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# Do race, neglect, and childhood poverty predict physical health in adulthood? A multilevel prospective analysis

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## Abstract

Childhood neglect and poverty often co-occur and both have been linked to poor physical health outcomes. In addition, Blacks have higher rates of childhood poverty and tend to have worse health than Whites. This paper examines the unique and interacting effects of childhood neglect, race, and family and neighborhood poverty on adult physical health outcomes. This prospective cohort design study uses a sample ($N$ = 675) of court-substantiated cases of childhood neglect and matched controls followed into adulthood ($M_{age}$ = 41). Health indicators (C-Reactive Protein [CRP], hypertension, and pulmonary functioning) were assessed through blood collection and measurements by a registered nurse. Data were analyzed using hierarchical linear models to control for clustering of participants in childhood neighborhoods. Main effects showed that growing up Black predicted CRP and hypertension elevations, despite controlling for neglect and childhood family and neighborhood poverty and their interactions. Multivariate results showed that race and childhood adversities interacted to predict adult health outcomes. Childhood family poverty predicted increased risk for hypertension for Blacks, not Whites. In contrast, among Whites, childhood neglect predicted elevated CRP. Childhood neighborhood poverty interacted with childhood family poverty to predict pulmonary functioning in adulthood. Gender differences in health indicators were also observed. The effects of childhood neglect, childhood poverty, and growing up Black in the United States are manifest in physical health outcomes assessed 30 years later. Implications are discussed.

### Keywords

childhood neglect; childhood poverty; race; physical health; prospective design

## Introduction

In the United States, childhood neglect is the most common form of maltreatment and accounts for over 60% of cases reported to child protective services. In 2011, 541,000 children in the United States were estimated to be victims of neglect (U.S. Department of Health and Human Services, 2012). Studies have also reported associations between childhood neglect and childhood poverty (Berger, 2005; Drake & Pandey, 1996; Theodore,



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Runyan, & Chang, 2007) with estimated rates of neglect of 2.2 children per 1,000 in middle- and upper -socioeconomic status (SES) families compared to 16.1 per 1,000 children in low-SES families (Sedlak et al., 2010). Furthermore, both neglect and poverty in childhood are associated with a range of negative sequelae, including poor physical health in adulthood (Conroy, Sandel, & Zuckerman, 2010; Danese et al., 2009; Lanier, Jonson-Reid, Stahlschmidt, Drake, & Constantino, 2009). However, few studies have examined physical health consequences of neglect (Wegman & Stetler, 2009). In this study, we focus on cases of childhood neglect that represent judgments that caregivers failed to provide food, shelter, clothing, and/or attend to the medical needs of the child beyond acceptable community standards at the time.

When examining the link between childhood neglect and poverty and adult outcomes, we have based our work on an ecological model that stresses the importance of social context and the need to consider the individual in the framework of the broader environment in which he or she functions (Belsky, 1980; Garbarino, 1977; Widom, 2000). This work is based on the premise that children exist within the context of families and that families are embedded in neighborhoods or, in some cases, isolated from neighborhoods. Thus, in order to understand adult outcomes, we believe it is important to take into account characteristics of the individual (race, gender, childhood neglect), the family (family poverty), and the neighborhood (neighborhood poverty) and the ways in which these factors work together or interact.

## Neglect, Poverty and Physical Health Outcomes

To date, much of the research on childhood neglect has focused on mental health, rather than physical health, outcomes. However, theoretical models of the impact of early stressful experiences (Repetti, Taylor, & Seeman, 2002) suggest that neglect may lead to poorer physical health by disrupting stress-response pathways and psychosocial functioning and contributing to risky behaviors. Several papers report a connection between physical and sexual abuse and adult physical health outcomes (Arnow et al., 1999; Drossman, Talley, Leserman, & et al., 1995; Fuller-Thomson, Bottoms, Brennenstuhl, & Hurd, 2011; Newman et al., 2000; Rapkin, Kames, Darke, Stampler, & Naliboff, 1990; Sachs-Ericsson, Medley, Kendall–Tackett, & Taylor, 2011; Walker et al., 1988). Studies of the relation between neglect and health outcomes are rare (Goodwin & Stein, 2004; Widom, Czaja, Bentley, & Johnson, 2012).

At the same time, research has shown that impoverished environments in childhood have long-term physical health effects (Case, Lubotsky, & Paxson, 2002). Studies examining family poverty with cross-sectional and longitudinal designs consistently find that children growing up in poorer families are at increased risk for health problems that may persist into adulthood (Adler & Rehkopf, 2008; Case et al., 2002; Cohen, Janicki-Deverts, Chen, & Matthews, 2010; Conroy et al., 2010; Galobardes, Lynch, & Davey Smith, 2004). Neighborhood level studies also link poverty to poor physical health in adulthood (Franzini, Caughty, Spears, & Esquer, 2005; Moore et al., 2010; Wilkinson & Pickett, 2007). The few studies that have examined the role of individual level poverty within the context of the

community have found that both family and neighborhood factors were important for physical health (Case, Fertig, & Paxson, 2005; Franzini et al., 2005; Moore et al., 2010).

Because childhood risk factors of neglect and poverty tend to co-occur, and many believe that poverty accounts for the negative consequences associated with neglect, it is important to understand if and how they each impact functioning and whether they interact. Lacking such knowledge, policy makers and interventionists may misappropriate efforts and miss important opportunities to create meaningful change.

