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**Diaper Need and Maternal Mental Health:  
A Geographic Assessment in the City of New Haven**

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## ABSTRACT

**Introduction:** With the burden of poverty currently falling heavily on women and poverty as an established risk factor for poor mental health, it is important to understand the pathways by which poverty influences maternal mental health. Diaper need may represent a form of material hardship that has adverse consequences for the mental health of low income mothers. The aim of the present study was to examine the association between maternal mental health, diaper need, and neighborhood context. We hypothesized that mothers who reported diaper need would also report poor mental health and that neighborhood context would significantly impact this association.

**Methods:** Data were derived from a cross-sectional study of 408 pregnant and parenting women living in the City of New Haven. Women completed surveys on topics related to mental health and basic needs; crime data were obtained through the City of New Haven Police Department. Multivariable logistic regression and geographic information software (GIS) were used to examine the relationship between diaper need, maternal mental health, and neighborhood level crime.

**Results:** One-fourth of women reported diaper need. Substantial heterogeneity in diaper need, maternal mental health status, and neighborhood level of crime was observed across neighborhoods in the City of New Haven. In the final multivariable logistic model, diaper need was found to be associated with poor maternal mental health such that women who reported diaper need were more likely to report poor mental health than women who did not report diaper need (OR=2.43, 95% CI 1.15, 5.13). Notably, diaper need was more strongly associated with maternal mental health than food need. Neighborhood level crime was not found to be significantly associated with diaper need.

**Discussion:** The present study found lack of an adequate supply of diapers to be significantly associated with poor maternal mental health, whereas food need and maternal mental health were not related. While many federal antipoverty programs provide food and food subsidies to families in need, diapers are not an allowable expense for families under many federal antipoverty programs. Results suggest that inclusion of diapers on federal anti-poverty programs may be a tangible way of reducing maternal stress and improving maternal mental health with additional benefits for child development and health.

**Conclusion:** Diapers represent a malleable risk factor for poor maternal mental health that is amenable to public health and public policy interventions. Inclusion of diapers in federal anti-poverty programs may be a way by which the negative emotional consequences of diaper need can be mitigated.

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## BACKGROUND AND RATIONALE

In 2011, approximately 15.9% or 48.5 million Americans were living in poverty (Bishaw, 2012). National estimates have found racial and ethnic minorities, women, children, and families headed by single women to be particularly vulnerable to poverty (NCLEJ, 2012). In 2011, 16.3% of females compared to 13.6% of males lived in poverty (DeNavas-Walt et al., 2012). In addition, 34.2% of households headed by single women were living in poverty compared to 7.4% of married couple families with children (NCLEJ, 2012). As such, the burden of poverty currently falls heavily on women and mothers who are the head of households (Beeber et al., 2008).

### *Poverty and Mental Health*

Poverty is a well-established risk factor in the etiology of a number of mental disorders. The association between poverty and poor mental health has been well documented with studies consistently demonstrating a positive relationship between low income or low socioeconomic status and increased risk for mental illness (Belle, 1990; Muntaner et al., 2004). In a recent longitudinal study of U.S. adults, the presence of most lifetime mental health disorders was associated with lower levels of income (Sareen et al., 2011). Moreover, reductions in income over the 3 year study period were associated with increased risk of mood, anxiety, and substance use disorders (Sareen et al., 2011). Among low income women in the U.S., results from several community-based studies have estimated the prevalence of clinically significant depression to be between 16% and 48% (Hall et al., 1985; Olson & DiBrigida, 1994; Lanzi et al., 1999; Kahn et al., 2000; Beeghly et al., 2003; Harrington & Greene-Harrington, 2007).

With the relationship between poverty and poor mental health well established among the population in general and women in particular, it is important to gain an understanding of the specific mechanisms by which poverty influences women's mental health. Poverty has been shown to increase exposure to negative and stressful life events associated with poor mental health including personal conflict and violence, low wages, and living in dangerous neighborhoods (Cox et al., 2003; Padgett, 1997; Curry et al., 2009). More recently, increasing attention has been given to lack of basic needs such as food and adequate housing among the poor as potential pathways through which poverty influences mental health. Such work is important as research suggests that it is not only the experience of living in poverty and with low income, but also material hardship, such as lack of basic needs, that influences parental mental illness (Gershoff et al., 2007). For example, there is a growing body of evidence which indicates that food insufficiency is strongly associated with poor mental health among low income women and may function as a causal or contributing factor to mental disorders in this population (Heflin et al., 2005; Siefert et al., 2007). These findings are meaningful as household food insufficiency, unlike other

poverty-related risk factors for poor mental health, is modifiable and provides a clear direction for public health and policy level interventions aimed at improving maternal mental health.

### *Diaper Need and Maternal Mental Health*

A basic need that has received virtually no attention in the mental health literature and that may be a potential risk factor for poor mental health among low income women is diaper need. In 2010, Kimberly Clark, the manufacturer of Huggies ® diapers, commissioned a study to investigate diaper need among U.S. and Canadian mothers of young children. Among the 1,513 U.S. mothers included in the study, one in three reported diaper need (i.e. cutting back on basic essentials in order to afford enough diapers for their children) and four in ten reported having at times to choose between buying diapers and other necessities (Raver et al., 2010). Results revealed that mothers who struggled with diaper need were more likely to be living in poverty or financial hardship than those without diaper need (Raver et al., 2010). In terms of their mental health, mothers with diaper need reported several emotional consequences of being unable to change their child's dirty diaper with 58% reporting feelings of guilt, 50% reporting frustration, 44% reporting feeling like a bad mother, and 41% reporting feelings of anxiety (Raver et al., 2010). While this study is important in that it is the only study to date that has assessed diaper need, it was industry sponsored and is not peer reviewed. In addition, mothers were recruited by telephone which limited survey eligibility to women who had sufficient income to afford consistent telephone services thus excluding those who may have experienced the most difficulty affording an adequate supply of diapers. Even so, the results indicate that diaper need may adversely impact the mental health of low income women by causing negative emotions, such as increased parenting stress and reduced sense of parenting competency, related to being unable to provide children with clean diapers. Of importance is the fact that diapers are currently not an allowable expense under many federal antipoverty programs including Temporary Assistance to Needy Families (TANF) and Women, Infants, and Children (WIC). Similar to food insufficiency, diaper need may operate as an independent contributing or casual factor to poor mental health among low income women and, as a potentially modifiable risk factor, suggests tangible means for public health and policy level interventions.

