EARLY CHILDHOOD HOSPITALIZATION AND PROBLEMATIC BEHAVIORS: A PROPENSITY SCORE ANALYSIS

by

Toria B. Flynn, B.A.

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Committee Members:

Priscilla Goble, Chair

Nicholas Bishop

Amy Weimer

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I. INTRODUCTION

Approximately 1.8 million children under the age of 18 are hospitalized each year for chronic and acute conditions unrelated to birth or pregnancy (Witt et al., 2014). Children from families that have experienced poverty are especially at risk for hospitalization and these children are also at risk for developing behavioral problems in early childhood (Brooks-Gunn et al., 1998; Duncan et al., 1994; Huaqing Qi et al., 2003; Stormont, 2002). In addition, hospitalization in childhood has been shown to increase problem behaviors, including internalizing (e.g., anxiety, withdrawal) and externalizing (e.g., hyperactivity, impulsivity) behaviors (Haslum, 1988; Mabe et al., 1991; Rennick et al., 2004; Small, 2002). Although research indicates that hospitalization can negatively impact children's behavior, most studies examining the effects of hospitalization on children's development are limited in three important ways.

First, research on hospitalization typically focuses on pediatric intensive care units (PICUs), neonatal intensive care units (NICUs), or emergency department (ED) visits. Researchers have not typically covered general non-ICU, inpatient hospitalization (Rees et al., 2004; Small, 2002). The limited existing research focused primarily on ICUs and EDs makes it difficult to uncover if the effects of hospitalization on children's development are related to the specific type of intensive care experienced or their experience of ever being hospitalized. Therefore, more research is needed on hospitalization to understand how general inpatient status impacts children's development

Second, research on hospitalization has traditionally focused on the pediatric population spanning from birth to 18 years. We know, however, that children's social

emotional skills begin to develop in the first years of life and that behaviors children have developed prior to entering elementary school are critical to later development and lifelong success (McEvoy & Welker, 2000; Sasser et al., 2016, Spira & Fischel, 2005). Furthermore, younger children, compared to older children, have been shown to have more behavioral problems during and after hospitalization (Haslum, 1988; Mabe et al., 1991; Rennick et al., 2004; Small, 2002). Thus, research is needed that focuses on hospitalization and behavior problems specifically during the early childhood period.

Finally, for practical and ethical reasons, previous research examining the link between hospitalization and behavior problems has focused on nonexperimental, observational, or correlational designs (Rennick & Rashotte, 2009; Vanek, 1979). These research designs do not allow casual conclusions to be drawn between exposure (e.g., hospitalization) and outcome variables (e.g., behavioral outcomes; McCartney et al., 2006). Very few studies have compared children who have been hospitalized to children who have not (Rees et al., 2004; Small, 2002), particularly on internalizing and externalizing behaviors. Thus, it is unclear if the problematic behaviors observed after hospitalization are atypical when compared to how these behaviors would naturally develop in childhood. A novel way to explore the development of problematic behaviors due to hospitalization is through the quasi-experimental approach of propensity score matching, allowing hospitalized children to be matched to a control sample of children who have not been hospitalized.

The present study aimed to address the limitations in the existing research on childhood hospitalization. Utilizing propensity score matching, the present study investigated children's behavior problems at 54 months in a sample of children who were

hospitalized in early childhood (between 15 and 54 months) and a matched control sample of children who were not hospitalized in early childhood. Furthermore, the examination of potential moderators associated with hospitalization and behavior problems were explored.

Hospitalization in Childhood

Children can be hospitalized for both chronic or acute conditions. Chronic conditions include, but are not limited to, congenital heart disease, spina bifida, cystic fibrosis, and cancer; however, these conditions are of low prevalence (Newacheck & Taylor, 1992; Torpy et al., 2012). Among less life-threatening chronic illnesses that lead to hospitalization, the most commonly reported reasons are allergies, ear infections, asthma, and diabetes (Leyenaar et al., 2016; Newacheck & Taylor, 1992). Acute conditions requiring hospitalization could include such circumstances as injuries from motor vehicle accidents, broken bone, fever, influenza, bronchitis, and pneumonia. In 2012, bronchitis and pneumonia were the most common reasons why children were hospitalized for acute conditions (Leyenaar et al., 2016).

There are numerous factors associated with children being hospitalized, including genetics and unfortunate circumstances, but perhaps the most stable predictor of hospitalization in childhood is family income status (Duncan & Brooks-Gunn, 1997). According to the fundamental cause of disease theory, socioeconomic status, which includes income status, is the most predictive factor associated to health outcomes and hospitalization (Link & Phelan, 1995). The fundamental cause of disease theory highlights that individuals with low income status are not able to access recourses which impacts health through multiple mechanisms and continues to maintain those health

disparities even with interventions (Link & Phelan, 1995). In particular, children from impoverished families are more likely than their affluent peers to be hospitalized due to risk factors including poor health (Aber et al., 1997; Duncan & Brooks-Gunn, 1997; Halfon & Newacheck, 1993), low child birthweight (McGauhey et al., 1991), and poor preventative health practices (e.g., attending primary care visits, utilizing acute care clinics and emergency departments; Brooks-Gunn et al., 1998; Diez Roux & Mair, 2010; Kersten et al., 2018; Larson & Halfon, 2010).

In general, children that experience poverty are in poorer health than more affluent children (Aber et al., 1997; Duncan & Brooks-Gunn, 1997; Halfon & Newacheck, 1993) and are particularly at risk for asthma, obesity, acute illness, and injury (Chen et al., 2006a; Chen et al., 2006b; Chen et al., 2002). Relatedly, children born to impoverished families are at increased risk for being born with low birthweight (Gould & LeRoy, 1988) and those born with low birthweight are more likely to have poorer health in early childhood compared to children born of a normal weight (McGauhey et al., 1991). Exacerbating these issues, families living in poverty are more likely to utilize acute care clinics and emergency departments and are less likely to attend primary care visits compared to families not living in poverty (Brooks-Gunn et al., 1998; Diez Roux & Mair, 2010; Larson & Halfon, 2010; Kersten et al., 2018). Indeed, these factors result in greater levels of hospitalization for children from poor families (Brooks-Gunn et al., 1998). Given the prevalence of hospitalization during childhood, especially for children who experience poverty, understanding the effects of hospitalization for children's development is of critical importance.

Hospitalization and Children's Development

When hospitalized, patients are faced with the expectation of learning new terminology and understanding complex ideas and procedures. Due to this learning curve, hospitalization could be a difficult experience for anyone, especially children. Furthermore, children are accustomed to routines in their home or child-care environments, but hospitalization disrupts established norms (Bossert, 1994; Codding, 1972; Coyne, 2006; Peterson & Johnson-Ridley, 1980). Hospitalization has been shown to increase stress and fear for children (Nagera, 1978) due to being out of a familiar environment (Lazarus & Folkman, 1984), reduce socialization with family and friends (Bowlby, 1951), reduce locus of control (Lerwick, 2016), and intensify the experience of the illness itself (Coyne, 2007).

Young children might not have the cognitive and social emotional skills necessary to comprehend and cope with stressors associated with hospitalization. Prior research has shown that the experience of being hospitalized can affect children's development across various domains, but particularly social and emotional development. For example, research on children ages 5 to 10 years old show that children exhibit more behavior problems after hospitalization than their peers who have not been hospitalized (Haslum, 1988).

