

[4] Children with family incomes between 185-235% may still receive public health coverage through the State Children's Health Insurance Program (SCHIP), therefore I also reported on the percentages of the sample that fell within these "higher" income brackets.

(GPS) technology and Geographic Information Systems (GIS) maps. To correct for non-normal distribution, the FLP took a log transformation of this variable. The mean of the transformed rurality measure was 8.29, *SD* = 0.72. The median was 8.31; range of 6.67-10.16. The median log-transformed geographic isolation measurement was used to distinguish differences between residents living in more versus less rural areas.

Travel time to doctors. The majority of the families (99%) reported less than an hour travel time to get to their doctor's office. The average travel time was 15 minutes, with a standard deviation of 12 minutes. Nine respondents reported an hour's commute to their physician, while two respondents said that their commute was two or three hours.

Personal transportation. Approximately 75% of the sample mothers reported having personal transportation, such as a car, to get to places such as the grocery store or the doctor's office.

Rurality-psychosocial/social support factors. In order to determine items that best identified different sources of social support for the mothers in our study, a factor analysis (principal-components analysis) was conducted. Results demonstrated that six components had Eigenvalues greater than one, but only two components had Eigenvalues equal to two or greater. These two components accounted for more than 10% each of the variance (over 40% combined) and had items strongly related to support from friends and family and support from current (spouse/partner) relationships. Friend and family support items described satisfaction with in-person and phone visiting. Relationship support items inquired about the level of satisfaction for a spouse/partner, someone to share intimate feelings with, and expectations of the stability of the current relationship in the future. Results demonstrated that the global satisfaction item, which

inquired about current life situation, factored highly with items describing spouse/partner relationship satisfaction. These two components of social support—social support from friends and family and social support from intimate relationships—were used in the current study's analysis.

Health insurance. At the 2 month home visit, approximately 64% (N = 825) of our sample reported receiving governmental support for health insurance since the target child's birth. Of those, 91.3% (N = 752) reported current enrollment in Medicaid/SCHIP, and approximately 96% (N = 724) said that they have used these services continuously. Only 17 out of 1197 (1.4%) children did not have health insurance at the 6 month home visit. Of those infants with health insurance, approximately 67% had public health insurance. Because the only health insurance question asked at the 2 month visit regarded Medicaid and almost all children in the study had health insurance at the 6 month visit, receipt of Medicaid will be used to predict maternal health care at 2 months and whether the child had public or private insurance will be used to predict infant health care at 6 months.

Available medical providers. To determine what kinds of health services were available to FLP families in Pennsylvania and North Carolina, background research and informal phone interviews were conducted with hospitals and health and human service departments and organizations. The availability of health services was also verified by FLP information on who provided the families with health care. Many of the available program offices and regional hospitals that were uncovered in the research process had provided the health services that mothers reported using.

Programs for pregnant women and children are quite numerous in both states, and "once in the system, families are hooked into all sorts of services" (North Carolina Family Resource

Line, telephone conversation, May 25, 2007). For example, in Pennsylvania, Healthy Beginnings (and Healthy Beginnings Plus) is a Medicaid program that renders medical, obstetric, and psychosocial services "to assist low-income, pregnant women who are eligible for Medical Assistance to have a positive prenatal care experience" (Pennsylvania DPW, 2007). The Children's Check-up Program is an Early Periodic Screening, Diagnosis, and Treatment (EPSDT) program that gives kids free check-ups and immunizations. In North Carolina, the Baby Love program oversees a variety of program services for low-income mothers during and after pregnancy in order to promote healthy pregnancies and birth outcomes. Programs include referrals to medical providers, childbirth classes, and pre- and post-natal home visits (North Carolina DHHS, 2007).

Need factors—Health risks

Mothers with health risks. Table 5 displays frequencies of maternal and infant health risks. Fifty-two mothers (4%) reported experiencing diabetes; 161 (12.5%) reported high blood pressure or hypertension; 29 (2.3%) had experienced cancer or malignancy; 28 (2.2%) had experienced seizure disorder; 209 (16.3%) had experienced depression; and 30 (2.3%) had experienced mental illness. Compiling these data, approximately 31% ($N = 402$) reported at least one of the previous health problems.

While pregnant with the target child, 328 (25.6%) experienced light bleeding or spotting; 58 (4.5%) experienced heavy bleeding; 359 (28%) experienced excessive nausea; 235 (18.4%) experienced weight loss over 10 pounds; 352 (27.5%) experienced a serious infection; 222 (17.3%) experienced high blood pressure; 5 (.4%) experienced convulsions; 108 (8.4%) experienced a serious accident; 164 (12.8%) experienced some type of emotional problem; and 173 (13.5%) experienced some other illness that required medical treatment during pregnancy.

Compiling the information on health risks experienced during pregnancy, 1093 (85%) respondents reported experiencing at least one of the previous health difficulties during pregnancy.

Infants with health risks. Within the sample, approximately 10% of the infants (N = 125) experienced fetal distress (decelerations in the heart rate which require constant monitoring) at delivery, 4.4% (N = 57) required immediate treatment for breathing difficulties, and 3.5% (N = 45) had congenital malformations or birth defects, such as blindness, cerebral palsy, cleft lip, cleft palate, deafness, hydrocephalus, liver disease, or spina bifida. Approximately 15% of mothers (N = 186) recalled some other difficulty at their child's birth. Out of 1272, 101 infants (7.9%) were born prematurely (< 37 weeks gestation). Out of 1284, 102 infants (7.9%) would be considered low-birth weight (LBW), weighing less than 2500 grams, while 15 infants (1.2%) would be considered very low-birth weight (VLBW), weighing approximately 1500 grams or less. Fifty-seven infants were admitted to the Neonatal Intensive Care Unit (NICU), where they averaged a stay of 20 days (SD = 25.57 days). Seven percent of sample infants (N = 89) had to stay in the hospital after the mother went home. On average, they stayed 3 days later (SD = 7.48 days). Surprisingly, LBW or very LBW babies did not stay in the hospital significantly longer than non-LBW babies. Only 84.2% (N = 1075) of primary respondents felt that their child's health was in excellent condition at the 2 month home visit.

Association of health risks and socio-demographic variables. Mothers who reported any health problems prior to delivery and infants who experienced any health difficulties at birth were considered to be at a higher health risk and in more need of health care, therefore, more inclined to health care utilization. Membership to the "High-risk Mother", "High-risk Pregnancy" and "High-risk Infant" groups was dummy-coded and analyzed. Analysis of this

higher health-risk sample revealed that higher health risk did indeed increase the likelihood of certain health care receipt, but higher health risk was also associated with socio-demographic and geographic characteristics. On average, Pennsylvania had significantly more mothers and infants experiencing health problems than North Carolina [PA mothers (38%), NC mothers (27%), χ^2 (1, N = 1286) = 9.04, p < .01; PA infants (41.5%), NC infants (28.6%), χ^2 (1, N = 1271) = 12.01, p = .001]. Black families were more likely than White families to have infants with health problems at birth, including LBW status [36.9% vs. 28.6%), χ^2 (1, N = 1271) = 5.18, p < .05]. Socio-economic characteristics also seemed to play an important role in high-risk status. Generally, lower educated, unemployed, and lower-income mothers tended to have more health problems than highly educated, employed, or higher-income mothers [Low education (32.6%), High education (27.2%), χ^2 (1, N = 1286) = 4.44, p < .05; Unemployed (36.9%), Employed (23.1%), χ^2 (1, N = 1286) = 27.33, p < .001; Low income/need (35.3%), High income/need (7.1%) χ^2 (1, N = 1199) = 8.81, p < .05].

Association of health risks and health care receipt. Mothers who experienced health difficulties during pregnancy (17.9%) were more likely to receive pregnancy home visits than those who did not experience health problems during pregnancy (13.5%), χ^2 = (1, N = 1279) = 3.70, p = .05. Mothers who birthed LBW infants (i.e., weighed < 2500g) (53.9%) were more likely to receive post-birth home visits than those who gave birth to infants with a healthy weight (30.6%), χ^2 (1, N = 1284) = 23.34, p < .001. Mothers with VLBW babies were also more likely than mothers with normal-weight babies to receive post-birth home visits (73.3% versus 32%), χ^2 (1, N = 1284) = 11.55, p < .01. Infants who were born LBW (M = 4.35, SD = 1.64), or premature [(M = 4.34, SD = 1.61), or experienced any difficulties at birth (M = 4.53, SD = 1.68) averaged significantly more visits to the doctor's at 6 months of age compared to infants who

were not born LBW (M = 4.92, SD = 1.91), $t(1167) = -2.79$, $p < .01$), premature (M = 4.98, SD = 2.21), $t(1167) = -3.56$, $p < .001$), or without health risks at birth (M = 4.32, SD = 1.67), $t(1167) = -2.08$, $p < .05$.

Health risk index. Given the fairly high percentages of mothers and infants who experienced a health-related problem of some variety prior to pregnancy (31%; N = 402), during pregnancy (71.1%; N = 910) or at the time of the birth (37%; N = 472), a risk index for the health history of the mothers, their health during pregnancy, and for infant health was created using the total count of health problems experienced in order to better differentiate among the risk sample. According to the health history index, the average risk for sample mothers was 0.46, SD = 0.69 (range 0-4). According to the pregnancy health index, the average risk for sample mothers was 1.8, SD = 1.32 (range 0-8). Results using the risk indices showed that although a large proportion (85%) of sample mothers may have experienced a health problem in their past or during gestation, mothers only experienced one or two health risks on average. The infant health risk index (0-6 risks) showed that the infants in our sample averaged less than one health risk at birth (M =0.69, SD = 1.01).

For its association with the study's predictor and outcome variables, mother's and infant's health risk will be controlled for by entering their health risk indices (number of health risks reported) into adjusted regression analyses.

Association of geography and other predictor variables

Geographic residential isolation. Differences in independent variables by geographic isolation (more versus less rural) are presented in Table 6. As Table 6 shows, there were no significant differences in the study's predictor variables by rurality, with the exception of race. Based on these preliminary analyses, only racial differences may be able to explain differences

in health care utilization by geographic isolation. In Pennsylvania (PA), rural differences are not likely to be explained by income/need level or race as there is no significant relationship between rural residence and income/need ratio and very few Black families in the study reside in PA. In contrast to PA, significant differences in income/need and race by geographic isolation were found within North Carolina (NC). In NC, the proportion of poor families living in less rural areas is greater than the proportion of poor families living in more rural areas, and the percentage of Blacks living in less rural areas is greater than the percentage of Blacks living in more rural areas. However, income/need differences by geographic isolation were no longer significant when race was added. In other words, the fact that more Black families live in less rural areas explained the difference in poverty between more versus less rural areas. When the income/need ratio was added to rural/urban comparisons of race in North Carolina, significant differences in race by rurality only applied to families with lower income/need ratios, χ^2 (1, N = 679) = 14.05, p < .001. In other words, there was a significant difference in the proportion of Whites and Blacks living in more rural areas compared to less rural areas, but only for those who were at or below 185% income/need level. Among poor White families, approximately 30% live in rural (geographically isolated) areas while approximately 16% live in less rural areas. Among poor Black families, approximately 70% live in rural areas while approximately 84% live in less rural areas. Therefore, differences in health care due to geographic residential isolation (or rurality) are not likely to be explained by economic differences alone. Rather, differences by rurality may be due to the fact that poor Whites tend to live in more geographically isolated areas whereas poor Blacks tend to live in less isolated areas.

State residence. Significant state differences in maternal and infant health care may be explained by the fact that almost all the Black mothers (96%) in the FLP sample live in NC.