### *Place and Mental Health*

Not only are individual socioeconomic status, household income, and other related factors such as basic needs important in terms of the mental health of women, but place, the community or neighborhood in which an individual lives and works, can also have a significant impact on emotional wellbeing. Accumulating evidence across multiple studies has shown that, independent of individual- and family-level characteristics, neighborhood conditions and neighborhood-level characteristics such as neighborhood socioeconomic composition significantly impact a variety of outcomes, including mental

health (Ellen et al., 2001). Perhaps the best example of the impact of neighborhood context on mental health is found in the Moving to Opportunity studies. In the Moving to Opportunity studies, families living in public housing units in a high-poverty neighborhood were randomized to either move into private housing in near-poor or non-poor neighborhoods or to remain in public housing (Leventhal & Brooks-Gunn, 2003). At the 3-year follow-up, parents who moved to low poverty neighborhoods reported fewer distress and depressive symptoms than parents who remained in public housing (Leventhal & Brooks-Gunn, 2003). Moreover, long-term (10-15 year) benefits for parents who moved to low poverty neighborhoods were across a broad index of mental health (Ludwig et al., 2012).

Additional studies have specifically examined the relationship between neighborhood context and women's mental health with several demonstrating a significant association between various neighborhood-level variables and the mental health of women. In a sample of 720 African American women who were the primary caregiver to a child between 10 and 12 years of age, Cutrona and colleagues (2000) found that higher levels of neighborhood disorder, a composite measure of several items rated by the women including the extent to which there was trash, broken glass, vacant or deserted buildings, selling or using drugs, and gang violence in their neighborhood, was significantly associated with higher levels of individual distress among mothers. In the same sample, Cutrona and colleagues (2005) found that rates of major depression were significantly higher among women who lived in neighborhoods characterized by higher levels of poverty and higher levels of social disorder than women who lived in better quality neighborhoods while controlling for individual-level factors. In addition, among 123 low-income African American families headed by a single mother with a 7 to 15 year old child, higher levels of neighborhood stress defined as the presence of gangs, physical fighting, drug use or dealing, shootings and/or knifings, homicides, substandard housing conditions, unsanitary living conditions, noise, and overcrowding were associated with greater psychological distress among mothers. (Kotchick et al., 2005). Notably, greater psychological distress among mothers was then found to be related to lower levels of positive parenting practices 15 months later (Kotchick et al., 2005). These studies demonstrate not only the importance of neighborhood context for maternal mental health, but also the need for research on maternal mental health to examine place as a salient and potentially malleable risk factor for women's mental health.

### *GIS and Maternal and Child Health*

Geographic information systems (GIS) in public health contexts have been primarily used to examine the effect of place in terms of healthcare utilization and the spread of infectious diseases. In maternal and child health, innovative efforts have begun to use such techniques to analyze geographically specific data and to examine how exposures and risk factors vary by place. For example, in one of the



few studies to examine place as it relates to maternal and child health, McLafferty & Grady (2004; 2005) used GIS to examine the relationship between prenatal clinic density and the initiation of prenatal care and how this varied among high and low risk immigrant groups. In addition, South and colleagues (2012) used GIS and spatial analyses to demonstrate that modifiable risk factors for preterm birth are not uniformly distributed by place and that certain risk factors are of greater importance in some communities than in others. Such information can be used to design effective, targeted interventions that will be relevant to the needs of the specific community of interest (South et al., 2012). Clearly, GIS techniques can be used to make significant contributions to the area of maternal and child health and can potentially be used to explore modifiable risk factors important to maternal mental health.

### *The Present Study*

The present study sought to determine the contribution of diaper need and neighborhood of residence to maternal mental health among a sample of low-income pregnant and parenting women living in the City of New Haven. Specifically, this study examined the relationship between diaper need and maternal mental health, how this relationship varies by neighborhood in the City of New Haven, and the impact neighborhood of residence has on the relationship between diaper need and maternal mental health status. New Haven represents a unique location for such an analysis given the high level of poverty among families living in the city (27%; American Community Survey, 2011) and the fact that many of the city's neighborhoods are homogeneous in terms of poverty, segregation, and racial and ethnic composition, but vary with respect to other important factors. One such factor is crime, specifically the level of violent, non-violent, and domestic crimes that occur within each neighborhood, which can be used as a variable to represent neighborhood of residence and neighborhood context. Diaper need and social and neighborhood context represent unique contributions to maternal mental health and are malleable factors that can be intervened upon from a public health perspective. An understanding of the contributions of these factors to maternal mental health will provide clear directions for ways in which public health practitioners can intervene at both the policy level and the neighborhood level in order to improve maternal mental health. This study represents the first to examine such constructs in the City of New Haven and is among the first non-industry sponsored studies to specifically examine diaper need.

### **SPECIFIC AIMS AND HYPOTHESES**

The aim of the present study was to examine the contribution of diaper need and neighborhood of residence to maternal mental health among a sample of low income pregnant and parenting women living in the City of New Haven. Specifically, our aims were to:

1. Examine the association between diaper need and maternal mental health status.

2. Examine the association between diaper need and maternal mental health status by neighborhood in the City of New Haven.
3. Examine the effect of neighborhood of residence in the City of New Haven on the association between diaper need and maternal mental health status.

We hypothesized that:

1. The association between diaper need and maternal mental health status would vary directly such that mothers who report diaper need would also report poor mental health.
2. The association between diaper need and maternal mental health status would vary directly by neighborhood in the City of New Haven such that neighborhoods with high diaper need would also have high levels of poor mental health.
3. Neighborhood of residence in the City of New Haven, represented as level of violent, non-violent, and domestic crime per neighborhood, would significantly impact maternal mental health and the association between diaper need and maternal mental health status.

## **METHODS**

### **Study Design and Sample**

#### *Location and Overview*

Data for this study were derived from the New Haven Mental Health Outreach for MotherS (MOMS) Partnership (PI: Smith, HIC#1010007484), one of ten sites funded by a Coalition for a Healthier Community Award through the U.S. Office of Women’s Health. The MOMS Partnership consists of a network of community partners including organizations that serve low income pregnant and parenting women in the City of New Haven: the Diaper Bank, All Our Kin, Clifford Beers Clinic, the State of Connecticut Department of Children and Families, the Housing Authority of New Haven, New Haven Healthy Start, the New Haven Health Department, and the Yale School of Medicine. The target population of the Partnership is low income, racially and ethnically diverse, pregnant and parenting women living in the City of New Haven. The Partnership’s mission is to ensure that these women achieve the highest possible standard of mental health and wellbeing throughout their lives.