Behavior Problems

In the general population of preschoolers, 10-15% typically displayed mild to moderate behavioral problems (Campbell, 1995). Behavior problems in early childhood can be separated into two main categories: internalizing and externalizing behaviors (Achenbach, 1991). Internalizing behaviors include internal states such as anxiety,

depression, social isolation, and withdrawal (Stacks & Goff, 2004; Madigan et al., 2013). Children who display internalizing behaviors could exhibit characteristics such as loneliness, abnormal dependence on adults, experience headaches, or bite fingernails (Achenbach, 1991). Externalizing behaviors include aggression, impulsivity, hyperactivity, and inattention (Achenbach, 1991; Stacks & Goff, 2004). Children who display externalizing behaviors are likely to exhibit characteristics of arguing, fighting, having trouble sitting still, or impulsivity (Achenbach, 1991).

Although children in early childhood are likely to display internalizing and externalizing behaviors as a result of their developmental age, there are risk factors that increase the likelihood of exhibiting these problematic behaviors. Associated risk factors for problematic behaviors are broken down by environmental, parental, and child level factors (Carneiro et al., 2016). An environmental risk factor that is consistently related to children's problematic behaviors is their family's income. Specifically, children and adolescents living in poverty are more likely to exhibit internalizing (DeCarlo Santiago et al., 2011) and externalizing behaviors (Russell et al., 2016) compared to more affluent children. Within the fundamental cause of disease theory, family income impacts and maintains children's problem behaviors through multiple mechanisms (Link & Phelan, 1995). Illustratively, previous research indicates that the experience of poverty including high parental stress (Church et al., 2012), food insecurity (Slopen et al., 2010), low quality of physical home environment (Eamon, 2000), and other issues lead to problematic behaviors in childhood (Brooks-Gunn & Duncan, 1997; Chaudry & Wimer, 2016). Parental factors, such as low maternal education (Russell et al., 2016), maternal substance abuse (LaGasse et al., 2009; Twomey et al., 2013), maternal mental health

(Heberle et al., 2015), and less sensitive parenting (Ciciolla et al., 2014) are also predictive of children's internalizing and externalizing behaviors.

Among child level risk factors related to problem behaviors, two of the most commonly cited are gender (LaGasse et al., 2009) and temperament (Utendale & Hastings, 2011). In the United States and other countries, boys are less likely to exhibit internalizing behaviors than girls and boys tend to manifest externalizing behaviors at higher rates compared to girls (Achenbach et al., 1991; Ormel et al., 2005). Difficult child temperament, characterized by slow adaptability, negative mood, and withdrawal in new situations, are associated with both internalizing (Crawford et al., 2011) and externalizing behaviors (Miner & Clarke-Stewart, 2008).

Due to the stress and potential fear induced by hospitalization, children who are hospitalized in early childhood might also be more likely to show internalizing and externalizing behaviors than children who are not hospitalized. Previous research has primarily focused on the degree to which children exhibited internalizing or externalizing behaviors prior to hospitalization and after hospitalization. For example, research has shown that children between 2 to 7 years old who exhibited high levels of internalizing and externalizing behaviors prior to hospitalization experience a greater increase in these problem behaviors after discharge compared to children with lower levels of internalizing and externalizing behaviors prior to hospitalization (Small & Melnyk, 2006).

Research on hospitalized children also suggested gender differences in the effect of hospitalization on problem behaviors (Angold & Rutter, 1992). For example, Tiedeman and Clatworthy (1990) studied hospitalized children between the ages of 5 to 11 years old and found that boys are more likely to exhibit problem behaviors, including

both internalizing and externalizing, than girls. Even as early as age 5 to 11, boys have been shown to exhibit more anxiety than girls at admission, discharge, and after hospitalization (Tiedeman & Clatworthy, 1990). Furthermore, after hospitalization, girls were more likely to return to their pre-hospitalization levels of anxiety, whereas boys demonstrated no change in anxiety over time (Tiedeman & Clatworthy, 1990). These findings highlighted the need to examine gender when considering the effects of hospitalization on the development of behavior problems in early childhood because they emphasize that compared to girls, boys are more likely to display and maintain both internalizing and externalizing behaviors after hospitalization.

II. THE PRESENT STUDY

Previous research has shown that young children are particularly susceptible to problematic behaviors after hospitalization (Levy et al., 2008; Rennick & Rashotte, 2009; Vanek, 1979). There is limited research examining the development of behavior problems of children after hospitalization compared to children who had not been hospitalized during early childhood. It is possible that the increases in negative behaviors in children who had been hospitalized in early childhood are not outside the normal range of development.

Furthermore, family poverty status and child gender likely influence the relation between hospitalization and behavior problems. Accordingly, there are two aims of the present study:1 to investigate the relation between ever being hospitalized in early childhood and the development of internalizing and externalizing behaviors prior to kindergarten, and 2) to examine if family poverty status and/or gender moderate this association.

Unlike previous studies that examine hospitalization and problem behaviors using correlational designs (Rennick & Rashotte, 2009; Vanek, 1979), the current study uses the quasi-experimental approach of propensity score matching. Propensity score matching attempts to replicate causal effects established by experimental randomization by matching hospitalized and non-hospitalized children on background characteristics (Rosenbaum & Rubin, 1983). Given hospitalization cannot ethically be randomized, this analytic approach compares differences in children's internalizing and externalizing behaviors in those who have been hospitalized to a matched control sample who have not been hospitalized. Through this analytic approach, propensity score matching attempts to

remove potential confounding variables related to exposure (i.e., hospitalization) and/or outcome variables (i.e., internalizing and externalizing behaviors).

For this study, hospitalization was isolated to examine the impacts on internalizing and externalizing behaviors. Ideally, when comparing hospitalized children to non- hospitalized children, the only difference would be hospitalization. Therefore, matching children on similar background characteristics that are related to hospitalization helps to achieve equivalence between these two groups. Both propensity score matching and the more commonly used analytic technique, multiple regression, adjust for covariates (Green & Stuart, 2014). However, propensity score matching can better estimate causal effects compared to regression models' adjustment for covariates (Dehejia & Wahba, 1999; Ho et al., 2007; Stuart, 2010). Propensity score matching relies less on model misspecification and tries to balances covariates to reduce the need to extrapolate variables compared to regression (Dehejia & Wahba, 1999; Ho et al., 2007; Stuart, 2010).

Based on previous literature the following hypotheses were explored: 1) hospitalized children will exhibit higher levels of internalizing and externalizing behaviors than children who have not been hospitalized; 2) the association between hospitalization and internalizing and externalizing behaviors will be stronger for children who were poor at some time during early childhood than for children who did not experience poverty; and 3) the relation between hospitalization and internalizing and externalizing behaviors will be stronger for boys than girls.

III. METHODOLOGY

Participants

Child and parent participants from the current study were drawn from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD SECCYD). Families from NICHD SECCYD were recruited from hospitals in or near 10 sites: Little Rock, AR; Irvine, CA; Lawrence, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA, Charlottesville, VA; Morganton, NC; Seattle, WA, and Madison, WI. In 1991, researchers visited 8,986 mothers delivering in hospitals in the previously listed locations. Initially there were 5,416 eligible mothers recruited and NICHD randomly selected 1,364 mothers and their families when the infants were 1 month old.

Of the 1,364 children, only 1,061 children were considered for inclusion for this study based on complete outcome data. In the sample of 1,061 children, 50.1% were male. Children in the sample were primarily White (82.5%), followed by African American (11.5%), Asian or Pacific Islander (1.4%), and American Indian (.4%), or Other (4.2%). Mothers in the sample were primarily White (84.4%), followed by African American (11.3%), Asian or Pacific Islander (2.3%), American Indian (.6%), and Other (1.5%). Fathers in the sample were primarily White (83.9%), followed by African American (12.4%), Asian or Pacific Islander (1.7%), American Indian (0.4%), and Other (1.7%). The majority of the children were non-Hispanic (94.3%) as were the majority of the children's mothers (96.1%) and fathers (96.6%). Family poverty status was measured through income-to-needs ratio at 1- month to match hospitalized children to non-hospitalized children. The ratio was computed from dividing family income by the

poverty threshold for each household (U.S. Department of Labor, 1994). The income-to-needs ratio at 1-month ranged from 0.09 to 25.08 with an average of 2.94. At one month, 19.0% of the children in the study lived below the poverty level (incomes-to-needs <1). However, when poverty status was explored as a moderator, income-to-needs was created into a binary variable of "poor/not poor". Using the same formula, it was determined that 30.2% of the children had lived in poverty at some point during early childhood (prior to 54 months). Maternal education ranged from 7 to 21 years, with an average of 14.40 years. Paternal education ranged from 6 to 21 years, with an average of 14.64 years. See Table 1 for a breakdown of characteristics of the total sample.