Therefore, only White respondents will be used for state comparisons. Although a larger proportion of poor people reside in NC as compared to PA, this state difference in income/need levels disappears when race is taken into account. In other words, (similar to above findings for geographic residential isolation) the fact that more Black families (who are poor) live in North Carolina explains the difference in poverty between states. Among white families, there is no significant difference in proportion of poor families who reside in PA compared to NC. Therefore, significant state differences in health care are not likely due to economic differences but to differences in the racial composition of its residents. Once race is controlled, significant state differences in maternal and infant health care services are still expected.

Given that one state may be more rural than another, it is possible that observed geographic isolation differences in health care may be explained by differences in state residence. Analyzing only White families, significant differences in the proportion of families living in rural, remote areas were found between PA and NC. Families in NC were more likely to live more remotely than families in PA (59.8% vs. 51.6%), χ^2 (1, N = 741) = 4.50, $p < .05$. In other words, families in NC are more likely to be rural. Overall, variances in health care receipt by state may be due to differences in rurality; or, vice versa, variances in health care due to geographic isolation may be explained by state differences. Within NC, variances in health care receipt by geographic isolation may be explained by race or race and income/need differences.

Findings from bivariate analyses of maternal and infant health care

Unadjusted analysis of maternal health care

In unadjusted bivariate analysis, maternal health care receipt significantly differed by race, income/need ratio and geographical residence (see Table 7). Unadjusted bivariate analysis used NC for race comparisons and White families for state comparisons.

Prenatal care. Mothers who reported prenatal care throughout their pregnancy (for all trimesters) were more likely to: be White [χ^2 (1, N = 763) = 7.43, p < .01], live in households with higher income/need ratios [χ^2 (1, N = 1193) = 27.03, p < .001], and live in PA [χ^2 (1, N = 754) = 26.37, p < .001]. In accordance with literature on prenatal care (e.g., LaVeist et al., 1995), the study also examined late initiation of prenatal care, i.e., initiating prenatal care in the second or third trimester. Again, 98 mothers, or approximately 8% of mothers reported initiating prenatal care late in their pregnancy. Bivariate analysis revealed that mothers who were less educated [10.4%, χ^2 (1, N = 1263) = 13.07, p < .001] and had lower income/need ratios [9.8%, χ^2 (1, N = 1178) = 12.90, p < .001] were more likely than mothers with an education beyond high school (4.9%) and mothers with higher income/need ratios (4.1%) to report late prenatal care initiation. Moderately significant race differences in late prenatal care initiation were no longer significant once accounting for SES (education or income/need). Analysis of late initiation of prenatal care by education and income showed that among mothers who are more educated, income/need levels still mattered—those with lower income/need ratios were still more likely to initiate prenatal care later despite having an education higher than the high school/GED level (8.5% vs. 2.4%), χ^2 (1, N = 1178) = 11.05, p < .01.

Childbirth classes. Mothers who reported utilization of childbirth classes were more likely to live in households with higher income/need ratios [χ^2 (1, N = 1194) = 10.52, p = .001] and live in PA [χ^2 (1, N = 756) = 30.86, p < .001].

Pregnancy home visits. Mothers who reported the receipt of home visits during pregnancy were more likely to live in less geographically isolated areas [χ^2 (1, N = 1245) = 24.89, p < .001] and live in NC [χ^2 (1, N = 756) = 4.53, p < .05].

Post-birth home visits. Mothers who reported the receipt of post-birth home visits were more likely to be Black [χ^2 (1, N = 769) = 31.89, p < .001] and live in households with lower income/need ratios [χ^2 (1, N = 1199) = 69.14, p < .001].

Breastfeeding assistance. Mothers who reported receiving help with breastfeeding were more likely to live in PA than in NC, χ^2 (1, N = 756) = 12.18, p < .001.

Parent education videos. Mothers who reported receiving parent education videos were more likely to: be Black [χ^2 (1, N = 769) = 11.95, p < .01], live in households with lower income/need ratios [χ^2 (1, N = 1199) = 9.62, p < .01], and live in PA [χ^2 (1, N = 757) = 5.25, p < .05.

Unadjusted analysis of infant health care

Regular doctor. Whether the target child had a preferred physician differed only by state residence in unadjusted analysis of race, income/need, state residence, and geographic isolation. Among White families, those in NC were more likely to report a preferred doctor at their regular practice than PA families, χ^2 (1, N = 696) = 4.23, p < .05.

Frequency of well-child visits. There were no significant disparities in the frequency of well-child visits by race, income/need, state residence, or geographic isolation. For this reason, no further analysis on the number of well visits will be pursued.

Summary

In summary, unadjusted bivariate analysis demonstrated significant income/need, racial, and geographic differences in maternal regular and specialty health care. It was hypothesized that poorer families (i.e., families with lower household income/need), Black families, and families who were more geographically isolated would be more at risk for not receiving health care.

These hypotheses were only partially supported. As hypothesized, families with higher income/need levels were more likely to receive prenatal care and childbirth classes. Families who were less geographically isolated were more likely to receive pregnancy home visits. Contrary to hypotheses, however, Black families and families with lower income/need were actually more likely than White families and families with higher income/need to receive post-birth home visits and parent education videos. With the exception of PBHV, all maternal healthcare outcomes demonstrated differences according to state residence. Mothers living in PA were more likely than mothers living in NC to receive prenatal care throughout pregnancy, childbirth classes, breastfeeding help, and parent education videos. The next set of analyses adjusts for variability in race, income/need, and geography (rural residence and state residence).

Adjusted bivariate analysis of maternal health care

Adjusted bivariate analysis was conducted to determine whether significant unadjusted differences in maternal and infant health care existed across differences in income/need ratio, race, geographic isolation, and state. Adjusted bivariate analysis also illustrated which subpopulations of the FLP sample experienced significant differences in health care receipt. Adjusted bivariate analysis used NC for race comparisons and White families for state comparisons. These findings are organized by the type of health care service below.

Prenatal care. As in unadjusted analysis, income/need levels were positively associated with prenatal care, but only for White families living in more rural areas. Prenatal care was more frequent for White mothers living in rural areas with higher household income/need ratios than for White mothers living in rural areas with lower household income/need ratios. These income/need differences remained significant across state. In PA, the difference was 98.4% vs. 88.9%, χ^2 (1, N = 694) = 9.60, $p < .01$; in NC, the difference was 94.4% vs. 78.5%, χ^2 (1, N =

694) = 7.48, $p < .01$. Differences in prenatal care receipt by race and state were no longer significant after adjusting for income/need and geographic isolation.

Childbirth classes. Similar to prenatal care, income/need differences only mattered for more rural, White mothers. More rural, White mothers living in NC with higher income/need levels were more likely to receive childbirth classes than those with lower income/need levels (19.7% vs. 7.6%), χ^2 (1, $N = 695$) = 4.22, $p < .05$. State differences in childbirth classes were significant for families who lived more remotely or had lower household income/need levels. Mothers living in PA were more likely than mothers living in NC to receive childbirth classes if they lived in more rural areas, regardless of economic standing [PA families with higher income/need (35.4%) vs. NC families with higher income/need (19.7%), χ^2 (1, $N = 695$) = 5.38, $p < .05$; PA families with lower income/need (30.8%) vs. NC families with lower income/need (7.6%), χ^2 (1, $N = 695$) = 13.06, $p < .001$], or if they lived in less rural areas but had lower income/need [30.3% vs. 10.3%, χ^2 (1, $N = 695$) = 6.14, $p < .05$]. No significant differences in childbirth classes by state residence were found for families with higher income/need living in less rural areas.

Pregnancy home visits. Geographic differences in pregnancy home visits were still found after adjusting for income/need and race. Less rural families were still more likely than more rural families to receive pregnancy home visits, but these differences were only statistically significant for higher-income Whites (22% vs. 7%, χ^2 (1, $N = 675$) = 5.72, $p < .05$) and lower-income Blacks (31.1% vs. 15.3%, χ^2 (1, $N = 675$) = 11.83, $p = .001$) living in North Carolina. In other words, pregnancy home visits were most frequent for Whites with higher/income needs and Blacks with lower/income needs living in less rural areas of NC compared to more rural areas of NC. Differences according to geographic isolation adjusting for income/need levels among

Whites in PA were not significant. A significant state difference in pregnancy home visits was found for White families with lower income/need living in less isolated areas. Among less rural, White families with lower income/need households, those living in NC (27.5%) were more likely to receive pregnancy home visits than those living in PA (8.3%), χ^2 (1, N = 696) = 9.32, p < .01.

Post-birth home visits. After adjusting for geographic isolation, race, and state differences, income/need variances in post-birth home visits were no longer significant. However, in North Carolina, Black mothers were still more likely than White mothers to report post-birth home visits among families with lower income/need levels living in less isolated areas [47.9% vs. 25%, χ^2 (1, N = 679) = 7.15, p < .01] and among families with higher income/need levels living in more isolated areas [32.6% vs. 15.5%, χ^2 (1, N = 679) = 4.56, p < .05].

Breastfeeding assistance. Breastfeeding assistance was significantly different according to state residence but the direction of the effect depended on economic standing (income/need ratio) and rurality (geographic isolation). In unadjusted analysis, receipt of breastfeeding assistance only differed significantly by state residence, with White mothers in PA receiving more breastfeeding assistance than White mothers in NC. However, after adjusting for income/need levels and geographic isolation among White mothers, receipt of breastfeeding assistance was more likely for NC mothers (27.5%) than PA mothers (8.3%), χ^2 (1, N = 696) = 9.32, p < .01 among White families with lower household income/need living in less isolated places.

Parent education videos. In adjusted analysis, parent education videos were more likely to be received by lower income/need families (34.2%) than higher income/need families (22.8%) among Whites living in more rural parts of PA, χ^2 (1, N = 696) = 3.87, p < .05. Within North Carolina, no significant differences by income/need levels were found after adjusting for race

and geographic isolation. At both high and low income/need levels, Blacks who live in less isolated areas, were more likely than Whites in less isolated areas to receive parent education videos [higher income Black/White comparisons: 31.8% vs. 14.0%, χ^2 (1, N = 679) = 4.28, p < .05; lower income Black/White comparisons: 31.9% vs. 12.5%, χ^2 (1, N = 679) = 6.19, p < .05]. White mothers from less rural, lower income/need households who live in PA tended to receive more parent education videos than their counterparts in NC, χ^2 (1, N = 675) = 6.65, p < .05.

Adjusted analysis of infant health care

Regular doctor. In contrast to unadjusted analysis that found White mothers in PA were less likely than White mothers in NC to report that they had someone they considered to be their child's regular doctor, adjusted bivariate analysis demonstrated alternate findings once income/need and rurality were taken into account. Among less rural, White families with lower household income/need, a greater percentage of mothers in PA (33.9%) reported having a regular doctor for their child than their counterparts in NC (12.5%), χ^2 (1, N = 696) = 6.65, p < .05.

Summary

Some general conclusions can be made when considering the types of maternal and infant health care services. Disparities in prenatal care and childbirth classes are predicted by economic standing (measured by household income/need ratio). Disparities in post-birth home visits are predicted primarily by race. Disparities in pregnancy home visits, breastfeeding assistance, and having a regular doctor for your child are predicted by geographic residence. Finally, disparities in parent education videos are predicted by economic standing, race, and geographic residence.