#### *Recruitment and Assessment*

During the first year of funding, the MOMS Partnership developed a gender-based needs assessment and collected data on women throughout the City of New Haven. The gender-based needs assessment was developed by conducting a comprehensive review of existing instruments used to assess women’s mental health and health needs from the Partnership members, partnering agencies, the research literature, and state and federal surveys. An immediate concern and important finding was the fact that

very few of the instruments asked about a woman's parenting or pregnancy status, assessed her mental health, or linked roles of mothers in terms of employment, childcare, and managing family in relation to mental health status. Thus, while about 20% of the questions on the needs assessment were drawn from standard health surveys and the research literature, the remainder of the assessment was a product created through a community partnership model. The final needs assessment focused on gathering a mix of quantitative (40%) and qualitative data (60%).

MOMS Partnership Community Mental Health Ambassadors (CMHAs) recruited women across the City of New Haven to participate in the needs assessment. CMHAs were New Haven mothers hired for their familiarity with local neighborhoods and trained in brief mental health outreach and participant engagement. Women were eligible for the needs assessment if they spoke English or Spanish, provided written informed consent, and were pregnant, the mother (biological or adoptive) of a child under the age of 18, and lived in the City of New Haven. Systematic efforts were made to conduct outreach evenly across low-income neighborhoods in the City and at places where families live (public housing), learn (schools, early childhood learning centers, adult education centers), interact (bus stops, hair and beauty salons, grocery stores, churches, libraries), and play (playgrounds, parks, fairs). CMHAs approached potential female participants at such locations and requested the participant's time to complete the needs assessment. The average interview lasted approximately 35 minutes, and participants received \$5 compensation in the form of a gift card for participation. The majority of needs assessments were completed by women as self-report (70% estimate), however CMHAs read the questionnaires to women who either requested it or demonstrated difficulty reading or interpreting the questions. Procedures for data collection and analysis were approved by the Yale University Institutional Review Board (IRB) and IRBs at participating agencies or locations if available.

## **Measures**

### *Demographics*

Demographic factors captured through the needs assessment included self-reported race, age, primary language, and the number of children under 18 living in the household. Participants were also given the option to provide their residential address if they desired to receive information on Partnership workshops and activities.

### *Maternal Mental Health*

Maternal mental health status was created as a composite of three separate items from the MOMS Partnership needs assessment. Maternal mental health status was defined based on ratings given to the following statements: "I have the skills to manage/control my stress", "Managing my sadness or depression...", and "Coping with the traumatic things that have happened to me...". The first statement

was rated on a scale from 1 to 10 with 1 indicating “Not great skills” and 10 indicating “Excellent stress management”. The remaining two statements were rated on a scale from 1 to 10 with 1 indicating “This is hard for me” and 10 indicating “Easy, no problem”. Women who responded with a rating of 1 to 4 on one or more of these items were considered to report poor mental health. Women who responded with a rating of 5 to 10 on all of these items were considered to report good mental health.

### *Diaper Need*

Diaper need was assessed through the Partnership needs assessment with the question, “If you have children in diapers, do you ever feel that you do not have enough diapers to change them as often as you would like?”. Women who responded “yes” were then asked what they do when they do not have enough diapers. Response choices included: borrow diapers or money from family or friends, get diapers from an agency, stretch the diapers I have, and other. Women who responded “yes”, they do not have enough diapers to change their children as often as they would like, and/or indicated they use one or more of the above methods to obtain diapers were considered to report diaper need. Women who responded “no”, they feel they do have enough diapers to change their children as often as they would like, and did not indicate that they use any of the above methods to obtain diapers were considered to report no diaper need.

### *Food Need*

Food need was assessed through the Partnership needs assessment with the question, “Does your family ever run out of food before the end of the month?”. Women who responded “yes” were then asked what they do when they run out of food before the end of the month. Response choices included: borrow food or money from family or friends, use a food bank, go to a soup kitchen, we go without, and other. Women who responded “yes”, they run out of food before the end of the month, and/or indicated they use one or more of the above methods to obtain food were considered to report food need. Women who responded “no”, they do not run out of food before the end of the month, and did not indicate that they use any of the above methods to obtain food were considered to report no food need.

### *Crime*

Crime data were obtained through the City of New Haven Police Department. Information on type of crime and date and address of crime occurrence were available by year for 2008-2012. All violent, non-violent, and domestic crimes for each of the five years were selected for inclusion in the present study. Specific crimes encompassing each of the three categories are outlined below.

Violent crimes were defined in accordance with the FBI’s Uniform Crime Reporting definition of violent crimes (FBI, 2010) and included assault, assault with dangerous weapon or firearm, attempted

assault, all cases dead on arrival, burglary with violence, murder, manslaughter, robbery with firearm, robbery with other weapon, robbery without a weapon, and simple assault.

Non-violent crimes included arson, attempted arson, attempted bribery, attempted drug offense, attempted kidnapping, burglary attempt, forcible burglary, non-forcible burglary, carrying a concealed weapon, carrying weapon in a motor vehicle, criminal mischief, drug investigation, forging narcotic prescription, holdup alarms, illegal possession of a weapon, interfering with an officer, issuing bad checks, kidnapping, landlord-tenant dispute, possession of a prohibited weapon, possession of dangerous/controlled drugs, possession of narcotics, possession of heroin, possession of marijuana, possession of paraphernalia, prostitution, riot, roving gangs, sale of dangerous/controlled drugs, sale of fireworks, sale of marijuana, sale of heroin, sale of narcotics, stolen automobile, stolen plate, theft, and window breaking.

Domestic crimes included civil investigation, custodial interference, dispute-no disturbance, family dispute, harassment, neglect or abuse of family, non-payment of alimony, non-support of family, substitution of children, and threatening.

### **Data Analytic Strategy**

Of 877 women completing the MOMS Partnership needs assessment, a total of 423 women provided full addresses within the city limits of New Haven between 2010 and 2012. Participant addresses were geocoded to a point location using the Environmental Systems Research Institute (ESRI) ArcGIS 10.1 software. Addresses were geocoded using the 2000 ESRI Topologically Integrated Geographic Encoding and Referencing (TIGER) file for New Haven county downloaded from the United State Census Bureau and the North American Address Locator (ArcGIS 10 style). To determine neighborhood of residence for each point location, data were spatially joined to the shapefile representing the boundaries of neighborhoods in the City of New Haven, which was obtained from the City of New Haven Planning Department (2005).

Addresses representing the location of crimes were also geocoded according to year, and the neighborhood where each crime occurred in the City of New Haven was determined using the methods described above. For each neighborhood, a five year average representing the average number of violent, non-violent, and domestic crimes per year was calculated. The neighborhoods were then categorized into quartiles representing low, mid-low, mid-high, and high levels of violent, non-violent, and domestic crime as per the five year average (Figure 1). All data was exported to SAS® version 9.3 in order to code variables of interest and conduct analyses.