Procedures

Data used in this study were collected through at-home interviews, questionnaires, observations, and telephone contact at various time points in early childhood. Telephone contact that included family updates were conducted at 18, 21, 27, 30, 33, 42, 46, and 50-months. Home interviews were conducted at 1, 15, 24, 36, and 54-months. Observations and questionnaires were filled out in the home or lab at 6 and 54-months. See Table 2 for a breakdown of each variable's collection time point and collection method. Further information regarding data collection procedures are included in the Manuals of Operation of the NICHD SECCYD (NICHD Early Child Care Research Network, 1993).

Measures

Hospitalization

The current study focuses on children's hospitalization that occurred within the span of 15 months to 54 months of age. Although data were collected at previous stages, children start exhibiting social and emotional developmental around the age of one,

therefore, this served as the reference point to include data starting approximately at one year old. Thus, utilizing data provided at 15-months was the closest time point to when social and emotional behaviors occur. Questions asked during the interviews and telephone calls were similar, including questions updating the interviewer on the child's health, hospitalization, check-ups, and reasons for illness or injury. The questions over hospitalization included "Has (child) seen a doctor or other medical professional or visited a clinic or emergency room since (X month call)?". The mother was then asked, "Was child hospitalized?" for "follow-up or earlier problem or chronic condition?", "Illness or suspected illness?", "Injury?", and "Other". To determine hospitalization, first a binary variable was created at each time point to represent if a mother reported a child to be hospitalized overnight at 15, 18, 21, 24, 27, 30,
33, 36, 42, 46, 50, or 54 months for prior conditions, illness, injury, or other. Next a binary variable "Ever Hospitalized" was created in which a child received a 1 if the child was hospitalized at any time from 15-54 months.

Internalizing and Externalizing Behaviors

Internalizing and externalizing behaviors were reported by the child's mother using the Child Behavior Checklist (CBCL; Achenbach, 1991) at 54 months. The CBCL was used to measure social skills and negative behaviors of children from the ages of 4-18. The CBCL was widely recognized as a highly reliable and valid measure of children's behaviors on broad band syndrome scales and narrow band syndrome scales (Achenbach, 1991; 1992). The scales contained broad behaviors of internalizing and externalizing as well as narrower scales that describe behaviors more in depth (e.g. anxiety, impulsivity). The CBCL contained approximately 100 questions rated on a 3-

point-scale ranging from 0 (not true for the child) to 2 (very true for the child; Achenbach, 1991; 1992). The CBCL was standardized based on age and gender. Furthermore, there were thresholds that indicate if a child falls into a normal range, borderline range, or clinical range for behavior problems. Raw scores from the CBCL are converted to standardized *T* scores, with higher scores indicating more behavioral problems. *T* scores falling below 60 were considered to be of normal range, 60 to 63 indicated borderline scores, and scores greater than 63 were in the clinical range of a diagnosis related to internalizing or externalizing behaviors.

Moderator Variables

Child gender (male, female) was collected during the 1-month home visit. Family poverty status was also collected during home visits throughout early childhood. A binary "poor/not poor" variable was created at each time point (1, 6, 15, 24, 36, and 54 months) by calculating poverty thresholds based on household size and income-to-needs ratio. Next, a binary "ever poor" variable was created to assess if children were ever below the poverty line during early childhood.

Selecting Covariates for Propensity Score Analysis

Propensity score matching used observed background characteristics to match hospitalized children (i.e., exposure group) to children that have not been hospitalized (i.e., control group). The goal was to isolate the effects of hospitalization on behavior outcomes while reducing the potential confounding effects of observed variables or differences related to hospitalization. Thus, the quality of the hospitalized and non-hospitalized matches depended on the questions included in interviews, questionnaires, observations, and telephone contact. Propensity score matching was designed to isolate

outcome effects without using random assignment (Rosenbaum & Rubin, 1983). To equate hospitalized children with non-hospitalized children on observed background characteristics, 40 variables were considered in the propensity score model. Research advised matching based on exposure (i.e., hospitalization) by using covariates collected prior to exposure to reduce potential bias (Rubin, 2007; Rubin & Thomas, 1996). Thus, environmental, family, and child level demographic factors collected during home visits when the child was 1-month and 6 months of age were utilized. Based on research examining hospitalization, the following characteristics were considered: Family income-to-needs at 1-month, maternal age, ethnicity, and education, paternal ethnicity and education, child's ethnicity, birthweight, gestational age, if they attended their routine check-ups, and prior health conditions like intestinal problems and respiratory problems. In addition to the demographic characteristics related to hospitalization, the following characteristics thought to be related to children's internalizing and externalizing behaviors were also included: child gender, child temperament, mother's marital status and her social support, maternal sensitivity, maternal mental health, maternal substance abuse during gestation, and environmental smoke exposure during gestation.

At the 1-month interview, mothers reported on family poverty status, her age, her ethnicity, if she was Hispanic, her marital status, her education level, father's education level, his ethnicity, if he was Hispanic, child's ethnicity, and if the baby was Hispanic. Family poverty status was reported through income-to-needs at 1 month and was assessed and calculated from poverty thresholds based on household size. Maternal age was asked in number of years. Maternal, paternal, and child's ethnicity was chosen from American Indian, Asian or Pacific Islander, African American, White, or Other. Mother, father, and

child were determined to be Hispanic through a binary, yes or no, question. Ethnicity was then coded as a binary variable of White and non-White for mother, father, and child. Mothers who reported White and said yes to Hispanic were categorized as non-White for maternal, paternal, and child ethnicity. Marital status was determined by her identification as one of the following (a) married and living together; (b) partnered and living together; (c) separated and not living together; (d) divorced and not living together; (e) widowed; (f) never married, have a continuing romantic relationship and not living together; (g) never married, not involved romantically, and not living together; or (h) other. Marital status was then used to create a binary variable of "living together/not living together". Mothers reported on their education by choosing from six options of years of education. The choices for maternal and paternal education included (a) less than 12 years of education; (b) high school graduate or GED; (c) some college, but no degree, associate's degree, or vocational school beyond high school; (d) bachelor's degree from college or university; (e) some graduate work or a master's degree, law degree; or (f) more than one master's degree or a doctoral degree. Maternal and paternal education were then separately dummy coded with high school graduate or GED being used as the reference group.

During recruitment, mothers reported on the child's birth weight and gestational age. Birthweight was reported in pounds and ounces then converted to grams. Gestational age was calculated in weeks. Mothers also reported at the 1-month interview variables related to the baby including type of delivery, length of stay in the hospital, complications after delivery, health of baby, respiratory problems, intestinal problems, and attended check-up. Type of delivery included three choices of vaginal delivery, planned c-section,

or emergency c- section. A binary variable for type of delivery was then created for "vaginal/not vaginal" birth. Two variables were combined to measure length of stay for the child. Mothers reported on how many days they stayed in the hospital and if their child stayed the same number of days. If the number of days in the hospital for the baby differed from the mother, mothers were then asked how many days the baby stayed in the hospital. These two variables were combined to create a composite of length of stay. Complications after delivery was a binary variable of yes or no. Health of the baby was rated as poor, fair, good, or excellent, then health of the baby was coded as a binary variable rated as "poor/fair" and "good/excellent". Respiratory problems like runny nose, cough, or cold and intestinal problems like vomiting, diarrhea, and not eating were recorded as yes or no. Preventative care for a child such a check-up was reported by mothers through a yes or no question.