When considering for whom health care disparities matter, adjusted bivariate analysis found significant economic differences in prenatal care, childbirth classes, and parent education

videos for White, rural families. White, rural families with higher income/need were more likely to receive prenatal care and childbirth classes and were less likely to receive parent education videos. Adjusted bivariate analysis also found significant racial differences in post-birth home visits and parent education videos for families living in less rural areas of North Carolina. Among families living in less rural areas of North Carolina, Blacks were more likely to receive post-birth home visits and parent education videos than Whites. Finally, adjusted bivariate analysis found significant geographic differences in maternal and infant health care. Differences in the receipt of pregnancy home visits by geographical isolation were modified by income/need and race such that differences in pregnancy home visits were significant only for Whites with higher income/need and Blacks with lower income/need living in North Carolina. In North Carolina, more isolated families were less likely than less isolated families to receive prenatal home visits. Significant state differences in the receipt of childbirth classes, pregnancy home visits, breastfeeding assistance, parent education videos, and whether infants have a regular physician were found for White families with lower income/need living in less rural areas. White families with lower income/need living in less rural areas of PA are more likely than their counterparts in NC to receive childbirth classes and parent education videos, and have a regular doctor for their child, and less likely to receive pregnancy home visits and breastfeeding assistance.

Considering whether significant differences in health care remained significant across income/need, race, geographic isolation, and state found that income/need differences remained significant across state for prenatal care, but did not remain significant across race, rurality, or state for childbirth classes, post-birth home visits, or parent education videos. Race differences remained significant across income for the receipt of parent education videos but did not remain

significant for prenatal care. Race differences in post-birth home visits were significant for both lower and higher income/need families and for rural and non-rural families, but the intersection of income/need and rurality predicted whether race made a difference. Similarly, rural differences were significant for both lower and higher income/need families and for Black and White families living in NC, but the intersection of income/need and race predicted whether rurality made a difference in home visit receipt during pregnancy. Finally, state differences remained significant across rurality and across income/need levels among the more rural for childbirth classes, but did not remain significant across rurality and income/need for all other maternal and infant health care services.

Findings from regression analyses of maternal and infant health care

Multivariate logistic regression was conducted to test effects of multiple categorical and continuous predictor variables, including several components of SES and factors related to rural environments that may enable or impede health care utilization. The first set of regression analyses tested whether significant differences in health care receipt associated with geographic isolation and state residence remained significant after adjusting for predisposing and need covariates (maternal age, number of health risks experienced, and whether the child is the mother's first biological child), SES, and race. It also tested whether other possible enabling factors, including receipt of Medicaid insurance, travel time to the health care provider, having personal transportation, and social support, helped to explain differences in health care. The last set of regression analyses tested the full model of possible predisposing, enabling and need variables on maternal and infant health care outcomes using state-stratified samples.

Multivariate assessment of other geographic differences

Hierarchical logistic regression analysis was used to determine individual effects while controlling for all other variables in the model. Among other effects, race differences controlling for state can be determined, and state differences controlling for race can be determined. Separate analyses on race comparisons using the North Carolina sample and state comparisons using White families were also conducted to double check whether findings using the full sample were similar. Analyses demonstrated similar results; therefore findings from the multivariate regression analysis of all possible predictors using both race and state variables are reported here.

Differences by rurality-geographic isolation. Previous bivariate analyses showed that residential geographic isolation was not significant in explaining variance in the receipt of any maternal or infant health care services except for pregnancy home visits. Therefore, only the receipt of pregnancy home visits was tested for the effects of geographic isolation after controlling for predisposing, enabling, and need variables.

Multivariate regression analysis showed that greater residential isolation decreased the likelihood that mothers would receive home visits during their pregnancy [OR = 0.46 (0.34, 0.63), $p < .001$], even after adjusting for predisposing, enabling, and need variables. Adjusting first for predisposing and need covariates (maternal age, maternal health risks, and whether the target child was the mother's first biological child) demonstrated that the number of health risks experienced at pregnancy also predicted the receipt of pregnancy home visits. The more health problems mothers experienced during pregnancy, the higher the likelihood of receiving home visits while pregnant [OR = 1.12 (1.01, 1.24), $p < .05$]. Adjusting for race and SES characteristics demonstrated that Black mothers were more likely than White mothers to receive pregnancy home visits, that is, until accounting for state variance. Once state was controlled, race

was no longer significant in the regression model. Similar to bivariate findings, residence in North Carolina increased the likelihood of pregnancy home visits [OR = 1.82 (1.08, 3.06), $p < .05$]. Finally, among other enabling factors, access to personal transportation also predicted the receipt of pregnancy home visits. Having a personal vehicle for transportation reduced the likelihood of having pregnancy home visits [OR = 0.43 (0.27, 0.70), $p < .01$].

In summary, greater rurality reduced the likelihood of maternal health care (in particular, pregnancy home visits) as hypothesized. However, contrary to hypotheses, race and SES did not contribute to the explanation of rural differences in pregnancy home visits. Rather, health risks experienced during pregnancy, state residence, and having access to personal transportation, in addition to geographic isolation, predicted whether mothers received home visits while pregnant. The variance in pregnancy home visit receipt explained by geographic isolation remained significant after entering predisposing, enabling, and need variables in the regression model. Although the likelihood ratio changed slightly with the addition of other predictors, families who reside in more geographically isolated locations had a lower likelihood of receiving pregnancy home visits [OR = 0.56 (0.38, 0.84) $p < .01$] after accounting for all other variables.

Differences by state residence. Prior bivariate analyses also demonstrated significant state differences in the receipt of breastfeeding help, parent education videos, and whether the child (TC) had someone considered to be their regular doctor. These significant state differences were tested in regression models to determine whether the variance could be explained by predisposing, enabling, and need variables.

Even after accounting for other predisposing, enabling, and need characteristics, residence in North Carolina decreased the likelihood of receiving breastfeeding help [OR = 0.60 (0.40, 0.90), $p < .05$] but increased the likelihood that TC has a regular doctor [OR = 2.33 (1.52,

3.57), $p < .001$]. With regards to the receipt of breastfeeding help, maternal education, Medicaid, and personal transportation also predicted receipt of breastfeeding assistance and did not alter the variance explained by state residence. Maternal education beyond high school [OR = 0.62 (0.43, 0.88), $p < .01$] and Medicaid receipt [OR = 0.60 (0.41, 0.88), $p < .01$] individually decreased the likelihood of receiving breastfeeding help, while having personal transportation increased the likelihood of receiving breastfeeding help [OR = 1.77 (1.18, 2.64), $p < .01$]. With regards to the receipt of parent education videos, differences by state residence did not prove significant in the regression model once variables other than state, geographic isolation, income/need, and race were considered. Instead, birth order predicted the receipt of parent education videos. Mothers who are expecting their first-born child [OR = 1.60 (1.03, 2.51), $p < .05$] have a greater likelihood of receiving parent education videos. With regards to TC having a regular doctor, no variables other than state residence helped to explain whether TC had a regular doctor at their health care practice.

To summarize, the state that families reside in may predict the receipt of certain forms of health care. For mothers, state residence is a significant predictor of the receipt of breastfeeding assistance. For infants, state residence makes a difference as to whether an infant has a regular physician. Compared to sample mothers in Pennsylvania, sample mothers in North Carolina were less likely to get breastfeeding services and more likely to have a designated doctor for their child. State residence, in conjunction with predisposing and enabling factors, predicts maternal receipt of breastfeeding assistance. State residence uniquely predicts whether a mother is more likely to report a doctor for her child. State differences in receipt of parent education videos were not explained by variances in race, SES, or geographical isolation but by differences in maternal parity (whether TC was the mother's first).

Overall, the geographic differences that were significant in predicting maternal and infant health care services remained significant even after controlling for other predictors. In addition to geographical residence (rural and state residence), maternal education, Medicaid status, personal transportation, and having a first biological child help to explain differences in maternal health care receipt.

Full model stratified by state

The analysis now turns to a multivariate assessment of all possible predictor variables in each study state. Table 8 displays multiple logistic regression results for maternal health care outcomes in Pennsylvania; Table 9 displays multiple logistic regression results for maternal health care outcomes in North Carolina. Table 10 displays multiple logistic regression results for infant health care outcomes in Pennsylvania and North Carolina. Findings are discussed below by health care outcome in each state.

Pennsylvania

Prenatal care. No independent variables significantly differentiated receipt of prenatal care for mothers in Pennsylvania.

Childbirth classes. For mothers in PA, an education beyond high school increased the likelihood of reporting childbirth classes [OR = 2.16 (1.13, 4.13) $p < .05$]. The likelihood of receiving childbirth classes [OR = 23.94 (12.46, 46.02), $p < .001$] also increased if the target child (TC) is the mother's first biological child.

Pregnancy home visits. Having personal transportation significantly decreased the likelihood of receiving pregnancy home visits in PA [OR = 0.21 (0.10, 0.44) $p < .001$]. As the number of reported pregnancy health problems increased, the likelihood that mothers living in PA received home visits increased significantly [OR = 1.44 (1.15, 1.79), $p < .01$].

Post-birth home visits. A lower income/need ratio predicted greater likelihood of receiving post-birth home visits [OR = 1.84 (1.05, 3.21), $p < .05$] in PA. The likelihood of post-birth home visits [OR = 2.61 (1.53, 4.45) $p < .001$] also increased if the target child (TC) is the mother's first biological child.

Breastfeeding assistance. An education beyond high school decreased the likelihood of receiving breastfeeding assistance in PA [OR = 0.52 (0.31, 0.87), $p < .05$]. Geographic isolation increased the likelihood of receiving breastfeeding assistance [OR = 1.83 (1.18, 2.85), $p < .01$], but as travel time to get to the doctor's office increased, the likelihood of receiving breastfeeding help decreased [OR = 0.98 (0.95, 0.99), $p < .05$]. Medicaid status also decreased the likelihood that mothers would receive breastfeeding help in PA [OR = 0.58 (0.35, 0.95), $p < .05$].

Parent education videos. The likelihood of receiving parent education videos [OR = 5.15 (3.05, 8.71), $p < .001$] in PA increased if the TC is the mother's first biological child.

Regular doctor for child. No significant predictors of whether the child had a regular physician were found among the PA sample.

North Carolina

Prenatal care. Family's income/need ratio predicted the receipt of prenatal care throughout pregnancy in NC. A lower income/need ratio decreased the likelihood that mothers obtained prenatal care throughout pregnancy [OR = 0.47 (0.22, 0.99), $p < .05$]. The number of maternal past health problems increased the likelihood that mothers in NC received prenatal care throughout pregnancy [OR = 1.68 (1.03, 2.73), $p < .05$].

Childbirth classes. The likelihood of receiving childbirth classes in NC increased if mothers were expecting their first child [OR = 12.67 (5.94, 27.03), $p < .001$].

Pregnancy home visits. Geographic isolation decreased the likelihood of receiving pregnancy home visits [OR = 0.39 (0.23, 0.65), $p < .001$]. Having personal transportation significantly decreased the likelihood of receiving pregnancy home visits in NC [OR = 0.43 (0.27, 0.70), $p = .001$].

Post-birth home visits. The likelihood of Black families receiving post-birth home visits were 1.84 times the likelihood of White families receiving post-birth home visits [OR = 1.84 (1.11, 3.03), $p < .05$]. Medicaid status increased the likelihood that mothers would receive post-birth home visits in NC [OR = 2.97 (1.49, 5.92), $p < .05$].

Breastfeeding assistance. Having personal transportation increased the likelihood of receiving breastfeeding help in NC [OR = 1.83 (1.08, 3.09), $p < .05$]. The likelihood that mothers received breastfeeding assistance significantly decreased as ratings of social support from friends and family increased [OR = 0.92 (0.85, 0.99), $p < .05$].

Parent education videos. The likelihood of Black families receiving parent education videos were 2.28 times the likelihood of White families receiving parent education videos [OR = 2.28 (1.34, 3.86), $p < .05$]. The likelihood of receiving parent education videos [OR = 2.97 (1.88, 4.70), $p < .001$] in NC increased if mothers were expecting their first child. As the number of pregnancy-related health problems increased, the likelihood mothers received parent education videos increased [OR = 1.42 (1.01, 2.00) $p < .05$].