Bivariate analyses were conducted using  $\chi^2$  or Fisher's exact test to examine the association between maternal mental health status and diaper need, neighborhood, and demographic variables of interest. Variables from bivariate analyses that were significant at  $p < .10$  and variables that had theoretical plausibility were included in the multivariable logistic regression model. Primary language was excluded from the model due to multicollinearity with race, and missing data were also excluded. Unadjusted associations were calculated for all variables included in the final multivariable logistic model. The final multivariable logistic regression model included race, number of children under 18 in the household, age, food need, diaper need, and neighborhood level of violent, non-violent, and domestic crime as independent variables and maternal mental health status as the dependent variable. Odds ratios and 95% confidence intervals were estimated for this model. Data aggregated on the neighborhood level was imported back into GIS for visual display.

## RESULTS

### Sample Characteristics

A diagram outlining recruitment and enrollment consistent with the STROBE checklist and guidelines for observational studies representing the final sample size is presented in Figure 2. Of 877 women completing the MOMS Partnership needs assessment, 423 provided addresses within the City of New Haven. Of these, 408 (96.5%) were successfully geocoded. There were no significant differences between women who provided addresses and those who did not with respect to many of the main variables of interest. However, there was a significant difference between women who provided addresses and those who did not with respect to mental health status. Of those who did provide addresses, 38.2% ( $n=156$ ) reported poor mental health while 27.5% ( $n=129$ ) of those who did not provide addresses reported poor mental health.

Descriptive characteristics of the sample ( $n=408$ ) appear in Table 1. The majority of women were African American (59.6%,  $n=243$ ) or Hispanic (29.9%,  $n=122$ ). Over eighty percent of the sample (83.8%,  $n=368$ ) spoke English as their primary language with the remainder primarily speaking Spanish. The majority of women were between the ages of 20 and 44 (65.7%,  $n=268$ ) with a mean age of 36 ( $SD=10.3$ ). Almost half of the sample had two to three children under the age of 18 in the household (44.6%,  $n=182$ ) with an average of 2.1 children ( $SD=1.3$ ). Over ninety percent of the sample (91.2%,  $n=372$ ) had received food stamps and/or WIC, and fifty-five percent (55.2%,  $n=225$ ) of the sample reported food need. With respect to the primary variables of interest, almost forty percent of women (38.2%,  $n=156$ ) reported poor emotional health, and one-fourth (25.0%,  $n=102$ ) reported diaper need.

### **Hypothesis 1: Association between diaper need and maternal mental health status**

Bivariate analyses are presented in Table 2. Bivariate analyses revealed that maternal mental health status was significantly associated with food need ( $p=0.0004$ ) and diaper need ( $p=0.003$ ). Of those reporting poor mental health, 55.3% ( $n=47$ ) reported diaper need while of those reporting good mental health, 34.3% ( $n=37$ ) reported diaper need. In addition, demographic variables of interest including race, number of children under 18 in the household, maternal age, and primary language did not differ significantly according to maternal mental health status.

Food need and diaper need were found to be significantly associated ( $p=0.003$ ). Of those reporting diaper need, 69.3% ( $n=70$ ) also reported food need while of those reporting no diaper need, 49.6% ( $n=58$ ) also reported food need.

### **Hypothesis 2: Association between diaper need and maternal mental health status by neighborhood**

Proportions of women reporting poor mental health and diaper need by neighborhood appear in Figures 3 and 4, respectively. There was a great deal of variation in both variables across the City of New Haven. The Hill (60.0%), Beaver Hills (61.1%), and Newhallville (58.3%) neighborhoods had the greatest proportion of women reporting poor mental health. Similarly, the Hill (65.3%), Dixwell (58.8%), and West Rock (66.7%) neighborhoods had the greatest proportion of women reporting diaper need.

### **Hypothesis 3: Effect of neighborhood of residence on maternal mental health status and the association between diaper need and maternal mental health status**

Neighborhood level of violent, non-violent, and domestic crime is presented in Figure 5 along with the proportion of women reporting poor mental health. We observed diversity in crimes rates according to neighborhood across the City of New Haven. Visually, the Hill and Newhallville both appear to have high levels of violent, non-violent, and domestic crime as well as high proportions of women reporting poor mental health.

As presented in Table 2, the level of violent, non-violent, and domestic crime in a woman's neighborhood of residence was not found to be significantly associated with maternal mental health status. Of those who reported poor mental health, 9.5% ( $n=19$ ) lived in a neighborhood with a low level of violent, non-violent, and domestic crime, 30.9% ( $n=62$ ) lived in a neighborhood with a mid-low level, 22.4% ( $n=45$ ) lived in a neighborhood with a mid-high level, and 37.3% ( $n=75$ ) lived in a neighborhood with a high level. Results remained unchanged when neighborhood level of violent and domestic crimes only was used.

Unadjusted odds ratios describing the relationship between maternal mental health status and diaper need, food need, neighborhood level crime, and demographic variables appear in Table 3. In unadjusted analyses, food need (OR=2.18, 95% CI 0.96, 4.05) and diaper need (OR=2.37, 95% CI 1.32, 4.26) were significantly associated with maternal mental health such that women who reported food need or diaper need were more likely than those who did not report these needs to also report poor mental health. Results from the multivariable logistic regression also appear in Table 3. In the final multivariable logistic model, women who reported diaper need were significantly more likely than women who did not report diaper need to also report poor mental health (OR=2.43, 95% CI 1.15, 5.13). There was a trend toward significance such that women who reported food need were more likely than women who did not report food need to also report poor mental health (OR=1.97, 95% CI 0.96, 4.05). The interaction term representing the combined effects of food need and diaper need was not found to be significant ( $p=0.18$ ) and was removed from the final model. Neighborhood level of violent, non-violent, and domestic crime was not found to be statistically significant.

## DISCUSSION

The aim of the present study was to examine the association between diaper need and maternal mental health among a sample of low-income, racially and ethnically diverse pregnant and parenting women living in the City of New Haven. In addition, the impact of neighborhood of residence on maternal mental health and on the association between maternal mental health and diaper need was explored. We found that one-fourth of women in our sample reported diaper need and almost forty percent reported poor mental health. We observed a significant association between diaper need and maternal mental health status and substantial heterogeneity in diaper need and maternal mental health status by neighborhood across the city of New Haven. When adjusting for mothers' neighborhood of residence using the level of violent, non-violent, and domestic crimes in her neighborhood and controlling for a number of demographic factors, the relationship between diaper need and maternal mental health status remained significant.