Child temperament was collected when the child was 6 months old, in the home, through the Revised Infant Temperament Questionnaire (*My Baby- Home Version*) (Carey & McDevitt, 1978) with reliability and validity previously demonstrated (Hubert et al., 1982; Slabach et al., 1991). Maternal sensitivity was assessed through an instrument called the Mother-Child Interaction Semi-Structured Procedure based on previous findings on qualities of parenting and development of secure attachments for children (Ainsworth et al., 1978; Egeland & Farber, 1984). Maternal sensitivity was rated by objective observers using 15- minute videos of mother's interacting with their children during free play, collected at the 6- month home visit, but no previous studies evaluate psychometric properties. Maternal social support was collected at 1 month in the home through the Relationships with Other People instrument (Marshall & Barnett, 1993).

There was a high reliability (α = .91) and maternal sensitivity was significantly correlated with depression (r = -.38, p < .001), anxiety (r = -.23, p < .001), and physical health as measured by physical symptoms (r = -.20, p < .001). Although the distribution of maternal social support is skewed, previous research has not transformed the data (Bono et al., 2016). Maternal mental health was collected using the Center of Epidemiological Studies Depression Scale (CES-D) (*My Feelings*) during the 6- month home visit (Orme et al., 1986; Radloff, 1977; Roberts, 1980; Roberts & Vernon, 1983) and was transformed due to skewness. In regard to reliability, internal consistency was high (α =.85) in the general population and (α =.90) in the clinical sample and there were high correlations between the CES-D and other measures of depressive symptoms have been demonstrated (Radloff 1977; Roberts & Vernon 1983; Orme et al., 1986). Maternal substance abuse and environmental smoke exposure was determined by mothers reporting on a two-item questionnaire (Bauman et al., 1991; Fried & Watkinson, 1990; Overpeck & Moss, 1991; Sexton et al., 1990; Tager, 1991) with psychometric properties not having been previously reported.

IV. ANALYTIC APPROACH

Missing Data

Prior to conducting analyses, the sample was reduced from 1,364 participants to 1,061 participants to only include individuals with complete CBCL data. Only children with complete outcome data were included to avoid the possibility that hospitalization would be imputed for children who dropped out of the study prior to 54 months. Multiple imputation (MI) in SPSS 24 was used to estimate missing values for the remaining 1,061 participants (IBM Corp, 2016). Multiple imputation creates multiple copies of the data set (*m*) with different imputations for missing data values (Enders, 2010). Subsequently, analyses are conducted as if the data set were complete, but each analysis is run m times (Enders, 2010). For the purpose of the current study, data was imputed 20 times (Graham et al., 2007). Each analysis generates parameter estimates and standard errors, and a pooling phase combines all analyses into one set of results (Enders, 2010). SPSS 24 does not allow data to be pooled when estimating propensity scores, thus, pooling for this phase of analyses was handled manually. Pooling the propensity score analyses consisted of averaging parameter estimates and standard errors.

Estimating the Propensity Score and Outcome Models

After handling missing data, the first step in the analysis involved estimating the propensity scores. Logistic regression was used to estimate each child's predicted probability of being assigned to the exposure group (i.e., hospitalization) adjusting for covariates including background characteristics related to both hospitalization (e.g., gestational age, birth weight) and problematic behaviors (e.g., child temperament, maternal sensitivity; see Table 3). The logistic regression model was run 20 times to

estimate the propensity score for each data set that was multiply imputed (Graham et al., 2007). The average of each child's 20 propensity scores was taken to create the average or pooled propensity score used to match participants. The propensity scores were then arranged from highest to lowest propensity score with each observation having neighbors with the smallest propensity distance.

Once the average propensity score was created it was multiplied by its standard deviation and then by .2 to create the caliper score (Austin, 2011; Wang et al., 2013). The caliper score indicates the range the average propensity score must fall between to be considered as an appropriate match (Cochran & Rubin, 1973). The caliper score was used to ensure children were matched within a certain propensity score distance. Children who had been hospitalized were matched to children who had not been hospitalized based on their average propensity score value and if their average propensity score fell within the caliper used in the current study of .0130691. Once matched, children from the control group (i.e., not hospitalized) were not put back into the pool to be matched with another hospitalized child. Originally, 99 children had been hospitalized, but one participant did not have a match (i.e., non-hospitalized child) within the caliper and thus was excluded from the matching process. If a hospitalized child had two potential matches, the non-hospitalized child with a smaller propensity score distance or nearest neighbor method was used to match to the hospitalized child (Tumlinson et al., 2014). After children were matched, the estimated propensity score distributions and distributions of each separate covariate were compared to assess balance between treatment and control groups. Balance was assessed through t-tests and standardized mean difference (SMD) or Cohen's *d* (Zhang et al., & written on behalf of AME Big-Data Clinical Trial

Collaborative Group, 2019). Finally, once groups were balanced, demographic differences were examined between the matched and unmatched groups.

Using the sample of hospitalized and non-hospitalized children matched on propensity scores, study hypotheses were examined using multiple regression to estimate effects of hospitalization on outcome behaviors. Multiple regression was used because internalizing and externalizing behaviors are continuous outcomes that are normally distributed. Several multiple regression models were run to examine study hypotheses. In the first model, the main effect of hospitalization on problematic behaviors was examined. Next, two models (one for poverty status and one for gender) examined main effects for hospitalization and ever poor/gender on problematic behaviors. Third, two additional models (one for poverty status and one for gender), examined the moderating effect of poverty status and gender on the relation between hospitalization and problematic behaviors. These two models included hospitalization, ever poor/gender, and an interaction variable of hospitalization by ever poor/gender. Lastly, one model examined the moderating effect of poverty status on the relation between hospitalization and problematic behaviors that included hospitalization, ever poor, the interaction variable of hospitalization by ever poor, and covariates that were not balanced. This model including unbalanced covariates ensured that results were robust (Nguyen et al., 2017). In all models testing study hypotheses, a stringent p value of $p < .01$ was utilized to reduce the potential for Type II error as a result of conducting multiple tests.

V. RESULTS

Of the 1,061 participants, 196 children were included in the matched sample. Demographic characteristics were examined between the matched (n = 196) and unmatched groups (n = 865). There was a significant difference for gender (X_2 = 4.052, p < .05) between the children included in the matched and unmatched samples, with a higher percentage of males in the matched sample. There were no other significant differences between children included in the matched sample and children excluded from the matched sample.

The matched sample consisted of 98 hospitalized children and 98 children who were not hospitalized prior to being 54 months old. To assess if the groups in the matched sample were considered balance, standardized mean differences for each covariate included in the logistic regression and the average propensity score value for both groups were examined. If the standardized mean difference was larger than 0.10, the groups were considered imbalanced. Of the 40 covariates on which children were matched, 10 covariates were not balanced (see Table 3). Given these findings, double adjustment for analyses examining study hypotheses was applied by including covariates that were unbalanced to ensure that results were robust (see Model 4 in Table 4; Nguyen et al., 2017). The study variables (hospitalization, ever poor, and gender) were balanced.