Regular doctor for child. Among the mothers living in NC, an education beyond a high school increased the likelihood that mothers reported having a regular physician for their child [OR = 1.70 (1.00, 2.88), $p < .05$].

Summary

This section was meant to discover common and unique predictors of maternal and infant health care services between each study state, as a matter of interest. First, we can determine some similarities between the states in this study in what predicts certain kinds of health care. Perceived need and enabling factors played a significant role in predicting the receipt of specialty health care for mothers. A mother who is expecting her first biological child is more likely to receive childbirth classes and parent education videos in both Pennsylvania and North Carolina. Mothers who come from lower income households (as measured by either lower income/need ratios or Medicaid status) are also more likely to report receiving post-birth home visits in both states. Finally, in both PA and NC, having personal transportation decreases the likelihood mothers receive home visits while they are pregnant.

Next we can determine what uniquely predicts certain health care services for mothers and infants living in Pennsylvania as compared to North Carolina. These comparisons are broken down by dependent variables.

Prenatal care. There were no significant differences in the receipt of prenatal care throughout pregnancy for expectant women in PA. In contrast, in NC, lower income/need decreased the likelihood of mothers in NC reporting prenatal care throughout their pregnancy. Prenatal care for mothers in NC was also differentiated by the amount of health problems experienced prior to pregnancy. Mothers who have had more health problems in the past were more likely than mothers who have had fewer problems to report consistent prenatal care.

Childbirth classes. A mother who was expecting her first-born child was more likely to report childbirth classes in both PA and NC, but among Pennsylvanian mothers, higher

education, in addition to expecting a first-born child, predicted the likelihood of childbirth classes.

Pregnancy home visits. Although characteristics of being physically isolated (geographic residential isolation and/or having personal transportation) differentiated who received pregnancy home visits in both PA and NC, pregnancy-related health problems also differentiated who received pregnancy home visits among mothers in PA.

Post-birth home visits. Although differences in post-birth home visits seem to be predicted by risk indicators in both states, in PA, they were predicted by low economic standing and whether TC is the first child. In comparison, in NC, post-birth home visits were predicted by race (Blacks are more likely than Whites to receive) and Medicaid status (having Medicaid increases the likelihood of PBHV).

Breastfeeding assistance. In PA, breastfeeding assistance was predicted by predisposing and enabling characteristics, whereas in NC, it was predicted by different enabling characteristics. In PA, maternal education, geographic isolation, travel time to the doctor's office, and Medicaid status predicted who received breastfeeding assistance. In comparison, having personal transportation and social support predicted who received breastfeeding services.

Parent education videos. Risk indicators—race and pregnancy health risks—also seemed to differentiate the receipt of parent education videos in NC, whereas in PA, maternal parity (whether TC is the first-born) differentiated the likelihood of receiving parent education videos.

Regular doctor. Educational attainment mattered for whether TC has a regular doctor among NC families but did not matter among PA families

Discussion

The purpose of this study was to better understand geographic health care disparities in a largely understudied but presumably at-risk population of more rural-dwelling, lower-income mothers and infants. The research on rural populations, especially on mothers and infants, is relatively sparse, but the literature that does exist generally indicates that rural populations are at risk of poorer health outcomes, fewer medical resources, and lower utilization of preventive health care when compared to more urban populations. This study, however, found little difference in the receipt of various maternal and infant health care services associated with its measure of rurality—relative physical geographic isolation.

Various reasons may account for not finding much difference in maternal and infant health care utilization. First, our sample, as a whole, was surprisingly well-served in terms of maternal and infant health care. Almost all respondents reported having a regular pediatrician and a regular source of care for their child. By six months of age, study children were on target for average number of well-child visits received (American Academy of Pediatrics, 2008). As well, very few mothers in the sample reported a complete lack of prenatal care; more than 85% reported receiving prenatal care throughout their pregnancy with the target child. Hence, it would appear that our sample of non-urban, lower-income mothers and infants was at low-risk of not receiving early health care.

This lack of differences in maternal and infant health care receipt due to rurality may help to explain the lack of rural/urban differences in infant birth outcomes that have been found in more recent studies (e.g., Hillemeier et al., 2007). In the study by Hillemeier and colleagues (2007), the risk of giving birth to a low-birthweight infant was not significantly different among women living in urban-focused areas compared to women living in *small, town-focused* areas or

women living in *isolated, small, rural-focused* areas. However, women living in *large, rural, city-focused* areas had a significantly lower risk of giving birth to babies with low-birthweight in comparison to women in urban-focused areas. This study and the study by Hillemeier et al. similarly reflect the possible but emerging benefit of living in more rural/less metropolitan areas than less rural/more metropolitan areas and suggests that the environment of less urban, smaller city/town residence serves as a protective factor to maternal and infant health. Less variation in health care receipt among residents, coupled with finite sources, may help ensure health care receipt. Moreover, it hints that non-metropolitan areas are improving availability and access to prenatal and medical care. Since the mid-1980s, increased educational and employment opportunities, internal infrastructure, and health care organization and financing have steadily improved the lives of those living in more populated rural areas adjacent to city-focused areas (Hillemeier et al., 2007).

Another reason the current study may not have detected differences according to rurality is because our rurality measure is an average of distances to ten community assets. Hence, even if families lived far from one or two community assets such as a freeway on-ramp or public park, they would not appear as isolated if they lived close to the remaining other assets such as schools, a gas station, and the doctor's office. In general, findings suggest our families were not extremely physically isolated. Almost ¾ of the sample had access to personal transportation, and almost all families (99%) could reach their doctor in under an hour, with an average travel time of approximately 15 minutes.

Additionally, unlike the Hillemeier et al. study, the current study did not use Rural-Urban Classification (RUCA) codes, which calculates city population size and work commute flows. Therefore, the study would not be as sensitive to detecting differences according to the size of

the resident's town or city and the proximity to urban zones. Proximity to city-focused areas may influence health care receipt given that health care options tend to increase as level of urbanization increases (National Center for Health Statistics, 2006). It is likely that many of our families lived in, or lived adjacent to areas that, although not considered metropolitan, may be considered town- or city-focused areas, which in turn, positively influenced health care receipt. Future research on rural populations should take into consideration the variation within rural residence.

Geographic isolation still showed a couple small to moderate effects on health care utilization. According to unadjusted bivariate analysis, geographic isolation negatively predicted pregnancy home visits. One possible explanation for this finding is that rural families may have different preferences than less rural families and prefer not to receive home visits. Another explanation is that rurality, or geographic isolation, likely deters providers from accessing families for prenatal home visits. These families may live beyond the service delivery area. While the Family Life Project's home visitors purposely set out to interview these families, most home visiting programs for expectant mothers target families with other risk factors, such as low-income, and not necessarily rural families. Therefore, the receipt of pregnancy home visits, among all other maternal and infant health care services, may require some proximity to community resources.

Still, the finding that rurality made a difference in the receipt of home visits at pregnancy but did not make a difference for home visit receipt after the child's birth is interesting. Geographic location would seemingly impact visits to a family's home prior to and after the child's birth similarly. However, the purpose or reason for pregnancy home visits versus post-birth home visits may be different. Likely, pregnancy home visits are geared towards maternal

health during pregnancy, nutrition, and childbirth, while post-birth home visits are focused on parenting, child development and child rearing. Because the home visits have different purposes, different factors likely influence receipt. Certainly, this study demonstrated that post-birth home visits were predicted more by race, SES, and maternal parity, whereas pregnancy home visits were predicted more by factors that might enable or impede service utilization such as geography or transportation.

The study showed that predictors such as geographic isolation functioned differently depending on the state families resided in. Controlling for multiple predictors in a multivariate hierarchical regression analysis demonstrated that the geographic physical isolation effect on pregnancy home visits was small (OR = 0.39) and relevant for residents living in North Carolina (see Table 9). In Pennsylvania, geographic isolation showed a moderate *positive* effect (OR = 1.83) on the receipt of breastfeeding help (see Table 8). In other words, controlling for all other predictors, living in more rural areas of Pennsylvania was positively associated with reporting breastfeeding assistance. The reason for this difference is unclear, but study participants who have higher SES tended to live in more rural areas than less rural areas, and the practice of breastfeeding has been negatively associated with SES indicators. In this study, Medicaid or SCHIP receipt decreased the likelihood of receiving breastfeeding help in PA (see Table 8). In another study, Flower and colleagues (2008) also analyzed the FLP sample and found that WIC use was strongly associated with not initiating or discontinuing breastfeeding. Thus, women living in rural areas of PA may have been more likely to choose to breastfeed their infants than women living in less rural areas; federal and state social services may have had some influence on this decision.

This study also found significant geographic differences in maternal and infant health care according to state residence. Between state comparison of non-White families was not possible due to the paucity of those families in the Pennsylvania portion of the sample. Comparisons of White families in Pennsylvania and North Carolina found that mothers in North Carolina are more likely to report having a regular doctor for their child and less likely to report having received breastfeeding assistance. Interestingly, Flower and colleagues (2008) found that breastfeeding initiation and continuation were more common among mothers living in PA than in NC. Although not much emphasis is usually placed on state differences in rural health care for mothers and infants, these findings highlight possible areas for improvement and may lead to future state policies and programming. In conjunction with the findings of Flower and colleagues, this study's finding that mothers in PA were more likely than mothers in NC to report breastfeeding assistance suggests that the provision of assistance and support can help mothers to initiate and sustain the healthy practice of breastfeeding. North Carolina may want to look into providing more breastfeeding education and support programs. While Pennsylvania may provide more comprehensive services (e.g., childbirth classes, breastfeeding assistance, and parent education videos) to mothers than North Carolina, PA may want to consider emphasizing the benefits of having a regular doctor who provides care for the child.

Another purpose of this study was to examine the relationship between socio-economic status (SES), race, and geography, and determine whether SES and racial disparities in health care persist across differences in geography. Disparities in health care were hypothesized to disadvantage the most vulnerable populations: Blacks more than Whites, the more impoverished versus the less, and the more rural (isolated) compared to the less rural. Risks were expected to

demonstrate cumulative effects, e.g., income differences would negatively affect more rural families than less rural families, Blacks more than Whites.

Indeed risks associated with low-income affected more rural families than less rural families when considering receipt of prenatal care and childbirth preparation. However, risks associated with low-income negatively affected White families as opposed to Black families. Essentially, bivariate analyses showed that income/need differences in the receipt of maternal health care did not hold across race and rurality; disparities in prenatal care and childbirth class receipt related to low income/need levels were only significant for White families living in more rural areas of PA or NC.

Surprisingly, risks of poor maternal and infant health care receipt commonly associated with race (e.g., Flores, Bauchner, Feinstein, & Nguyen, 1999; LaVeist, Keith, & Guiterrez, 1995; Mayberry, Mili, & Ofili, 2002; National Center for Health Statistics; PADOH, 2004), and race and SES (Farmer & Ferraro, 2005; Wooten, Luman, & Barker, 2007), were not found in this study. In fact, Black families actually benefited more than White families in receipt of services such as parent education videos and post-birth home visits (PBHV), even among families that were poorer. Income/need level and rurality did not negatively affect health care receipt for Black families. Controlling for all other predictor variables, Black mothers in North Carolina had a moderately higher adjusted odds of receiving both PBHV (OR = 1.84) and parenting videos (OR = 2.28) (see Table 8). Although the Black families in this study disproportionately lived in less rural versus more rural locations and were also disproportionately represented in the lower socio-economic strata, the study's finding suggests that Black families living in non-metropolitan areas are at low-risk of not receiving health care services, and may be at lower risk than their counterparts in more urbanized, metropolitan areas. Health care providers may use race as a risk

identifier, regardless of income/need level and residential location, and may intentionally give post-natal, parent-preparation services (in this case, parent education videos and post-birth home visits) to families deemed at greater risk (i.e., Black families). In sum, contrary to most research and this study's speculations, Black families were more likely to receive certain kinds of health services than White families.