In bivariate and multivariate analyses, a significant association between diaper need and maternal mental health status was demonstrated. Mothers who reported feeling as though they did not have enough diapers to change their children as often as needed were more likely to endorse poor mental health than those who felt they generally had an adequate supply of diapers. Diaper need represents a form of material hardship and a potential pathway by which poverty affects maternal mental health. An inadequate supply of diapers may increase parenting stress and create a reduced sense of parenting competency among low income women with negative implications for mothers' mental health. The link between diaper need and maternal mental health has important implications not only for overall maternal



wellbeing, but for child development and wellbeing as well. The impact of increased maternal stress and depression on child development, the mother-child relationship, and the risk of social, emotional, and behavioral problems in the child has been well established in the literature (Murray & Cooper, 1997; Campbell et al., 2007; Campbell et al., 2009; Feder et al., 2009). In addition, failure to provide adequate diaper changes has been linked to the development of urinary tract infections and diaper dermatitis in young children (Adalat et al., 2007; Sugimura et al., 2009). Providing low income mothers with a means by which they can obtain an adequate supply of diapers would thus be a way to protect child physical health, but also a tangible way of reducing stress and negative emotions related to being a parent thereby improving maternal mental health and child developmental outcomes.

In unadjusted analyses, both diaper need and food need were significantly associated with maternal mental health. However, in the final multivariable logistic model, we found diaper need to be more strongly associated with maternal mental health status than food need, and we did not observe a significant interaction between food need and diaper need. Specifically, in the adjusted analysis, women who reported diaper need were 143% more likely than women who did not report diaper need to endorse poor mental health. Diapers, unlike food, are currently not an allowable expense in federal antipoverty programs including TANF, Supplemental Nutrition Assistance Program (SNAP), and WIC. Food need may have a reduced impact on maternal mental health in comparison to diaper need because it is an allowable expense under such federal antipoverty programs. Mothers may feel less stress and insecurity around food need because of the knowledge that supports and safety-nets are in place to provide them with assistance around this basic need. These findings provide a clear direction for public policy interventions. Inclusion of diapers as an allowable expense in TANF, WIC, or even SNAP would provide low income mothers with the ability to access an adequate supply of diapers thereby reducing stress around meeting this basic need. As results from this study demonstrate, being able to provide children with clean diapers when needed would have the potential to significantly improve maternal mental health.

The importance of place and neighborhood context for women's mental health has been demonstrated in only a handful of studies (Cutrona et al., 2000; 2005; Kotchick et al., 2005). This study substantially contributes to the literature in this area by providing data on the intersection between place, material hardship, and women's mental health specific to mothers. A visual inspection of the maps presented in figures 3 and 4 depicts heterogeneity in diaper need and maternal mental health status across the City of New Haven. Given the demonstrated association between diaper need and maternal mental health and the existing evidence of the importance of place in terms of women's mental health, targeted, neighborhood-level interventions may be useful in this context. Neighborhoods in which women report high levels of diaper need and poor mental health present areas in which interventions should target both maternal mental health services and the provision of basic needs. Specific to the City of New Haven, the

Hill neighborhood presents one such area, and planning should first focus on providing mothers with an adequate supply of diapers as a way to both meet their basic needs and improve their emotional wellbeing.

In bivariate analyses, maternal mental health status was not found to be associated with the level of violent, non-violent, and domestic crime in a woman's neighborhood of residence. Similarly, neighborhood level of violent, non-violent, and domestic crime was not found to be significant in the final multivariable logistic model. These findings are contrary to previous studies in which a significant association between women's mental health and levels of neighborhood stress and disorder has been demonstrated (Cutrona et al., 2000; 2005; Ktochick et al., 2005). In such studies neighborhood level of stress and disorder included crime related factors such as homicides, physical fights, drug dealing, and gang violence, but also included several other factors such as unsanitary living conditions, noise, and overcrowding and was based on women's responses to interview questions about their neighborhood. Our neighborhood level variable was based on crime only and was objective in nature rather than being based on the perceptions or exposure of participants which could be potentially confounded by maternal mental health status. However, in a sub-sample of women included in the present study (n=153), their rating of the safety of their neighborhood was not found to be associated with their mental health status. In addition, different measures of mental health were used among the various studies. Such differences may alter the nature of associations observed with women's mental health.

### **Limitations and Future Directions**

Limitations of the present study include its cross-sectional nature which limits the ability to make casual assumptions about demonstrated associations. For example, does poor mental health status contribute to diaper need or does diaper need contribute to poor mental health status? The mental health status of participants was not assessed with a diagnostic instrument. However, the proportion of women endorsing mental health need is comparable to that found in other similar low-income populations of women (Manuel et al., 2012). In addition, the level of violent, non-violent, and domestic crime per neighborhood was the only variable used to control for a woman's neighborhood of residence. On one hand, this is a strength as data are collected independently and not biased by maternal psychological status or recall. On the other hand, other neighborhood-level variables may be important to consider, though the neighborhoods included in the present study were similar on a number of potentially relevant domains including racial/ethnic composition and income. Of mothers who provided addresses and thus were included in the final analyses, a higher percentage reported poor mental health than mothers who did not provide addresses. This was to be expected as the MOMS Partnership needs assessment prompted women to provide an address if they wished to be contacted about Partnership services and events. Those

who are struggling emotionally may be more likely to be interested in receiving information regarding services geared toward improving mental health and reducing stress. Lastly, the measure of diaper need used in the present study has not been validated. However, the measure was developed with expert input and several (n=46) pilot tests of its face validity and acceptability with the target population of low-income mothers.

Future research regarding maternal mental health should continue to consider material hardship as a pathway by which poverty affects the mental health of mothers. The method developed to assess diaper need for the present study can be easily employed in other investigations of maternal mental health, and the findings of the present study demonstrate diaper need as a construct worth further examination. The association between maternal mental health and diaper need demonstrated in the present study needs to be replicated in additional studies that take into consideration important demographic and neighborhood level factors that may confound or moderate this association. Neighborhood level factors may include objective measures of the neighborhood context as well as more subjective measures based on participants' self-reported perceptions. Future studies would benefit from the use of a diagnostic or clinical instrument to assess women's mental health status and a longitudinal design to determine the nature of the relationship between diaper need and maternal mental health.

## **Conclusion**

Results from the present study establish diaper need as a form of material hardship among low-income women and as potential risk factor for poor maternal mental health. Importantly, diapers represent a malleable risk factor for poor maternal mental health that is amenable to public health and public policy interventions. Inclusion of diapers in federal antipoverty programs and interventions designed to address maternal mental health may be ways by which the negative emotional consequences of diaper need for mothers can be mitigated.