In the matched sample of 196 children, 56.6% were male. Children in the matched sample were primarily White (83.2%), followed by African American (11.7%), Other (2.6%), Asian or Pacific Islander (1.5%), and American Indian (1.0%). Mothers in the sample were primarily White (84.7%), followed by African American (11.7%), Asian or Pacific Islander (2.0%), Other (1.0%), and American Indian (0.5%). Fathers in the sample

were primarily White (83.7%), followed by African American (12.8%), Asian or Pacific Islander (1.5%), Other (1.5%), and American Indian (0.5%). The majority of children were non-Hispanic (94.9%) as well as the majority of the children's mothers (98.0%) and fathers (96.4%). The income-to-needs ratio for the matched sample at 1-month ranged from 0.11 to 11.63 with an average of 2.76. At 1-month, 19.3% of the children in the matched sample lived below the poverty level (income-to-needs <1). Utilizing the binary poor/not poor variable, it was determined that 33.3% of the children had lived in poverty at some point during early childhood (prior to 54 months). Maternal education ranged from 8 to 21 years, with an average of 14.24 years. Paternal education ranged from 8 to 21 years, with an average of 14.59 years. See Table 3 for descriptive statistics for these characteristics by hospitalization group and see Table 5 for study variable descriptive statistics (i.e., hospitalizations, internalizing, and externalizing behaviors) by moderator variables (i.e., poverty status and gender).

Contrary to hypothesis one, there were no significant main effect associations between hospitalization and problematic behaviors (see Model 1 in Table 4). In support of hypothesis two, being poor at some point during early childhood significantly moderated the relation between hospitalization and internalizing and externalizing behaviors (see Model 3 in Table 4). The significant moderated effect was still present after including the set of covariates and using a stringent p value of $p < .01$ (see Model 4 in Table 4; Stevens, 1990). Analyses examining gender revealed that children's gender did not moderate the relation between hospitalization and problematic behaviors (see Model 5 in Table 4).

Follow-up analyses examining the simple slopes for moderated effect of ever poor, including all covariates, showed that hospitalization was positively associated with internalizing and externalizing behaviors for children who experienced poverty during early childhood (B = 7.97 and 9.16, $p < .01$, respectively). Simple slopes revealed nonsignificant negative relations between hospitalization and internalizing and externalizing behaviors for children that were never poor (B = -0.76 and -0.55, $p > 01$, respectively). Standardized betas on pooled data are not reported in SPSS, therefore only unstandardized betas were reported.

VI. DISCUSSION

The current study utilized a quasi-experimental design to examine the impact of hospitalization on children's socioemotional development during early childhood. Contrary to previous research on hospitalization, the results did not reveal a main effect of hospitalization for internalizing and externalizing behaviors. Despite the lack of main effects, poverty status appeared to play a moderating role in the association between hospitalization and children's problematic outcomes. The simple slopes analysis revealed that children who are hospitalized and poor at some point during early childhood have more problematic behaviors than children who were poor but not hospitalized, and children who were never poor. There were no gender effects in the relation between hospitalization and problematic behaviors. These results make an important contribution to the existing literature examining relations between hospitalization and problematic behaviors because of the quasi- experimental design attempts to replicate causal experiments.

Previous research has indicated that hospitalization is related to children's internalizing and externalizing behaviors, however this was not supported in the current study. Potentially the most important reason for the disparity between previous literature and the current study was the use of a quasi-experimental design (i.e., propensity score matching; Rennick & Rashotte, 2009; Vanek, 1979). Propensity score matching utilizes a more rigorous method to handle potential confounding covariates and allows for causal inference to be drawn compared to traditional regression models (Dehejia & Wahba, 1999; Ho et al., 2007; McCartney et al., 2006; Stuart, 2010). Additionally, prior studies' samples compared hospitalized children to other hospitalized children unlike the current

study that compares hospitalized children to those that have not been hospitalized (Rees et al., 2004; Small, 2002). Therefore, previous studies that examined the relationship between hospitalization and problematic behaviors without utilizing propensity score matching may indicate less precise findings. Given the lack of casual inference in previous research, the observed increase in problematic behaviors could have been a function of natural change in children's behavior over time or due factors related to children being hospitalized such as poverty status. During early childhood, 10-15% of preschoolers can already exhibit problematic behaviors which may be why there were no differences between those who have been hospitalized and those who have not (Campbell, 1995). In addition to prior studies typically comparing only those who have been hospitalized, children who might be prone to hospitalization might already have higher levels of behavior problems due to their chronic illness compared to those who have never been hospitalized (Klinnert et al., 2008; McQuaid et al., 2001). Therefore, previous research could have confounded results when examining behavior problems only among hospitalized children. The current findings indicate that children who are hospitalized with a severe chronic illness may be the reason for prior findings on observed problematic behaviors.

Another potential factor impacting the lack of direct relations between hospitalization and behavioral outcomes might be the amount of time children spent in the hospital. Previous research has typically focused on critical and intensive hospital stays including pediatric ICUs and EDs (Rees et al., 2004; Small, 2002). Critical and intensive hospital stays could be the reason that previous research found children have exhibited behavioral problems. Children who experience critical and intensive hospital

stays are likely to have severe chronic illnesses and those individuals do indeed show higher levels of problematic behaviors compared to their healthy peers (Pinquart & Shen, 2011; Pinquart & Teubert, 2012). However, in the current study, parents did not report the length of stay for children at the hospital and accordingly it could not be considered as a factor for the development of problematic behaviors after hospitalization. Parents also did not report if children were hospitalized in an intensive care unit or if children were general inpatient status. Because children in the current study might not have been hospitalized for long periods of time and their hospital status might not have been as serious compared to children that are in ICUs, this could have led to the lack of significant findings. Pediatric ICUs and EDs can be traumatizing to young children and those invasive experience might be the reason for prior significant problematic behaviors (Rees et al., 2004; Small, 2002).

Moreover, a potential reason hospitalized children might not have exhibited significant behavioral problems compared to their peers is because episodic memories do not begin to form until the age of 3 or 4 years (Hayne & Imuta, 2011). Episodic memories are memories of personal experiences (Tulving, 1972). Children who are hospitalized prior to being able to recall episodic memories likely did not explicitly remember hospitalization. Without remembering hospitalization, this time in their life might not have had a significant impact on the children's development of problematic behaviors prior to kindergarten. Children who do not remember being hospitalized might not need to cope or comprehend their thoughts and feelings on the hospitalization experience through exhibiting internalizing and externalizing behaviors. However, data used for this study did not include children or parents reporting on if children

remembered being hospitalized. Future research should consider children's episodic memories when examining the effect of hospitalization on behavior problems, particularly during childhood.

Nevertheless, there was a significant relation between hospitalization and problematic behaviors when considering children's experiences of poverty. As previously stated, children who live in poverty are more likely to be hospitalized and exhibit more behavior problems compared to those from more affluent families (Brooks-Gunn et al., 1998; DeCarlo Santiago et al., 2011; Russell et al., 2016). The results of the current study suggest that the negative effects of hospitalization for children's behavior problems in early childhood were only present for children who had experienced poverty at some time. This is the first study to examine poverty status as a factor in the relation between hospitalization and behavior problems without solely focusing on children who are in intensive care units during early childhood (Rees et al., 2002; Small, 2002). The implications of the current findings highlight the need to both reduce the prevalence of hospitalization in families that experience poverty and to identify interventions that support healthy coping for these young children during and after hospitalization.