As expected though, greater SES made a significant positive difference in whether mothers reported receipt of health care services. In North Carolina, a higher income/need ratio had a small positive influence on ensuring mothers received prenatal care. Mothers with an education beyond high school were twice as likely as mothers with a high school education or below to report having a regular doctor for their child. In Pennsylvania, higher education had small to moderate positive effects on the receipt of childbirth classes and breastfeeding assistance. These findings may be the result of lags in obtaining health care by low-SES women. Studies have found low-income women are not as likely to initiate prenatal care during their first-trimester (Gavin, Adams, Manning, Raskind-Hood, & Urato, 2007). Women who had less education and low income/need levels in this study were more likely to report late initiation of prenatal care. Findings suggest that programs focused on the provision of early maternal and infant health care and services for low-income families should be established.

In contrast to the above findings, greater economic standing is not needed to receive parent-related services such as parenting videos or post-birth home visits. In bivariate analyses, low-income women were more likely than higher-income women to receive parenting videos. In regression analyses adjusting for multiple predictor variables, low-income women were almost twice as likely to receive post-birth home visits in Pennsylvania while women reporting receipt of Medicaid or SCHIP in North Carolina were almost three times as likely to receive post-birth

home visits. This finding supports prior studies that suggest families who receive public insurance fare better in health care receipt than families who are not insured (Adler & Newman, 2002; Andrulis, 1998). Medicaid affords low-income families increases in post-birth home visits or parenting-related health services. While Medicaid increased post-birth home visits, it also decreased breastfeeding assistance in sample mothers. The results suggest that government-sponsored health insurance aids impoverished rural mothers in the receipt of home-based health care services, especially after the birth of their child. While this is a critical period for family services, especially for new mothers, programs that serve low-income women—particularly programs funded by Medicaid—may want to focus more on breastfeeding nutrition in order to support this health-promoting practice. Additionally, hospitals, presumably the hospitals where TC was born, were commonly listed as the sources of parent education videos; therefore, hospital staff would make a likely source of information and services for families in need of these services.

These findings suggest that rurality, race, and SES may not always function in the preconceived manner we believe—that is, they are not necessarily risk factors acting synergistically to decrease positive health and health care outcomes. Being poor and Black in a more rural area was not shown in this study to increase the risks of not receiving regular and specialty health care. Being poor and White in a more rural area proved detrimental to the odds of prenatal care and childbirth class receipt. Being poor and White in a less rural area decreased the odds of breastfeeding assistance. Even though Black families in this sample were more likely to have low SES than White families, they were more likely to receive certain post-partum services. Analyzing another sample or other outcome variables, race, SES, and rurality may influence maternal and infant health and health care outcomes differently.

Another goal of this study was to consider other aspects related to rural living that have been previously unexplored in prior research that may enable or impede health care utilization. Using Andersen's model of health service utilization to identify independent variables, the study found that aside from variables such as race and SES that would predispose a person to health care utilization, other enabling/disabling factors such as transportation, time traveled to get to the doctor's office, and social support predicted maternal and infant health care receipt in both study states.

Related to physical isolation, having personal transportation and travel distance to the doctor had an overall small but significant effect on health care receipt. First, depending on health care outcome, having access to personal transportation had a small to moderate influence on health care service receipt. Mothers in North Carolina with access to personal transportation had almost two times the odds of obtaining breastfeeding assistance (see Table 9). In contrast, access to personal transportation minimally decreased the likelihood of pregnancy home visits in both Pennsylvania and North Carolina (Table 8 & 9). A personal vehicle may enable women to attain health services, such as breastfeeding assistance, and therefore, reduce the need for other services, such as home visits. Longer duration of travel to get to the doctor's office reduced the likelihood of breastfeeding assistance in PA. The time required to travel to attain this service is something that mothers must consider; longer travel time poses a barrier to breastfeeding help for mothers in PA.

Mothers in North Carolina who reported higher satisfaction with their social networks were slightly less likely to get breastfeeding assistance. One rationale for this finding may be that mothers who are more satisfied with their social support may be more able, or more inclined, to seek assistance from their friends and family, and therefore may not need breastfeeding services

provided by others. On the other hand, women who have stronger ties to family and friends may also be more subject to scrutiny and peer evaluation and internalized social norms. Through ethnographic data, Flower et al. (2008) found that African-American women who did not initiate breastfeeding cited embarrassment, not identifying with the practice, and that they did not know anyone who breastfed. Social support should be examined more closely to fully understand the construct better within the rural/urban context, and within the Black community.

Need characteristics of the mother, perceived or otherwise, also predicted maternal health care services. Mothers' experience of health difficulties either in her past health history or during pregnancy moderately increased her odds of receiving health care services. It is not certain whether mothers who experience health problems are more likely to seek health care or whether they are targeted by health service providers. Personal communication with a home health nurse (Dee, personal communication, July 17, 2007) would suggest the latter; however, both reasons could be applicable.

Whether mothers were expecting their first biological child showed the largest effects on determining health care receipt. Mothers who were expecting their first child were much more likely than mothers who already have more than one biological child to receive several health care services. Controlling for other predictor variables, mothers who were expecting their first born were13-24 times more likely to receive childbirth classes and were nearly 3-5 times more likely to receive parent education videos. This finding supports the study hypothesis that first-time mothers would be more eager to receive pre- and postnatal health services and reflects the fact that many health care programs and services are geared to first-time mothers (e.g., NFP).

Finally, information on common predictors of health care services and unique predictors within each study state is expected to be relevant for future health care programming and

policies. For example, the receipt of pregnancy home visits and breastfeeding services demonstrated differences based on whether families live in more rural compared to less rural environments. For families living in North Carolina, geographic isolation was negatively related to the receipt of pregnancy home visits, controlling for all other variables. For families living in Pennsylvania, geographic isolation was positively related to the receipt of breastfeeding assistance, controlling for all other variables. Thus, rurality, or geographic isolation, poses a deterrent to providers of pregnancy home visits and/or to expectant women in North Carolina who may otherwise benefit from prenatal home visits, but rurality is not a barrier to providers of breastfeeding services and/or mothers who want breastfeeding assistance in Pennsylvania.

Unfortunately, these findings do not convey why rurality affects the receipt of these services differently in different states. One rationale for the variance in the effects of rurality is that there may be something fundamentally different about rural living in Pennsylvania (PA) versus rural living in North Carolina (NC) that was not measured in this study. Another rationale is that the recipient of the health care service is driving the difference in health care receipt. In comparison to women who are less isolated, women who are more isolated in North Carolina (NC) may have chosen not to have visitors come to their homes during their pregnancy and mothers who are more isolated in Pennsylvania (PA) may have chosen to breastfeed their infant because they are far from infant food sources and sought assistance despite being more isolated. Another alternative is that the service provider is the reason for the difference. Perhaps the services provided in PA, as compared to NC, are more comprehensive and are provided more extensively to women even in more remote areas of the state. Interpretation from the results of adjusted bivariate analysis would suggest that pregnant women would be better off living in PA compared to NC if they are more rural or poor. PA women have a greater likelihood of receiving

childbirth classes if they are more rural, or if they are not rural but poor, when compared to NC women. If women are more rural and poor, they are more likely to receive parent videos in PA versus NC. Therefore, mothers living in rural areas of NC seem to be more at risk of not receiving health services than mothers living in rural areas of PA. Additionally, one of the most prominent pre-and postnatal home visiting services for low-income women who are expecting their first child is the Nurse-Family Partnership Program (Olds, 2002), which has implementing agencies in all three study counties in Pennsylvania (Blair, Cambria, and Huntingdon) but does not in the three study counties in North Carolina (Sampson, Wayne, and Wilson). Therefore, these rural differences may be due to the fact that there are state differences in the availability and scope of home visiting providers.

Limitations

One of the limitations of this study is that race and state are confounded. Almost all the Black families in the FLP sample resided in North Carolina. In order to address this issue, the North Carolina sample was used to analyze race comparisons and White families were used to analyze state differences. The only exception to this analytic process was made for the hierarchical regression analysis. The goal of this particular analysis was to determine whether the receipt of health care outcomes that demonstrated geographic differences in unadjusted bivariate analysis of the full sample would also be significant for the entire sample after controlling for other possible predictors, including race and state. Race comparisons using only the North Carolina sample, and state comparisons using only White families, do not allow one to determine whether rural differences are stemming from differences in race or from differences in state, and whether state differences are stemming from differences in race or rurality. Essentially, people of similar race or income are more likely to live in the same place (in this case, there are more

Blacks living in North Carolina), making it more difficult to decipher what explains health care disparities (Kaneda & Adams, 2008). Therefore, regression analysis was used to allow for the interpretation of the effect of one predictor variable holding all other predictor variables constant in the model. In the case of two predictors that are highly correlated (in this study, they are race and state), the first predictor may become non-significant when the second predictor is added because there is very little variance explained by the first variable that is not also explained by the second. This occurred when performing hierarchical regression analysis on the receipt of pregnancy home visits. Race and state are highly correlated, and race became non-significant when state was added to the model. Hence, differences in state explained differences in race in terms of pregnancy home visits. Holding state and others variables constant, geographic isolation was ultimately found to negatively affect receipt of pregnancy home visits. Overall, the study tried to address this limitation as best as it could.

Two study states may also be seen as a limitation. Independent and dependent variables may not be parallel, or comparable, across states. For instance, a home visit in one state may not be the same in another, in terms of its purpose or why or how women receive them. For example, a home visit to an expectant mother in one state might only be conducted if there are signs of health problems and these health problems need to be addressed, whereas in another state, a home visit to an expectant mother is part of a routine preventative health service and is meant to promote maternal and prenatal health. Even though the study cannot directly address this issue, the study ran analyses using state-stratified samples. In this way, unique predictors are noted and can be assessed for how they function for particular health care outcomes within each state.

Another limitation of this study is that, beyond the predictor variables, it cannot definitively explain reasons for differences in maternal and infant health care receipt. Although

variables such as personal transportation can help to explain why rurality may or may not affect the likelihood of health care receipt, other variables are not as informative. Therefore the mechanisms for why certain predictors are associated with particular forms of health care are not completely understood. Without contextual findings (e.g., qualitative information), interpretations are mostly speculative. For instance, we do not know exactly why higher educational attainment (beyond high school) promotes the receipt of childbirth classes among mothers in PA. Perhaps women who are educated beyond high school, compared to women who have a high school education or less, want to learn more about how to prepare for childbirth. Perhaps more educated women have higher occupational status and higher income, and therefore can afford the cost, the time, and the flexibility to receive childbirth classes.

Another limitation is that health care outcomes are based on maternal retrospective self-report. Data for this study was pulled from interviews with sample mothers that asked them to report on health care receipt since becoming pregnant with TC. Therefore, there may be some error involved related to retrospective questions. Yet, responses to these retrospective questions were yes/no for whether they received or did not receive. With the exception of infant health care visits, questions were not asking mothers to report on frequency or time of care. Therefore, responses are more likely to be valid given the fact that people can typically recall whether they did or did not have a service.

Despite these limitations, this study contributes significantly to the relatively sparse research that has been conducted on geographic disparities in maternal and infant health care. Despite existing literature that posits significant health disparities for rural populations, results from this study suggest that disparities in health are not likely due to the non-receipt of regular and specialty health care by more rural mothers and infants. Other aspects that affect health

status and health outcomes should be studied. For example, maternal health behaviors are important influences on pregnancy health and birth outcomes, but they do not necessarily affect the receipt of early health care by mothers.