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## Tables

<b>Table 1: Sample characteristics (n=408)</b>	
<b>Variable</b>	<b>N (%)</b>
<b>Race (self-report)</b>	
African-American	243 (59.6)
Hispanic	122 (29.9)
White	34 (8.3)
<b>Number of children under 18 in household</b>	
1	151 (37.0)
2-3	182 (44.6)
≥4	35 (8.6)
<b>Age (years)</b>	
20-44	268 (65.2)
≥45	89 (21.8)
<b>Primary language</b>	
English	452 (83.8)
Spanish	35 (15.4)
<b>Food need</b>	
Yes	225 (55.2)
No	170 (41.7)
<b>Diaper need</b>	
Yes	102 (25.0)
No	118 (28.9)
<b>Mental health status</b>	
Poor	156 (38.2)
Good	203 (49.8)
<b>Neighborhood level of violent, non-violent, and domestic crime</b>	
Low	31 (7.6)
Mid-low	127 (31.1)
Mid-high	85 (20.8)
High	158 (38.7)

Note: Percentages may not sum to 100% due to rounding and missing values.

<b>Table 2: Association between maternal mental health status and diaper need, neighborhood, and demographic variables (n=408)</b>					
<b>Variable</b>	<b>Poor mental health (N, %)</b>	<b>Good mental health (N, %)</b>	<b>X<sup>2</sup></b>	<b>df</b>	<b>p*</b>
<b>Race</b>			3.52	2	0.17
African-American	92 (59.3)	133 (66.8)			
Hispanic	45 (29.0)	53 (26.6)			
White	18 (11.6)	13 (6.5)			
<b>Number of children under 18 in household</b>			0.13	2	0.93
1	57 (41.0)	80 (42.8)			
2-3	69 (49.6)	89 (47.6)			
≥4	13 (9.4)	18 (9.6)			
<b>Age</b>			0.73	1	0.39
20-44	97 (71.9)	137 (76.1)			
≥45	38 (28.2)	43 (23.9)			
<b>Primary language</b>			0.41	1	0.52
English	129 (83.8)	175 (86.2)			
Spanish	25 (16.2)	28 (13.8)			
<b>Food Need</b>			12.46	1	0.0004
Yes	104 (67.5)	96 (48.7)			
No	50 (32.5)	101 (51.3)			
<b>Diaper Need</b>			8.56	1	0.003
Yes	47 (55.3)	37 (34.3)			
No	38 (44.7)	71 (65.7)			
<b>Neighborhood level of violent, non-violent, and domestic crime</b>			2.16	3	0.54
Low	10 (6.6)	19 (9.5)			
Mid-low	54 (35.8)	62 (30.9)			
Mid-high	28 (18.5)	45 (22.4)			
High	59 (39.1)	75 (37.3)			

Note: Percentages may not sum to 100% due to rounding and missing values.

\* P-value for  $\chi^2$  test



**Table 3: Unadjusted and adjusted odds ratios between maternal mental health status and diaper need, neighborhood, and demographic variables (n=146)**

Variable	Unadjusted OR (95% CI*)	X <sup>2</sup>	df	p	Adjusted OR (95% CI*)	X <sup>2</sup>	df	p
<b>Race</b>		3.49	2	0.17		3.32	2	0.19
African American (reference)	1.00	---	---	---	1.00	---	---	---
Hispanic	1.23 (0.76, 1.98)	0.71	1	0.40	1.64 (0.76, 3.56)	1.56	1	0.21
White	2.00 (0.94, 4.29)	3.19	1	0.07	0.34 (0.06, 1.85)	1.57	1	0.21
<b>Number of children under 18 in household</b>		0.13	2	0.94		0.67	2	0.71
1 (reference)	1.00	---	---	---	1.00	---	---	---
2-3	1.09 (0.69, 1.73)	0.13	1	0.72	0.77 (0.35, 1.70)	1.51	1	0.51
≥4	1.01 (0.46, 2.23)	0.001	1	0.97	0.51 (0.15, 1.68)	1.24	1	0.27
<b>Age</b>								
20-44 (reference)	1.00	---	---	---	1.00	---	---	---
≥45	1.25 (0.75, 2.07)	0.73	1	0.97	1.52 (0.59, 3.89)	0.75	1	0.39
<b>Food Need</b>								
Yes	2.19 (1.41, 3.39)	12.28	1	0.0005	1.97 (0.96, 4.05)	3.37	1	0.07
No (reference)	1.00	---	---	---	1.00	---	---	---
<b>Diaper Need</b>								
Yes	2.37 (1.32, 4.26)	8.42	1	0.004	2.43 (1.15, 5.13)	5.46	1	0.02
No (reference)	1.00	---	---	---	1.00	---	---	---
<b>Neighborhood level of violent, non-violent, and domestic crime</b>								
	1.03 (0.83, 1.26)	0.05	1	0.82	0.98 (0.67, 1.42)	0.01	1	0.90