Reducing the risk of hospitalization for children that experience poverty could help decrease their compounding risk for problematic behaviors. Improving the health of children who have experienced poverty is a complex and challenging issue and can be supported through the fundamental cause of disease theory. The primary method through which the medical field attempts to improve children's health outcomes is through parental education about healthy and preventative behaviors for children (American Academy of Pediatrics, 1986; 1988; Spencer, 1989). When parents, particularly those

living in poverty, receive health related education, we see better outcomes for children (Centers for Disease Control and Prevention, 2015; Glascoe et al., 1998). Unfortunately, one factor related to preventative health care is having health insurance (Case & Paxson, 202; Chen et al., 2002; Pamuk et al., 1998). Families with health insurance are more likely to engage in preventative practices such as taking their child to check-ups and are less likely to use emergency rooms and urgent care clinics (Mayberry et al., 2000; Pamuk et al., 1998). Additionally, compounding the care received while engaging in preventative practices, within those preventative practices like check-ups, parents are often provided with information that support the promotion of children's health and behavior (American Academy of Pediatrics, 1986; 1988a; 1988b). Families living in poverty are less likely to have health insurance compared to more affluent families and children without consistent health insurance could be at risk for multiple hospitalizations and behavior problems because of the lack of preventative care and educational services provided by hospitals. Thus, parents who experience poverty are not able to access education on healthy behaviors and utilize preventative practices which may lead to children's health conditions and maintaining those outcomes can be supported by the fundamental cause of disease theory.

There are programs in communities that promote an integrative approach to health care for families that have experienced poverty that combine physical, cognitive, emotional, and social support (Halfon et al., 2007; High et al., 2000). Utilizing programs in the community may help individuals who are not able to pay for more expensive preventative practices such as health insurance and could be missing opportunities for both preventative care and education. Additionally, these programs could help reduce the

cost of medical bills that occur after hospitalization by preventing hospitalization in the first place, which is particularly important for families that experience poverty. Moreover, preventative education can also be received during hospitalization through means of healthcare workers and online hospital resources. Education for parents and their hospitalized children can include trauma and grief programs and information from social workers or case management (The National Child Traumatic Stress Network, 2010). Previous research has found that more than half of children between the ages of two and five have experienced a severe stressor (e.g., hospitalization; Egger & Angold, 2004). When children are hospitalized, they may experience amounts of stress that may not typically occur during development, which may be the reason why problematic behaviors can be exhibited. However, programs and health care professionals can provide information that parents need to help children process their hospitalization experience (Association of Child Life Professionals, 2020; The National Child Traumatic Stress Network, 2010).

Additionally, auxiliary services provided by hospitals such as certified child life specialists, animal assisted therapy, trauma and grief programs, and educational programs provide an integrative health care approach. These services provided by hospitals could reduce problematic behaviors for children who have experienced poverty. Auxiliary services are typically of no cost due to volunteers or monetary donations that provide funding for these services (Children's Hospital Association, 2019; Mattel Philanthropy Programs, 2007). For example, certified child life specialists can provide emotional support and teach coping strategies that children and families may need after hospitalization which can help improve coping mechanisms for these individuals

(American Academy of Pediatrics Committee on Hospital Care & Institute for Family-Centered Care, 2003). Hospitalized children from families that experience poverty might not have the financial and educational resources compared to children from more affluent families to help promote healthy coping mechanisms. Improving coping mechanisms may help hospitalized children that have experienced poverty improve their problematic behaviors. Another service provided in some hospitals is animal assisted therapy which can help reduce stress and normalize the hospital experience for children (Kaminski et al., 2002; Wu et al., 2002). Animal assisted therapy may be especially beneficial for hospitalized children who have lived in poverty because animal assisted therapy allows children to be able cope and express their feelings (e.g., anxiety, depression, and hyperactivity; Urbanski, & Lazenby, 2012). Expressing these feelings might help hospitalized children reduce their internalizing and externalizing behaviors.

Contrary to previous research examining gender on the relation between hospitalization and problematic behaviors, there were no differences between boys and girls after hospitalization on behavioral outcomes. Previous literature has found that after hospitalization, boys experience more internalizing and externalizing behaviors than girls (Tiedman & Clatworthy, 1990). Previous studies that explored the relation on gender between hospitalization and problematic behaviors did not utilize quasi-experimental designs such as propensity score matching (Tiedman & Clatworthy, 1990). Therefore, the current study is a stronger indicator for the relation on gender between hospitalization and problematic behaviors compared to previous research because propensity score matching can better estimate causal effects than regression models (Dehejia & Wahba, 1999; Ho et al., 2007; Stuart, 2010). Quasi-experimental designs can allow for causal

inference to be drawn compared to typical correlational design. Thus, allowing for the current study to draw causal conclusions when examining the relation on gender between hospitalization and problematic behaviors.

Additionally, unlike the current study, previous findings did not explore hospitalization and problematic behaviors prior to kindergarten (Tiedman & Clatworthy, 1990). One reason for the lack of differences between gender might be because differences in internalizing behaviors do not typically occur until adolescence (Angold & Rutter, 1992). Differences between internalizing behaviors typically emerges during adolescence and boys are less likely to exhibit these behaviors compared to girls (Achenbach et al., 1991; Angold & Rutter, 1992; Ormel et al., 2005). Boys are more likely than girls to display externalizing behaviors as early as 4 years old (Achenbach et al., 1991; Matos et al., 2017; Mesman et al., 2001; Ormel et al., 2005). The current study examined children prior to kindergarten and this developmental age may be reason that hospitalized children did not show any differences in problematic behaviors on gender. Unlike the current study, previous research compares hospitalized children to other hospitalized children on behavioral outcomes on gender (Tiedeman & Clatworthy, 1990). Thus, the differences in sample groups compared may be the reason for differences between hospitalization on behavior problems on gender.

Study Limitations

A factor that is highly related to poverty status is racial and ethnic differences (Chen et al., 2002). One important limitation of this study was that it was not nationally representative and included mainly White participants. Minority populations, including Black and Hispanic, are more likely to be hospitalized compared to White individuals

(Mayberry et al., 2000). Additionally, individuals from less affluent Black and Hispanic families are likely to show more behavior problems than White children (Keiley et al., 2000). Therefore, future studies should include a more diverse sample and potentially explore race and ethnicity as a moderating factor in the relation between hospitalization and problematic behaviors.

Another important limitation of the present study was that health insurance was not reported at the 1-month home interview. Families that have lived in poverty are less likely to have health insurance compared to more affluent families and this can decrease the use of preventative care (Brooks-Gunn et al., 1998; Diez Roux & Mair, 2010; Larson & Halfon, 2010; Kazac, 2006; Kersten et al., 2018). Thus, children who do not receive preventative care might be more at risk for already experiencing hospitalization because they might not be engaged in healthy behaviors and are at risk for experiencing behavioral problems after hospitalization. The lack of health insurance, particularly for low income children, compounds the likelihood to experience problematic behaviors after hospitalization. Future research should consider how having insurance is a factor in decreasing problematic behaviors after hospitalization for those of low-income status.

Lastly, the environmental factor of parental smoking and smoke exposure, which is related to poor health outcomes for children, especially those who have lived in poverty, was not included in the current study (Case & Paxson, 2002). Smoke exposure during childhood is a factor related to hospitalization and problematic behaviors. Children who are exposed to smoke are more likely to be at risk for respiratory problems and the exacerbation of asthma (California Environmental Protection Agency, 1997; Cook & Strachan, 1999; U.S. Environmental Protection Agency, 1992). Children with

chronic illnesses such as asthma may be at an increased risk of hospitalization. In addition, children with chronic illnesses are likely to have more behavior problems than their healthy peers (Pinquart & Shen, 2011; Pinquart & Teubert, 2012). Parental smoking and children's smoke exposure compound the potential risk for hospitalization and behavior problems for children who experience poverty.