Programs geared for expectant mothers and newborns may also look to other factors that predict health care receipt. Predisposing characteristics, such as SES, may be contributing factors of certain health disparities. In this study, SES was found to decrease the likelihood of prenatal care and breastfeeding services, which improve maternal and infant health during pregnancy and after the child's birth. Enabling factors, such as Medicaid/SCHIP receipt, was shown to positively influence PBHV but negatively influence breastfeeding assistance. Incorporating breastfeeding education and support within PBHV could greatly benefit low-income families on government assistance.

The current study also contributes to the literature that is beginning to examine relationships between geography, race, and SES. Not all subgroups are equally affected. Disparities in health care services typically depend on the type of service, the level of income/need, geographic residential location, and race. When risk factors are combined, e.g., low SES and geographic isolation, they can have deleterious effects on health care receipt, which in turn, can negatively affect health outcomes. Also, combinations of risk factors are not necessarily cumulative—risk associated with low-SES and rurality affected White families and not Black families. Black families generally experienced better health care receipt than White families.

Finally, even though the study found few significant differences by geographic isolation, the study expanded on common notions of rurality as population density and how rural residence relates to health care receipt. For instance, the study found that having access to personal

transportation helps to explain differences in the receipt of maternal health care services. Mothers who have their own vehicles are more likely to receive desired services because they can readily access them, and therefore do not need or do not have to rely on health providers to come to their homes. Our knowledge of rural characteristics and how they contribute to health and health care disparities will evolve as research on more rural populations grows. Continued studies of maternal and infant health care receipt among more rural populations are still suggested because early disparities in health care can quickly result in disparities in health over the lifespan.

Table 1

Characteristics of Women and Infants in Study Sample (N = 1286)

Variable	Rounded percent or mean (Range)	Missing (N =)
Socio-Demographic Variables		
Maternal age (years)	26 (14.5, 44.6)	0
Black (African-American)	41%	0
High school degree/GED	28%	0
College degree	9%	0
Married	50%	0
Employed	41%	0
Low-income[a]	62%	87
Infant is 1st born	40%	0
Medicaid recipient	64%	0
Mother has health insurance[b]	81%	97
Infant has health insurance	99%	88
Social support-family/friends[c]	14.0 (4.2, 21.0)	101
Social support-intimate partner[d]	11.6 (4.5, 14.3)	258
Geographic Variables		
State (PA)	40%	0
Geographic isolation[e]	8.29 (6.67, 10.16)	32

[a] Low-income is defined if family income ≤ 185% Federal Income Poverty Guidelines (FPIG)

[b] Whether mother and infant had health insurance was asked at the 6 month home visit

[c] A composite measure of relationship support items describing the level of satisfaction with support from family and friends:1="Very Dissatisfied", 2 = "Somewhat Dissatisfied", 3 = Somewhat Satisfied", 4 = "Very Satisfied"

[d] A composite measure of relationship support items describing the level of satisfaction with support from an intimate partner: ="Very Dissatisfied", 2 = "Somewhat Dissatisfied", 3 = Somewhat Satisfied", 4 = "Very Satisfied"

e A composite measure of the logged average distance (in meters) from the respondent home to 10 community assests

Table 2

Frequency of Prenatal and Postpartum Services Received by Mothers

Types of Services	N	%	Missing (N =)
Pediatrician	1280	99.5	0
Prenatal Care (all trimesters)	1109	86.7	7
Late Initiation (2nd/3rd trimester)	98	7.8	
Childbirth Classes	251	19.6	5
Parent Education Videos	362	28.1	0
Parenting Classes	96	7.5	0
Home Visits while pregnant	214	16.7	5
Post-Birth Home Visits	419	32.6	0
Breastfeeding help	365	28.5	5

Note . The total sample size = 1286 mothers.

Table 3

Average Number of Healthcare Visits by Type of Visit and Presence of Preferred Doctor

Type of Healthcare Visit	*M*	*SD*	N	Missing (N =)
Sick Child Visit	2.11	2.95	1187	99
Well Child Visit	4.4	1.67	1181	105

Table 4

Number of Emergency Room Visits Since Infant's Birth

Number of Visits	N	%
Zero Visits	779	65.6
One Visit	241	20.3
Two Visits	102	8.6
Three Visits	28	2.4
Four Visits	12	1
Five Visits	12	1
Six or More Visits[a]	13	1.2

Note . The percents add up to 100.1%. This is due to rounding. Missing (N = 98)

[a]Includes up to 20 visits to the emergency room.

Table 5

Maternal and Infant Health Factors

Variables	Rounded percent or mean (Range)	Missing (N =)
Past health problems		
Diabetes	4%	0
High blood pressure/hypertension	13%	0
Cancer/malignancy	2%	0
Seizure disorder	2%	0
Depression	16%	0
Mental illness	2%	0
Maternal health risk index[a]	0.46 (0, 4)	0
Health problems experienced during pregnancy		
Light bleeding/spotting	26%	5
Heavy bleeding	5%	5
Excessive nausea	28%	5
Weight loss >10 lbs.	18%	6
Serious infection	28%	5
High blood pressure	17%	5
Convulsions	<1%	5
Serious accident	8%	5
Emotional problem	13%	5
Other illness requiring medical treatment	14%	5
Pregnancy health risk index	1.8 (0, 8)	11
Infant health factors		
Fetal distress	10%	3
Breathing difficulties at birth	4%	2
Congenital malformations or birth defects	4%	2
Other birth difficulty	15%	2
Premature	8%	14
Low-birth weight[b]	8%	2
Very low-birth weight[c]	1%	2
Infant health risk index	.69 (0, 6)	27

[a] A risk index was calculated for past maternal health risks, pregnancy health risks, and infant health risks

[b] Weight < 2500 grams

[c] Weight ≤ 1500 grams

Table 6

Differences in Independent Variables by Rurality

	Full sample (n =1249)			Pennsylvania (n = 517)			North Carolina (n = 769)		
Variable	Less Rural	More Rural	Difference	Less Rural	More Rural	Difference	Less Rural	More Rural	Difference
Predisposing Factors									
Maternal Age (years)	26.00 *SD* = 6.24	25.87 *SD* = 5.86	*t* = 0.40	26.63 *SD* = 5.90	26.75 *SD* =5.93	*t* = 0.24	25.61 *SD* = 6.42	25.23 *SD* = 5.73	*t* = 0.85
Maternal Race									
Black	45.7% (285)	35.6% (223)		2.9% (7)	4.2% (11)		73.5% (278)	58.7% (212)	
White	54.3% (338)	64.4% (403)	χ^2 = 13.26***	97.1% (238)	95.8% (254)	χ^2 = 0.63	26.5% (100)	41.3% (149)	χ^2 = 18.15***
Maternal Education									
≤ High school	52.3% (326)	52.2% (327)		46.5% (114)	46.8% (124)		56.1% (212)	56.2% (203)	
> High school	47.7% (297)	47.8% (299)	χ^2 = 0.001	53.5% (131)	53.2% (141)	χ^2 = 0.004	43.9% (166)	43.8% (158)	χ^2 = 0.002
Enabling Factors									
Employed	40.8% (254)	40.9% (256)	χ^2 = 0.02	38% (93)	34.3% (91)	χ^2 = 0.72	42.6% (161)	45.7% (165)	χ^2 = 0.73
Income/Needs Ratio									
≤185% FPIG	63.7% (368)	58.7% (344)		49.8% (115)	49.6% (126)		72.9% (253)	65.7% (218)	
>185% FPIG	36.3% (210)	41.3% (242)	χ^2 = 3.02	50.2% (116)	50.4% (128)	χ^2 = 0.002	27.1% (94)	34.3% (114)	χ^2 = 4.20*
Health Insurance									
Medicaid	64.7% (403)	63.4% (397)	χ^2 = 0.22	45.7% (112)	44.9% (119)	χ^2 = 0.03	77% (291)	77% (278)	χ^2 = 0.00
Social support-family/friends	13.96 *SD* = 2.87	14.04 *SD* = 3.02	*t* = 0.45	13.89 *SD* = 2.78	13.77 *SD* = 2.93	*t* = 0.46	14.00 *SD* = 2.93	14.24 *SD* = 3.07	*t* = 1.02
Social support-intimate partner	11.43 *SD* = 2.01	11.67 *SD* = 1.88	*t* = 1.95	11.73 *SD* = 1.94	11.76 *SD* = 1.81	*t* = 0.17	11.21 *SD* = 2.04	11.58 *SD* = 1.94	*t* = 2.23
Need Factors									
1st born child	39.2% (244)	39.9% (250)	χ^2 = 0.08	42% (103)	43.4% (115)	χ^2 = 1.00	37.3% (141)	37.4% (135)	χ^2 = 0.001
Average # health risks (mother)	0.38 *SD* = 0.66	0.42 *SD* = 0.67	*t* = 1.06	0.45 *SD* = 0.70	0.52 *SD* = 0.73	*t* = 1.07	0.33 *SD* = 0.63	0.34 *SD* = 0.60	*t* = 0.28
Average # health risks (infant)	0.54 *SD* = 0.88	0.63 *SD* =1.03	*t* = 1.70	0.64 *SD* = 0.93	0.65 *SD* = 0.99	*t* = 0.18	0.48 *SD* = 0.84	0.62 *SD* = 1.05	*t* = 2.02

*p < .05 **p < .01 ***p < .001

Table 7

Unadjusted Bivariate Analyses of Maternal and Infant Health Care by Income/needs ratio, Race, Rurality, and State

	Income/Needs Ratio			Race[1]		
Health care services	≤185%	>185%	Difference	White	Black	Difference
Maternal health care						
Prenatal care	83.2%	93.5%	$\chi^2 = 27.03$***	87.9%	80.0%	$\chi^2 = 7.43$*
Childbirth classes	17.3%	25.1%	$\chi^2 = 10.52$**	13.2%	10.3%	$\chi^2 = 1.44$
Pregnancy home visits	17.8%	14.1%	$\chi^2 = 2.85$	16.3%	23.3%	$\chi^2 = 5.12$*
Post-birth Home visits	41.8%	18.6%	$\chi^2 = 69.14$***	22.8%	43.5%	$\chi^2 = 31.89$***
Help with breastfeeding	27.8%	28.7%	$\chi^2 = 0.11$	24.0%	22.1%	$\chi^2 = 0.35$
Parent education videos	32.2%	23.8%	$\chi^2 = 9.62$**	20.5%	32.4%	$\chi^2 = 11.95$**
Infant healthcare						
Regular doctor	68.1%	72.3%	$\chi^2 = 2.30$	76.7%	69.7%	$\chi^2 = 3.79$
# of well-visits	4.42	4.36	$t = 0.61$	4.29	4.46	$t = 1.44$

	Rurality			State[2]		
	Less Rural	More Rural	Difference	PA	NC	Difference
Maternal healthcare						
Prenatal care	86.2%	87.5%	$\chi^2 = 0.43$	93.6%	87.9%	$\chi^2 = 7.00$**
Childbirth classes	19.5%	20.3%	$\chi^2 = 0.12$	31.7%	13.2%	$\chi^2 = 30.86$***
Pregnancy home visits	22.3%	11.7%	$\chi^2 = 24.89$***	10.8%	16.3%	$\chi^2 = 4.53$*
Post-birth Home visits	33.4%	31.6%	$\chi^2 = 0.44$	25.3%	22.8%	$\chi^2 = 0.59$
Help with breastfeeding	27.0%	30.7%	$\chi^2 = 2.02$	36.5%	24.0%	$\chi^2 = 12.18$***
Parent education videos	28.3%	28.3%	$\chi^2 = 0.00$	28.1%	20.5%	$\chi^2 = 5.25$*
Infant healthcare						
Regular doctor	71.0%	69.3%	$\chi^2 = 0.41$	67.2%	76.7%	$\chi^2 = 6.80$**
# of well-visits	4.36	4.45	$t = 0.86$	4.37	4.29	$t = 0.65$

[1] Race differences calculated in North Carolina.