\*Likelihood ratio 95% CI

**Figures**

Figure 1. Neighborhood level of violent, non-violent, and domestic crime

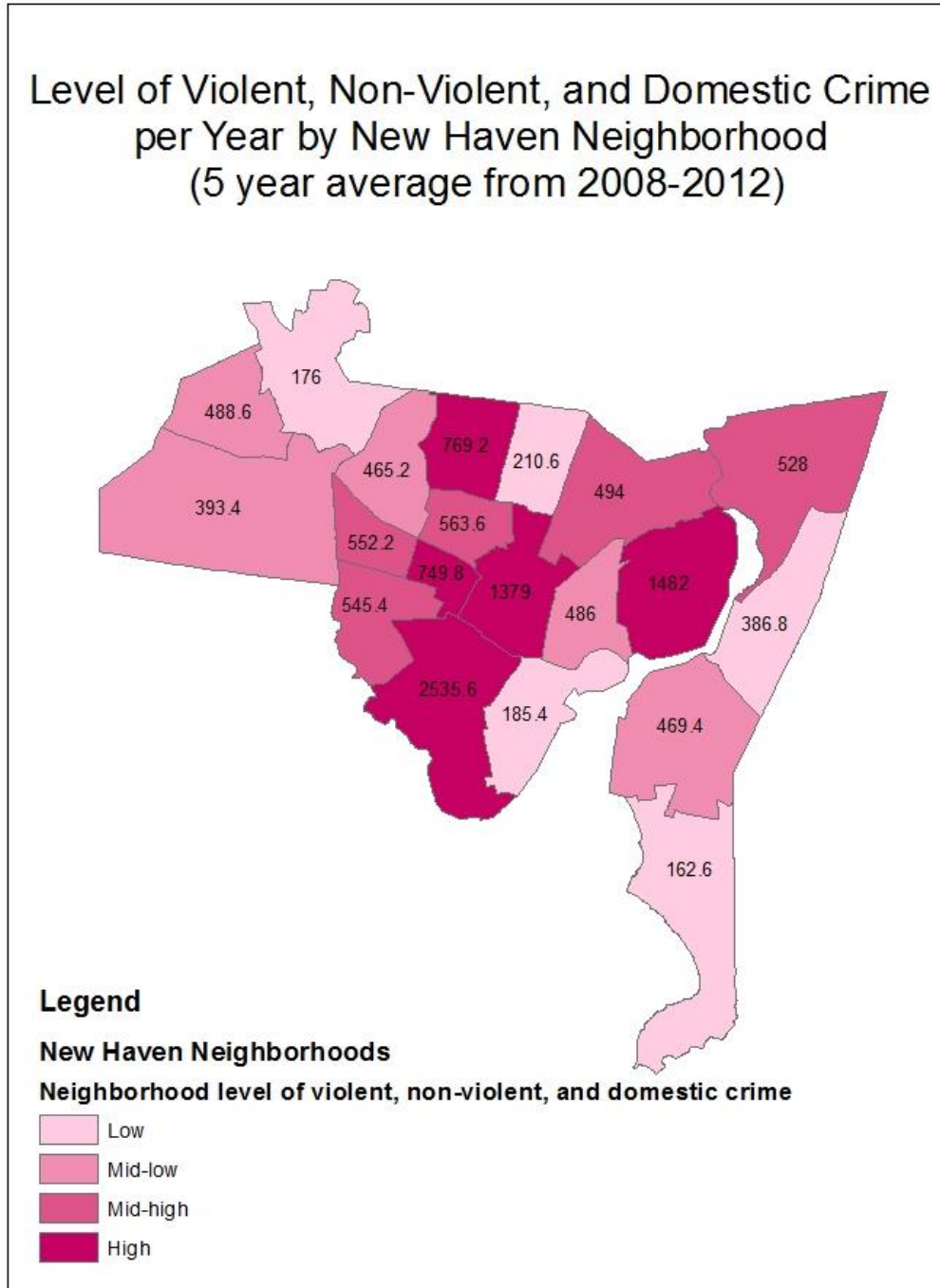


Figure 2. Sample recruitment and enrollment

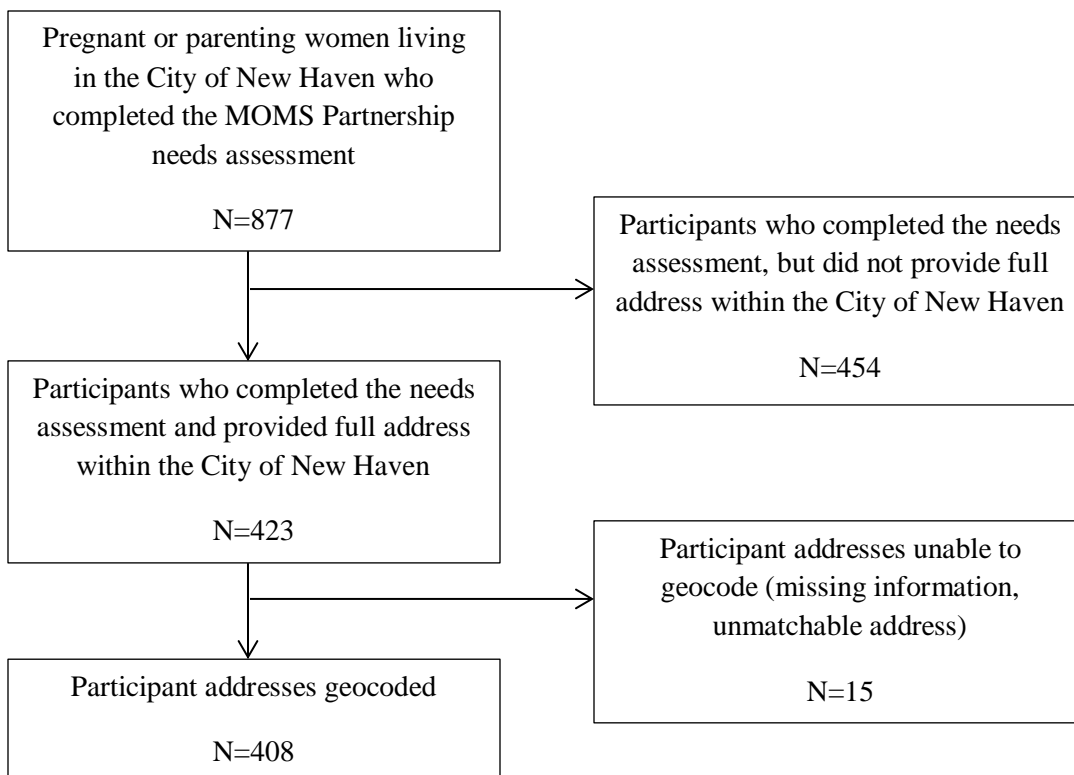