Given these limitations, this study benefitted from numerous strengths. Previous research on hospitalization and problematic behaviors typically focused on children in ICUs or ED settings. Additionally, the literature focused on the entire pediatric population, spanning from birth to 18 years, which is a large developmental range. Lastly, prior findings typically used nonexperimental, observational, or correlational designs to examine the relation between hospitalization and behavior problems. The current study addressed these limitations by focusing on the experience of hospitalization status, a specific developmental period (i.e., early childhood), and by utilizing a quasi-experimental design. The current study extended prior research in three important ways. First, this study found that the type of intensive care received in the hospital may be related to behavioral problems, not the overall experience of hospitalization. Second, findings suggest that problematic behaviors seen after hospitalization are not above and beyond what would typically be observed during early childhood. Lastly, this study extends the current literature because it used a quasi- experimental method to draw causal inferences about the impact of hospitalization on development. Future studies should examine how to improve health and behavioral outcomes for children that have lived in poverty and been hospitalized. Educating families on preventative practices and

providing services for ways to cope with hospitalization should be the next steps to reducing problematic behaviors in these children.

Table 1

Descriptive Statistics for Childhood Hospitalization, Problematic Behaviors, and Propensity Score Matching Covariates

	Total (N=1,061)								
	N	*n*	%	*M*	SD	Min	Max	Skew	Kurtosis
Hospitalization									
Hospitalized	1,061	99	9.30%						
Problematic Behaviors									
CBCL-Internalizing Behaviors	1,061			47.29	8.88	33.00	74.00	0.34	-0.27
CBCL-Externalizing Behaviors	1,061			51.69	9.39	30.00	82.00	0.11	-0.22
Moderator Variables									
Ever Poor	1,061	307	30.20%						
Child Gender (Male)	1,061	532	50.10%						
Covariates									
Site (Site 1)	1,061	103	9.7%						
Maternal Age	1,061			28.51	5.58	18.00	46.00	0.02	-0.53
Maternal Race (White)	1,061	868	81.80%						
Paternal Race (White)	1,060	867	81.80%						
Maternal Marital Status (Partnered)	1,060	927	87.50%						
Maternal Education	1,061			14.40	2.47	7.00	21.00	0.12	-0.01
Paternal Education	988			14.64	2.68	6.00	21.00	0.35	-0.01
Child Race (White)	1,061	835	78.70%						
Child Birth Weight (Grams)	1,061			3498.65	512.61	2000.00	5428.00	0.12	0.20
Child Gestational Age (Weeks)	1,047			39.28	1.43	33.00	43.00	-0.62	0.88
Type of Delivery (Vaginal)	1,061	835	78.70%						
Child Days in Hospital at Birth	1,061			2.57	1.63	0.00	14.00	2.68	10.33
Child Complications	1,061	257	24.20%						
Child Health	1,061	1033	97.40%						
Child Respiratory Problems	1,061	222	20.90%						
Child Intestinal Problems	1,061	135	12.70%						
Child to Doctor	1,061	938	88.40%						
Income-to-needs	1,002			2.94	2.57	0.09	25.08	2.54	10.94
Child Temperament	1,042			3.17	0.40	1.54	4.72	-0.16	0.49
Maternal Sensitivity	1,036			9.28	1.77	3.00	12.00	-0.52	-0.13
Social Support	1,061			5.18	0.63	1.73	6.00	-1.20	2.26
Maternal Depression	1,041			8.91	8.23	0.00	52.00	1.72	3.64
Natural Logarithm Maternal Depression	1,041			1.68	1.25	-2.30	3.95	-1.44	2.73
Prenatal Maternal Smoking	1,029	187	18.20%						
Prenatal Maternal Exposure to Smoke	1,031	302	29.30%						

Note. N=1,364. CBCL= Child Behavioral Checklist.

Table 2

Waves in Months that Covariates were Collected

	Data Collection Method	Rec.	1	6	15	18	21	24	27	30	33	36	42	46	50	54
Dependent Variables																
Internalizing Behaviors	Lab Visit															X
Externalizing Behaviors	Lab Visit															X
Independent Variable																
Hospitalization	Home Visit Questionnaire				X			X				X				X
Hospitalization	Telephone Contact					X	X		X	X	X		X	X	X	
Moderator Variables																
Ever Poor	Home Visit Questionnaire	X	X	X			X				X				X	
Child Gender	Home Visit Questionnaire	X														
Other Covariates																
Child Birth Weight	Hospital Recruitment Form	X														
Child Gestational Age	Hospital Recruitment Form	X														
Type of Delivery	Hospital Recruitment Form	X														
Site	Hospital Recruitment Form	X														
Maternal Age	Home Visit Questionnaire		X													
Maternal Race	Home Visit Questionnaire		X													
Paternal Race	Home Visit Questionnaire		X													
Child Race	Home Visit Questionnaire		X													
Maternal Marital Status	Home Visit Questionnaire		X													
Maternal Education	Home Visit Questionnaire		X													
Paternal Education	Home Visit Questionnaire		X													
Child Days in Hospital at Birth	Home Visit Questionnaire		X													
Child Complications	Home Visit Questionnaire		X													
Child Health	Home Visit Questionnaire		X													
Child Respiratory Problems	Home Visit Questionnaire		X													
Child Intestinal Problems	Home Visit Questionnaire		X													
Child to Doctor	Home Visit Questionnaire		X													
Income-to-needs	Home Visit Questionnaire		X													
Child Temperament	Home Visit Questionnaire			X												
Social Support	Home Visit Questionnaire		X													
Maternal Depression	Home Visit Questionnaire			X												
Prenatal Maternal Smoking	Home Visit Questionnaire							X								
Prenatal Maternal Exposure to Smoke	Home Visit Questionnaire							X								
Maternal Sensitivity	Home Visit Direct Observation			X												

Note. Rec.= Recruitment.