[2] State differences calculated using white respondents.

* = p < .05; ** = p < .01; *** = p < .001

Table 8

Maternal Healthcare Receipt Regressed on Explanatory Variables for Pennsylvania Mothers

	Prenatal care					Childbirth classes				
Explanatory variables	β	*SE*	*p*	*OR*	*CI*	β	*SE*	*p*	*OR*	*CI*
Predisposing factors										
Age (years)	0.02	0.47	0.96	1.02	.41 - 2.58	0.05	0.03	0.08	1.06	1.00 - 1.12
Education	0.06	0.06	0.28	1.07	.95 - 1.20	*0.77*	*0.33*	*0.02*	*2.16*	*1.13 - 4.13*
Enabling factors										
≤ 185% income/need ratio	0.02	0.31	0.62	1.12	.72 - 1.74	0.41	0.32	0.21	1.50	0.79 - 2.83
Employed	-0.09	0.52	0.86	0.91	.33 - 2.51	0.34	0.29	0.24	1.41	.80 - 2.46
Medicaid/SCHIP recipient	0.37	0.50	0.46	1.45	.55 - 3.83	-0.28	0.31	0.37	0.76	.41 - 1.39
Rurality										
Geographic isolation	0.02	0.47	0.96	1.02	.41 - 2.58	0.06	0.27	0.83	1.06	.62 - 1.81
Travel time to MD	0.00	0.02	0.89	1.00	.96 - 1.05	0.00	0.01	0.81	1.00	.97 - 1.02
Personal transportation	0.30	0.61	0.62	1.35	.41 - 4.46	0.45	0.39	0.25	1.56	.73 - 3.33
Social Support										
Friends&Family	0.00	0.08	0.97	1.00	.85 -1.17	-0.06	0.05	0.20	0.94	.85 -1.04
Intimate Relationship	0.22	0.11	0.05	1.24	1.00 - 1.54	0.08	0.08	0.35	1.08	.92 - 1.26
Perceived need										
1st (bio) child	-0.22	0.54	0.69	0.81	.28 - 2.33	***3.18***	***0.33***	***0.000***	***23.94***	***12.46 - 46.02***
Maternal health risks	0.02	0.31	0.95	1.02	.55 - 1.89	0.08	0.19	0.65	1.09	0.75 - 1.57
Pregnancy health risks	0.11	0.17	0.51	1.12	.80 - 1.56	0.04	0.09	0.65	1.04	.87 - 1.26

Bold italics p < .001

Bold *p* < .01

Italics p < .05

Table 8 (cont.)

Maternal Healthcare Receipt Regressed on Explanatory Variables for Pennsylvania Mothers

	Pregnancy home visits					Breastfeeding help				
Explanatory variables	β	*SE*	*p*	*OR*	*CI*	β	*SE*	*p*	*OR*	*CI*
Predisposing factors										
Age (years)	-0.05	0.04	0.27	0.96	.88 - 1.04	0.02	0.02	0.33	1.02	.98 - 1.07
Education	0.09	0.41	0.84	1.09	.49 - 2.44	*-0.65*	*0.26*	*0.01*	*0.52*	*.31 - .87*
Enabling factors										
≤ 185% income/need ratio	-0.63	0.43	0.15	0.53	.23 - 1.24	0.37	0.25	0.14	1.45	.88 - 2.38
Employed	0.27	0.37	0.46	1.31	.64 - 2.72	0.13	0.23	0.58	1.14	.72 - 1.80
Medicaid/SCHIP recipient	-0.17	0.42	0.68	0.84	.37 - 1.91	*-0.55*	*0.26*	*0.03*	*0.58*	*.35 - .95*
Rurality										
Geographic isolation	-0.04	0.36	0.91	0.96	.47 - 1.95	**0.60**	**0.23**	**0.007**	**1.83**	**1.18 - 2.85**
Travel time to MD	-0.01	0.02	0.72	0.99	.96 - 1.03	*-0.03*	*0.01*	*0.03*	*0.98*	*.95 - 1.00*
Personal transportation	***-1.55***	***0.38***	***0.000***	***0.21***	***.10 - .44***	0.56	0.34	0.11	1.74	.89 - 3.42
Social Support										
Friends&Family	0.01	0.07	0.87	1.01	.88 - 1.16	-0.01	0.04	0.91	1.00	.92 - 1.08
Intimate Relationship	0.00	0.10	0.98	1.00	.82 - 1.23	-0.01	0.06	0.88	0.99	.88 - 1.12
Perceived need										
1st (bio) child	0.33	0.38	0.39	1.39	.66 - 2.92	-0.47	0.25	0.05	0.62	.39 - 1.01
Maternal health risks	-0.21	0.28	0.46	0.81	0.47 - 1.41	0.22	0.15	0.15	1.25	.92 - 1.68
Pregnancy health risks	**0.36**	**0.11**	**0.001**	**1.44**	**1.15 - 1.79**	-0.07	0.08	0.40	0.93	.80 - 1.10

Bold italics p < .001

Bold *p* < .01

Italics p < .05

Table 8 (cont.)

Maternal Healthcare Receipt Regressed on Explanatory Variables for Pennsylvania Mothers

	Post-birth home visits					Parenting videos				
Explanatory variables	β	*SE*	*p*	*OR*	*CI*	β	*SE*	*p*	*OR*	*CI*
Predisposing factors										
Age (years)	0.01	0.03	0.80	1.01	.96 - 1.06	0.00	0.03	0.92	1.00	.95 - 1.05
Education	-0.26	0.28	0.37	0.77	.45 - 1.35	0.11	0.29	0.71	1.11	.64 - 1.95
Enabling factors										
≤ 185% income/need ratio	*0.61*	*0.28*	*0.03*	*1.84*	*1.05 - 3.21*	0.46	0.29	0.11	1.58	.90 - 2.77
Employed	-0.34	0.27	0.21	0.71	0.42 - 1.21	0.09	0.26	0.74	1.09	.66 - 1.80
Medicaid/SCHIP recipient	0.53	0.27	0.05	1.70	1.00 - 2.90	0.07	0.28	0.81	1.07	.62 - 1.83
Rurality										
Geographic isolation	-0.27	0.25	0.28	0.76	.47 - 1.24	-0.21	0.25	0.38	0.81	.50 - 1.31
Travel time to MD	0.00	0.01	0.74	1.00	.97 - 1.02	0.01	0.01	0.34	1.01	.99 - 1.03
Personal transportation	0.08	0.36	0.82	1.09	.54 - 2.19	0.29	0.35	0.40	1.34	.68 - 2.66
Social Support										
Friends&Family	0.05	0.05	0.26	1.05	.96 - 1.15	-0.06	0.05	0.19	0.94	.86 - 1.03
Intimate Relationship	0.03	0.07	0.66	1.03	.90 - 1.19	0.01	0.07	0.91	1.01	.88 - 1.16
Perceived need										
1st (bio) child	***0.96***	***0.27***	***0.000***	***2.61***	***1.53 - 4.45***	***1.64***	***0.27***	***0.000***	***5.15***	***3.05 - 8.71***
Maternal health risks	0.14	0.17	0.42	1.15	.83 - 1.59	-0.15	0.17	0.38	0.86	.61 - 1.21
Pregnancy health risks	-0.15	0.09	0.12	0.87	.72 - 1.04	-0.03	0.09	0.76	0.97	.82 - 1.15

Bold italics p < .001

Bold *p* < .01

Italics p < .05

Table 9

Maternal Healthcare Receipt Regressed on Explanatory Variables for North Carolina Mothers

	Prenatal care					Childbirth classes				
Explanatory variables	β	*SE*	*p*	*OR*	*CI*	β	*SE*	*p*	*OR*	*CI*
Predisposing factors										
Age (years)	0.02	0.03	0.52	1.02	.96 - 1.08	-0.06	0.04	0.14	0.95	.88 - 1.02
Race	-0.30	0.33	0.35	0.74	.39 - 1.40	-0.35	0.37	0.35	0.71	.34 - 1.45
Education	0.22	0.30	0.47	1.24	.69 - 2.24	0.57	0.37	0.13	1.77	.85 - 3.68
Enabling factors										
≤ 185% income/need ratio	*-0.76*	*0.38*	*0.046*	*0.47*	*.22 - .99*	-0.04	0.42	0.93	0.96	0.43 - 2.18
Employed	-0.11	0.28	0.70	0.90	.52 - 1.55	-0.32	0.35	0.36	0.73	.37 - 1.44
Medicaid/SCHIP recipient	-0.21	0.42	0.63	0.81	.35 - 1.87	-0.73	0.46	0.11	0.48	.20 - 1.18
Rurality										
Geographic isolation	0.00	0.30	1.00	1.00	.56 - 1.80	-0.31	0.33	0.35	0.73	.38 - 1.40
Travel time to MD	0.03	0.02	0.12	1.03	.99 - 1.06	0.01	0.01	0.31	1.01	.99 - 1.04
Personal transportation	-0.05	0.29	0.87	0.95	.54 - 1.70	0.13	0.37	0.73	1.14	.55 - 2.37
Social Support										
Friends&Family	-0.06	0.05	0.25	0.94	.86 - 1.04	0.08	0.06	0.20	1.08	.96 - 1.21
Intimate Relationship	0.05	0.07	0.49	1.05	.91 - 1.21	-0.03	0.09	0.77	0.97	.82 - 1.16
Perceived need										
1st (bio) child	-0.05	0.29	0.87	0.95	.53 - 1.69	***2.54***	***0.39***	***0.000***	***12.67***	***5.94 - 27.03***
Maternal health risks	*0.52*	*0.25*	*0.036*	*1.68*	*1.03 - 2.73*	0.09	0.28	0.75	1.10	.63 - 1.91
Pregnancy health risks	-0.10	0.09	0.29	0.90	.75 - 1.09	-0.13	0.12	0.29	0.88	.70 - 1.11

Bold italics p < .001

Bold *p* < .01

Italics p < .05

Table 9 (cont.)

Maternal Healthcare Receipt Regressed on Explanatory Variables for North Carolina Mothers

	Pregnancy home visits					Breastfeeding help				
Explanatory variables	β	*SE*	*p*	*OR*	*CI*	β	*SE*	*p*	*OR*	*CI*
Predisposing factors										
Age (years)	-0.01	0.03	0.81	0.99	.95 - 1.04	0.00	0.03	0.94	1.002	.95 - 1.05
Race	0.12	0.29	0.67	1.13	.65 -1.97	0.13	0.27	0.63	1.14	.68 - 1.91
Education	0.17	0.27	0.52	1.19	.70 - 2.02	-0.32	0.26	0.22	0.73	.43 - 1.22
Enabling factors										
≤ 185% income/need ratio	0.31	0.32	0.33	1.37	.73 - 2.56	0.15	0.3	0.62	1.16	.65 - 2.06
Employed	0.08	0.25	0.76	1.08	.66 - 1.77	0.02	0.24	0.95	1.02	.63 - 1.63
Medicaid/SCHIP recipient	0.08	0.35	0.81	1.09	.55 - 2.16	-0.50	0.32	0.11	0.6	.32 - 1.13
Rurality										
Geographic isolation	***-0.95***	***0.26***	***0.000***	***0.39***	***.23 - .65***	-0.29	0.24	0.23	0.75	.47 - 1.20
Travel time to MD	0.01	0.01	0.42	1.01	.99 - 1.03	0.00	0.009	0.95	1.001	.98 - 1.02
Personal transportation	**-0.84**	**0.25**	**0.001**	**0.43**	**.27 - .70**	*0.60*	*0.27*	*0.025*	*1.83*	*1.08 - 3.09*
Social Support										
Friends&Family	-0.02	0.04	0.70	0.98	.91 - 1.07	*-0.09*	*0.04*	*0.026*	*0.92*	*.85 - .99*
Intimate Relationship	0.01	0.06	0.86	1.01	.89 - 1.14	-0.01	0.06	0.87	0.99	.88 - 1.12
Perceived need										
1st (bio) child	0.14	0.26	0.58	1.15	.70 -1.90	0.30	0.24	0.22	1.35	.84 - 2.18
Maternal health risks	0.09	0.19	0.65	1.09	.76 - 1.56	-0.01	0.18	0.94	0.99	.69 - 1.41
Pregnancy health risks	0.06	0.09	0.45	1.07	.90 - 1.26	-0.05	0.08	0.55	0.95	.81 - 1.12

Bold italics p < .001

Bold *p* < .01

Italics p < .05

Table 9 (cont.)