Figure 3. Maternal mental health status by neighborhood

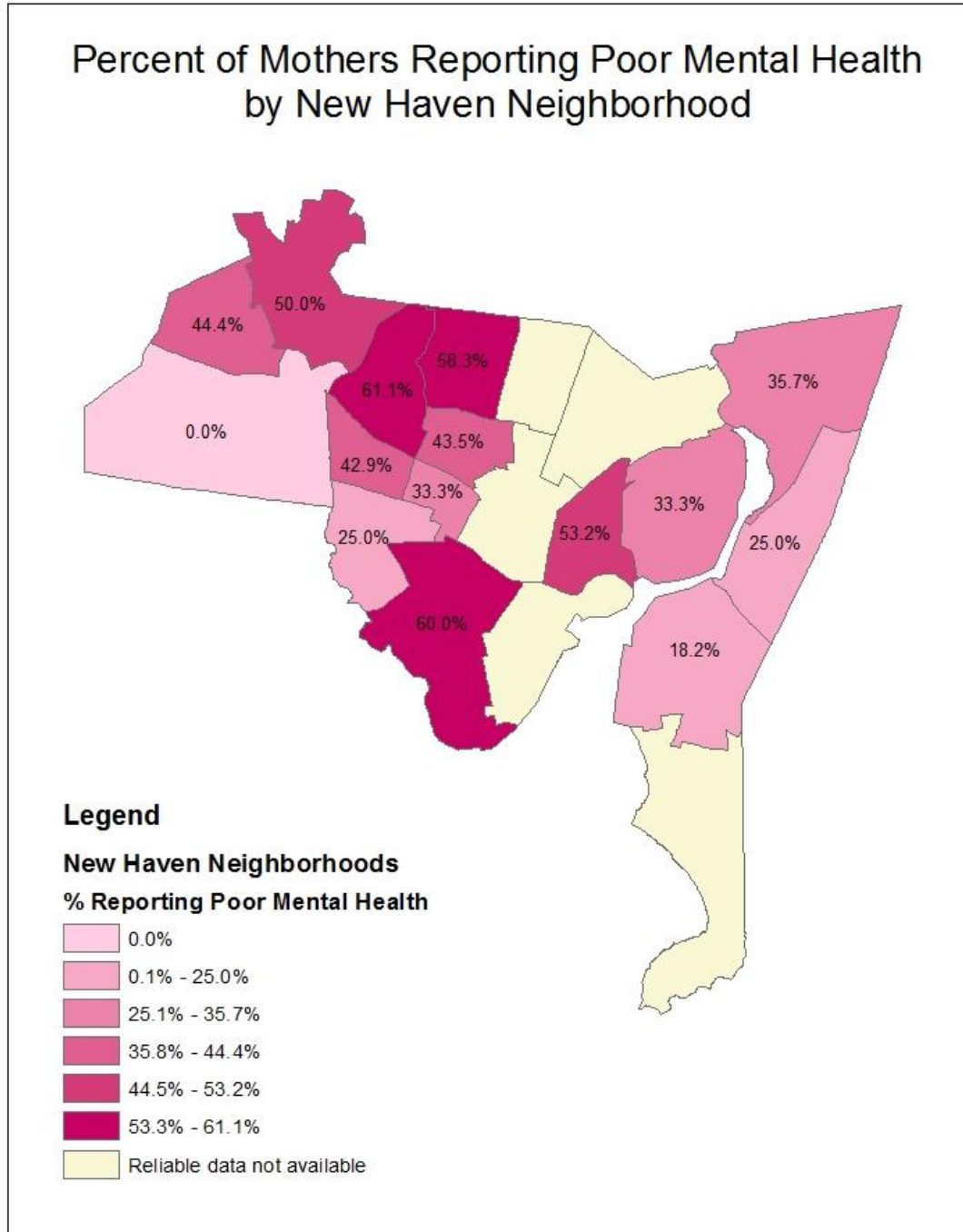


Figure 4. Diaper need by neighborhood

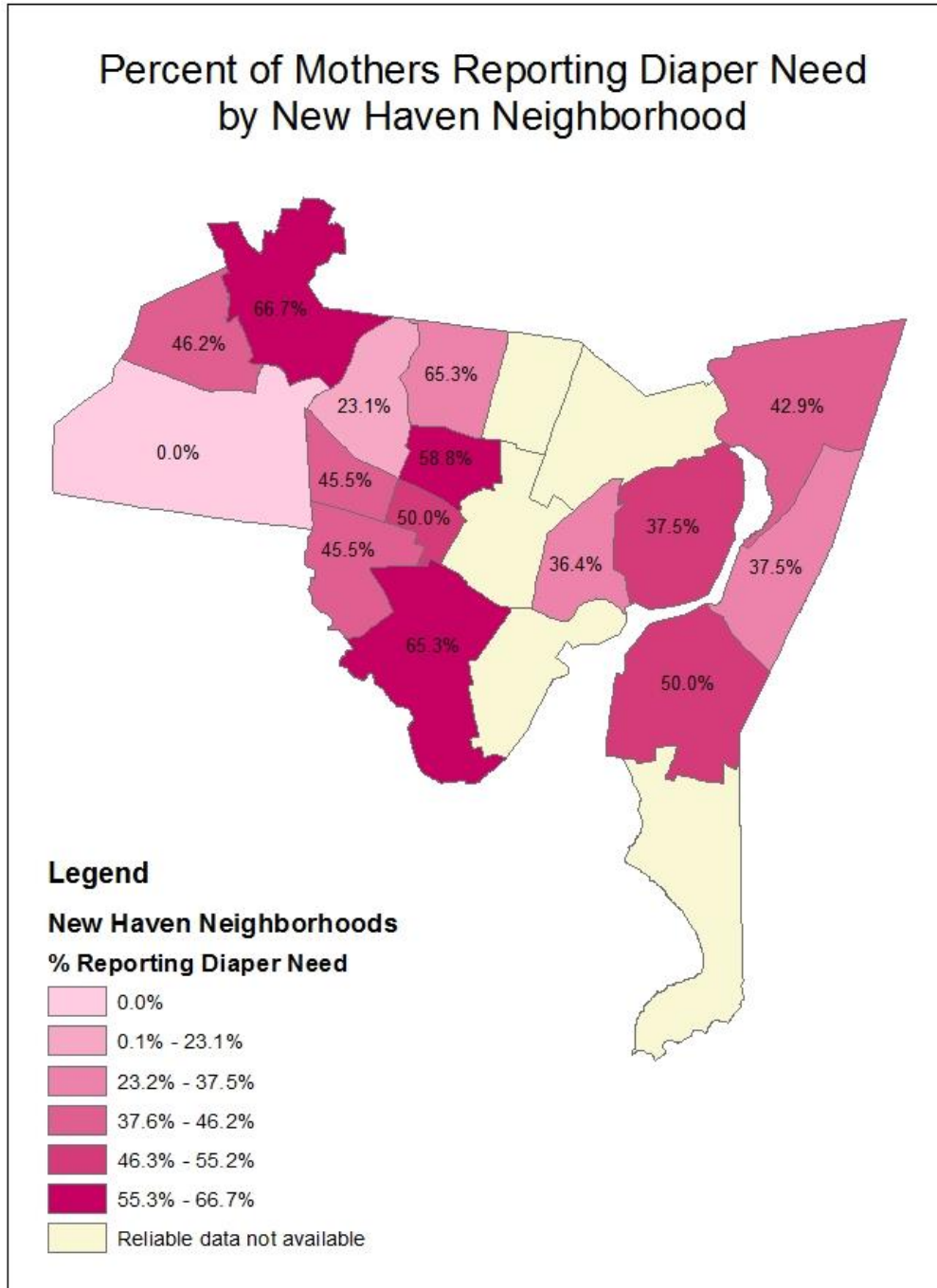


Figure 5. Neighborhood level of violent, non-violent and domestic crime and maternal mental health status