Table 3

Balancing of the Matched Sample Covariates and Propensity Score Averages

	Hospitalized (n=98)		Not Hospitalized (n=98)		Matched Sample (n=196)			
	M	*SD*	*M*	*SD*	*M*	*SD*	*SD Pooled*	*Cohen's d*
Binary Covariates								
Site2*	0.07	0.26	0.10	0.30	0.09	0.28	0.28	0.11
Site3	0.05	0.22	0.07	0.26	0.06	0.24	0.24	0.09
Site4	0.19	0.40	0.16	0.37	0.18	0.38	0.38	0.08
Site5	0.10	0.30	0.10	0.30	0.10	0.30	0.30	0.00
Site6	0.06	0.24	0.05	0.22	0.06	0.23	0.23	0.04
Site7	0.15	0.36	0.15	0.36	0.15	0.36	0.36	0.00
Site8*	0.06	0.24	0.03	0.17	0.05	0.21	0.21	0.15
Site9	0.07	0.26	0.05	0.22	0.06	0.24	0.24	0.09
Site10	0.09	0.29	0.11	0.32	0.10	0.30	0.30	0.07
Child Gender (Male)	0.58	0.50	0.55	0.50	0.57	0.50	0.50	0.06
Ever Poor (Poor)	0.32	0.47	0.36	0.48	0.34	0.47	0.47	0.08
Maternal Less than High School Education	0.10	0.30	0.10	0.30	0.10	0.30	0.30	0.00
Maternal Some College Education	0.23	0.43	0.22	0.42	0.23	0.42	0.42	0.02
Maternal Bachelor's Education	0.19	0.40	0.20	0.41	0.20	0.40	0.40	0.03
Maternal Graduate Education	0.17	0.38	0.17	0.38	0.17	0.38	0.38	0.00
Pateranl Less than High School Education	0.11	0.31	0.12	0.32	0.11	0.31	0.31	0.03
Paternal Some College Education	0.26	0.44	0.25	0.43	0.25	0.43	0.43	0.02
Paternal Bachelor's Education*	0.19	0.39	0.23	0.42	0.21	0.41	0.41	0.12
Paternal Graduate Education	0.19	0.39	0.19	0.39	0.19	0.39	0.39	0.00
Maternal Marital Status (Partnered)*	0.84	0.37	0.89	0.32	0.86	0.35	0.35	0.15
Maternal Race (White)	0.82	0.39	0.85	0.36	0.83	0.37	0.38	0.08
Paternal Race (White)	0.81	0.40	0.84	0.37	0.82	0.38	0.38	0.08
Child Race (White)	0.79	0.41	0.82	0.39	0.80	0.40	0.40	0.08
Type of Delivery (Vaginal)	0.80	0.41	0.83	0.38	0.81	0.39	0.39	0.08
Child Complications*	0.24	0.43	0.18	0.39	0.21	0.41	0.41	0.15
Child Health	0.97	0.17	0.98	0.14	0.97	0.16	0.16	0.06
Child Respiratory Problems	0.22	0.42	0.22	0.42	0.22	0.42	0.42	0.00
Child Intestinal Problems	0.16	0.37	0.17	0.38	0.17	0.37	0.38	0.03
Child to Doctor*	0.86	0.35	0.93	0.26	0.89	0.31	0.31	0.23
Prenatal Maternal Smoking*	0.18	0.38	0.14	0.34	0.16	0.37	0.36	0.12
Prenatal Maternal Exposure to Smoke	0.32	0.47	0.33	0.47	0.32	0.47	0.47	0.01
Continuous Covariates								
Income-to-needs	2.63	2.19	2.67	1.98	2.65	2.09	2.09	0.02
Maternal Age*	28.13	5.97	28.88	6.13	28.51	6.03	6.03	0.12
Child Birth Weight (Grams)	3442.47	493.03	3479.72	496.80	3461.10	492.80	494.92	0.08
Child Gestational Age (Weeks)	39.14	1.40	39.21	1.52	39.18	1.46	1.46	0.05
Child Days in Hospital at Birth	2.73	1.58	2.78	2.15	2.76	1.88	1.89	0.02
Child Temperament*	3.21	0.43	3.14	0.39	3.18	0.41	0.41	0.17
Maternal Sensitivity	8.89	1.94	8.71	1.86	8.80	1.90	1.90	0.09
Social Support*	5.08	0.61	4.99	0.75	5.03	0.68	0.68	0.13
Natural Logarithm Maternal Depression	1.71	1.30	1.67	1.34	1.69	1.32	1.31	0.03
Propensity Score Average	0.14	0.07	0.13	0.07	0.14	0.07	0.07	0.00

Note. Covariates followed by an * indicate an imbalance between groups. Categorical variables listed in Table 1 were separately dummy coded in order to use logistic regression to create the average propensity scores. Site was separately dummy coded and Site 1 served as the reference group. Maternal and paternal education were also separately dummy coded and high school graduate or GED served as the reference group.

Table 4

Main Effects and Moderation of Hospitalization and Problematic Behaviors on Poverty Status and Gender

	Internalizing			Externalizing		
	B	*SE*	95% CI	*B*	*SE*	95% CI
Model 1						
Hospitalization	2.15	1.36	0.11 to 0.11	2.32	1.44	0.11 to 0.11
Model 2						
Hospitalization	2.21	1.36	0.11 to 0.12	2.47	1.42	0.11 to 0.13
Ever Poor	1.64	1.48	0.07 to 0.12	4.26 **	1.52	0.18 to 0.22
Model 3						
Hospitalization	-0.81	1.64	-0.07 to -0.03	-0.70	1.71	-0.05 to -0.02
Ever Poor	-2.73	2.02	-0.18 to -0.09	-0.33	2.09	-0.06 to 0.02
Hosp X Ever Poor	8.97 **	2.88	0.31 to 0.40	9.41 **	2.99	0.31 to 0.38
Model 4						
Hospitalization	-0.76	1.78	-0.06 to -0.02	-0.55	1.79	-0.05 to -0.01
Ever Poor	-3.90	2.41	-0.25 to -0.13	-1.47	2.44	-0.12 to -0.01
Hosp X Ever Poor	8.73 **	3.11	0.29 to 0.37	9.71 **	3.14	0.31 to 0.39
Site2	-1.75	3.02	-0.06 to -0.03	-3.08	3.06	-0.12 to -0.06
Site3	0.70	3.35	0.00 to 0.03	-2.85	3.38	-0.11 to -0.05
Site4	3.89	2.53	0.14 to 0.18	-1.78	2.55	-0.10 to -0.05
Site5	3.15	2.87	0.08 to 0.14	2.64	2.91	0.05 to 0.10
Site6	3.28	3.55	0.06 to 0.10	2.82	3.58	0.05 to 0.08
Site7	2.10	2.54	0.06 to 0.13	-3.30	2.56	-0.14 to -0.10
Site8	0.26	3.82	-0.01 to 0.03	1.14	3.86	0.01 to 0.04
Site9	1.99	3.35	0.04 to 0.07	-5.48	3.37	-0.15 to -0.11
Site10	0.15	2.87	-0.01 to 0.07	-1.34	2.89	-0.06 to 0.00
Paternal Less than High School Education	3.55	3.24	0.00 to 0.22	2.48	3.20	-0.01 to 0.20
Paternal Some College Education	-0.70	2.17	-0.08 to 0.03	2.83	2.19	0.08 to 0.17
Paternal Bachelor's Education	-0.73	2.48	-0.09 to 0.03	-1.77	2.51	-0.12 to 0.00
Paternal Graduate Education	1.93	2.55	0.04 to 0.15	3.09	2.61	0.07 to 0.21
Maternal Age	-0.09	0.15	-0.12 to -0.03	-0.18	0.15	-0.16 to -0.07
Child Complications	1.16	1.84	0.03 to 0.07	2.66	1.86	0.09 to 0.13
Child to Doctor	4.51	2.33	0.11 to 0.16	5.23	2.35	0.14 to 0.18
Social Support	-0.95	1.08	-0.08 to -0.05	-1.88	1.09	-0.14 to -0.11
Prenatal Maternal Smoking	0.85	2.11	-0.01 to 0.07	0.62	2.15	-0.02 to 0.07
Child Temperament	-0.34	1.84	-0.06 to 0.02	-3.52	1.83	-0.19 to -0.11
Model 5						
Hospitalization	2.19	1.36	0.12 to 0.12	2.35	1.45	0.12 to 0.12
Gender	-1.23	1.37	-0.06 to -0.06	-1.22	1.46	-0.06 to -0.06
Model 6						
Hospitalization	3.03	2.07	0.16 to 0.16	2.80	2.20	0.14 to 0.14
Gender	-0.50	1.94	-0.03 to -0.03	-0.83	2.06	-0.04 to -0.04
Hosp X Gender	-1.48	2.75	-0.07 to -0.07	-0.78	2.92	-0.04 to -0.04

Note. ** $p < .01$. Standardized betas on pooled data are not reported in SPSS, therefore only unstandardized betas and the 95% confidence interval was reported. Categorical variables listed in Table 1 were separately dummy coded in order to use logistic regression to create the average propensity scores. Site was separately dummy coded and Site 1 served as the reference group. Maternal and paternal education were also separately dummy coded and highs graduate or GED served as the reference group.

Table 5

Matched Sample Descriptive Statistics for Hospitalization and Outcome Variables by Poverty Status and Gender

	Poor (*N*=62)				Not Poor (*N*=124)				Males (*N*=85)				Females (*N*=111)			
	n	%	*M*	*SD*	*n*	%	*M*	*SD*	*n*	%	*M*	*SD*	*n*	%	*M*	*SD*
Hospitalization	29	46.77%			64	51.61%			57	67.06%			41	36.94%		
Internalizing			47.76	10.33			46.41	9.18			47.55	9.37			46.39	9.71
Externalizing			53.58	12.00			49.42	8.99			51.55	10.23			50.41	10.09

Note. Matched Sample *N*=196.

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