Maternal Healthcare Receipt Regressed on Explanatory Variables for North Carolina Mothers

	Post-birth home visits					Parenting videos				
Explanatory variables	β	*SE*	*p*	*OR*	*CI*	β	*SE*	*p*	*OR*	*CI*
Predisposing factors										
Age (years)	0.01	0.02	0.65	1.01	.97 - 1.06	-0.05	0.03	0.05	0.95	.91 - 1.00
Race	*0.61*	*0.26*	*0.02*	*1.84*	*1.11 - 3.03*	**0.82**	**0.27**	**0.002**	**2.28**	**1.34 - 3.86**
Education	-0.37	0.24	0.13	0.690	.43 - 1.11	-0.06	0.26	0.81	0.94	.57 - 1.55
Enabling factors										
≤ 185% income/need ratio	0.4	0.28	0.15	1.5	.86 - 2.61	0.21	0.29	0.46	1.24	.70 - 2.19
Employed	-0.06	0.23	0.80	0.94	.60 - 1.47	0.35	0.24	0.14	1.42	.90 - 2.26
Medicaid/SCHIP recipient	**1.09**	**0.35**	**0.002**	**2.97**	**1.49 - 5.92**	-0.46	0.32	0.16	0.63	.34 - 1.19
Rurality										
Geographic isolation	0.02	0.23	0.94	1.02	.65 - 1.59	0.35	0.24	0.14	1.42	.89 - 2.26
Travel time to MD	0.01	0.01	0.22	1.01	.99 - 1.03	0.02	0.01	0.12	1.02	1.00 - 1.04
Personal transportation	0.02	0.24	0.92	1.02	.64 - 1.63	0.02	0.25	0.94	1.02	.63 - 1.66
Social Support										
Friends&Family	-0.01	0.04	0.77	0.99	.92 - 1.07	-0.02	0.04	0.63	0.98	0.91 - 1.06
Intimate Relationship	-0.04	0.06	0.54	0.97	.86 - 1.08	-0.02	0.06	0.78	0.98	.91 - 1.06
Perceived need										
1st (bio) child	*0.48*	*0.23*	*0.04*	*1.61*	*1.02 - 2.55*	***1.09***	***0.23***	***0.000***	***2.98***	***1.88 - 4.70***
Maternal health risks	-0.03	0.17	0.84	0.97	.70 - 1.34	*0.35*	*0.17*	*0.04*	*1.42*	*1.01 - 2.00*
Pregnancy health risks	0.1	0.08	0.20	1.11	.95 - 1.29	0.1	0.08	0.23	1.1	.94 - 1.29

Bold italics p < .001

Bold *p* < .01

Italics p < .05

Table 10

Regular infant healthcare by state regressed on explanatory variables

	Regular doctor for PA						Regular doctor for NC				
Explanatory variables	β	*SE*	*p*	*OR*	*CI*		β	*SE*	*p*	*OR*	*CI*
Predisposing factors											
Age (years)	0.00	0.02	0.92	1.00	.95 - 1.05		-0.01	0.02	0.50	0.99	.95 - 1.03
Education	-0.16	0.26	0.54	0.86	.52 - 1.41		*0.53*	*0.27*	*0.048*	*1.70*	*1.00 - 2.88*
Race							-0.33	0.28	0.23	0.72	.42 - 1.23
Enabling factors											
≤ 185% income/need ratio	-0.12	0.26	0.65	0.89	.54 - 1.47		-0.21	0.30	0.48	0.81	.45 - 1.47
Employed	0.24	0.23	0.29	1.28	.81 - 2.00		-0.30	0.25	0.23	0.74	.46 - 1.20
Medicaid/SCHIP	0.01	0.25	0.98	1.01	.62 - 1.65		0.01	0.33	0.97	1.01	.53 - 1.95
Rurality											
Geographic isolation	-0.22	0.22	0.33	0.80	.52 - 1.24		-0.19	0.25	0.44	0.83	.51 - 1.34
Travel time to MD	0.01	0.01	0.46	1.01	.99 - 1.03		0.01	0.01	0.65	1.01	.99 - 1.03
Personal transportation	0.04	0.31	0.89	1.04	.57 - 1.91		-0.19	0.26	0.46	0.82	.49 - 1.38
Social Support											
Friends&Family	0.01	0.04	0.88	1.01	.93 - 1.09		0.05	0.04	0.20	1.05	.97 - 1.14
Intimate Relationship	-0.02	0.06	0.71	0.98	.87 - 1.10		0.00	0.06	1.00	1.00	.88 - 1.13
Perceived need											
1st (bio) child	0.26	0.24	0.27	1.30	.81 - 2.09		-0.21	0.25	0.38	0.81	.50 - 1.31
Infant health risks	-0.11	0.11	0.32	0.90	.72 - 1.11		0.08	0.13	0.53	1.09	.84 - 1.41

Italics $p < .05$

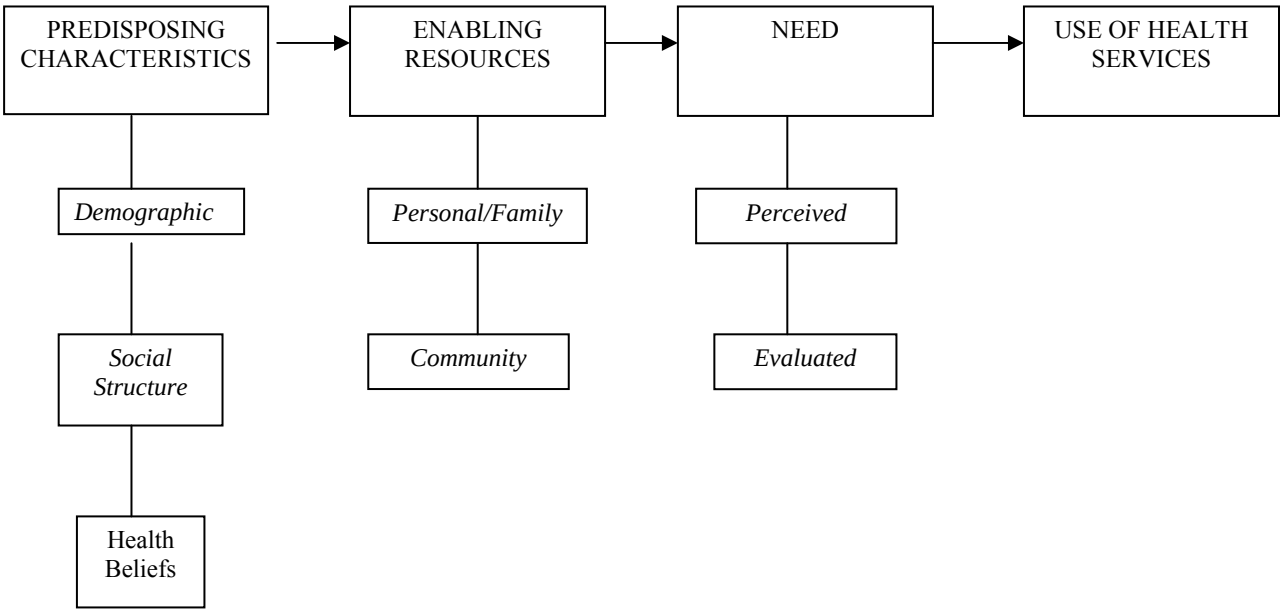

Figure 1. Andersen's (1995) Behavioral Model of Health Service Use.

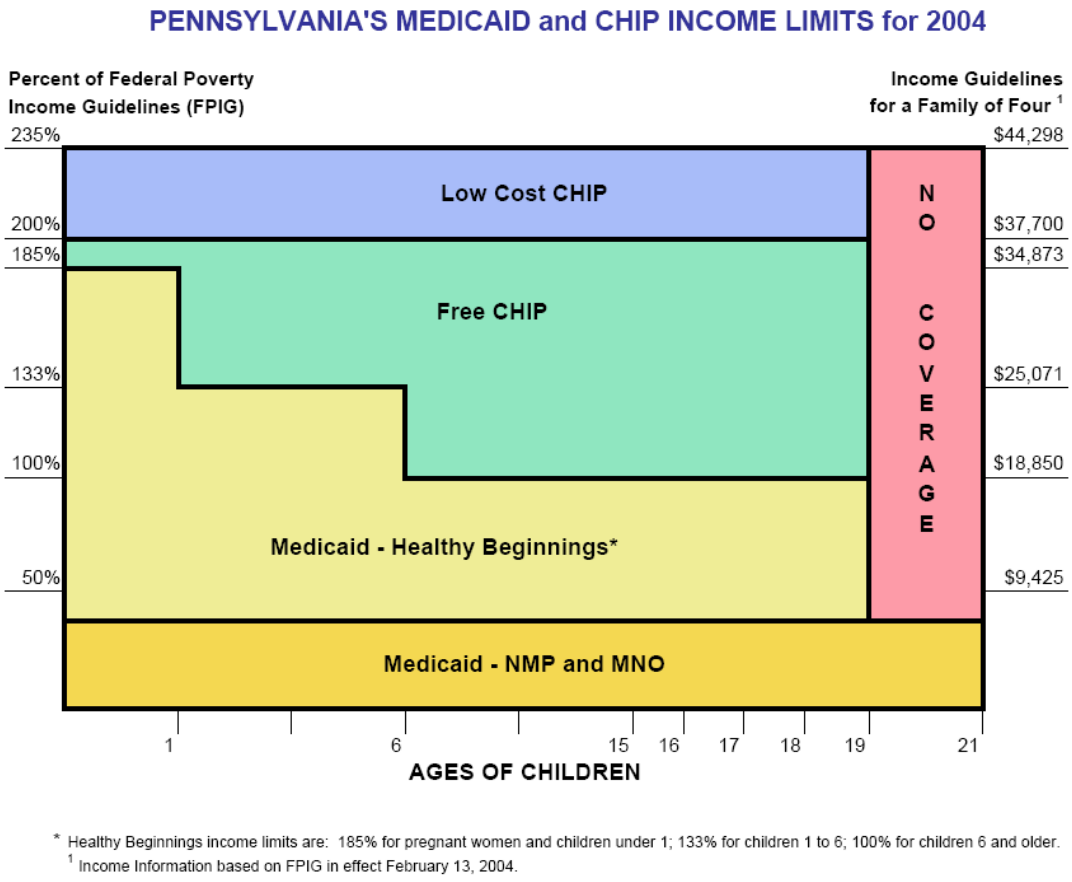

Figure 2. 2004 Medicaid and CHIP Income Limits for Pennsylvania.

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