To our knowledge, few studies have simultaneously examined the roles of neglect and poverty in relation to physical health. Goodwin and Stein (2004) found that when adult poverty and race were controlled, the association between childhood neglect and self–reported diseases in adulthood became stronger. However, independent effects of poverty and race were not reported and childhood poverty was not assessed. In another study using hospital record data and a longitudinal design, Lanier et al. (2009) found that neglect, welfare receipt, and average neighborhood income in childhood were all independently related to risk for hospital care and cardiovascular and respiratory disease in children and adolescents. Danese et al. (2009) found that maltreatment in childhood was related to C-Reactive Protein (CRP) levels after controlling for adult SES. Finally, one recent study (Widom, Czaja, Bentley, et al., 2012) followed a sample of court-substantiated cases of childhood maltreatment and matched controls into adulthood and found that neglect predicted several health outcomes, despite controlling for poverty. In that study the contributions of race, childhood family and neighborhood poverty, and their interactions were not addressed.

## Race and Physical Health Outcomes

The burden of poverty and poor health is not distributed equally in the United States, with approximately 35% of Black children living in poverty during 2009 compared to 17% of White children (Macartney, 2011). Blacks also tend to exhibit poorer physical health, relative to Whites (Adler & Rehkopf, 2008).

In cross-sectional studies examining poverty and race together, Black – White differences in health status (diabetes, blood pressure and obesity) were considerably minimized when poverty was taken into account (Bleich, Thorpe, Sharif-Harris, Fesahazion, & La Veist, 2010; LaVeist, Thorpe, Galarraga, Bower, & Gary-Webb, 2009; Thorpe, Brandon, & LaVeist, 2008), which suggests that poverty may account for the negative health outcomes associated with minority status. However, other research has reported that large race differences in physical health persist despite controlling for poverty (Adler & Rehkopf, 2008; Williams, Sternthal, & Wright, 2009). There is also evidence that the effects of poverty on health vary by race, which suggests that race may moderate the impact of poverty on health (Reagan, Salsberry, Fang, Gardner, & Pajer, 2012; Wickrama, Wickrama, & Bryant, 2006). In these studies, although Blacks were at risk for worse outcomes overall, Whites showed stronger associations between poverty and negative outcomes. Finally, recent research has shown that Black and White children manifest mental health consequences of childhood neglect differently (Widom, Czaja, Wilson, Allwood, & Chauhan, 2012). In sum, we argue that to understand the consequences of neglect on adult

physical health, it is necessary to also consider the role of race and its interactions with childhood neglect and poverty.

## Gender Differences

Men and women have also been found to be at risk for different physical health outcomes (Leuzzi, Sangiorgi, & Modena, 2010). Men are more likely to manifest traditional signs of heart disease, including hypertension, whereas women are more likely to develop inflammation (Ridker, 2003), that is reflected in higher than normal levels of CRP. Because gender differences in physical health outcomes may be partially explained by the different responses of men and women to adverse/stressful experiences, such as poverty, childhood neglect, and racism (Taylor et al., 2000), we include gender as a factor that may explain or modify the outcomes of childhood neglect and poverty.

## Current Study

We use data from a prospective study with clear temporal relationships and documented cases of child neglect. The design also includes a matched control group of children that establishes the base rates of health outcomes expected in a sample of adults from comparable backgrounds who did not come to court attention in childhood as victims of neglect. Physical health assessments are based on blood tests and physical measurements made by a licensed registered nurse. We focus on three health indicators (CRP, hypertension, and pulmonary functioning) that represent vital cardiac and pulmonary systems. The deficits in the functioning of these symptoms are associated with high rates of morbidity and mortality in the United States (Kochanek, Xu, Murphy, Minino, & Kung, 2011; U.S. Department of Health and Human Services, 2010) and with race and childhood adversity (Repetti et al., 2002; Thorpe, Brandon, & LaVeist, 2008; Williams, Sternthal, & Wright, 2009). CRP measures inflammation in the body and has been identified as one of the strongest markers and predictors of cardiac disease, the leading cause of death in the United States (Ridker, 2003; Ridker, Hennekens, Buring, & Rifai, 2000). Over 30% of Americans aged 20 and older have a diagnosis of hypertension (high blood pressure), and a primary diagnosis of hypertension accounts for 39 million yearly patient visits to physicians (Centers for Disease Control and Prevention, 2013). According to the same report, pulmonary dysfunction and respiratory disease is the fourth leading cause of death in the United States.

We address two basic questions: (a) Do childhood neglect, race, and childhood family and neighborhood poverty each predict physical health indicators in adulthood?, and (b) Do childhood neglect, race, gender, and childhood family and neighborhood poverty interact to predict health indicators in adulthood and, if so, how? Our fundamental hypothesis is that childhood neglect leads to physical health outcomes, independent of poverty, race, and gender, although we also expect interactions illustrating the important role of these contextual factors.

# Methods

## Design and Participants

Data were collected as part of a large prospective cohort design study (Leventhal, 1982; Schulsinger, Mednick, & Knop, 1981) in which abused and/or neglected children were matched with non-abused and non-neglected children and followed into adulthood. Because of the matching procedure, the participants were assumed to differ only in the risk factor; that is, having experienced childhood abuse or neglect. Because it is not possible to assign participants randomly to groups, the assumption of equivalency for the groups is an approximation. For complete details of the study design, see Widom (1989a).

The original sample of maltreated children ($N$ = 908 abused/neglected, 697 of whom were neglected) was comprised of all substantiated cases of childhood physical, sexual abuse, and neglect processed from 1967 to 1971 in the county juvenile (family) or adult criminal courts of a Midwestern metropolitan area. Cases of abuse and neglect were restricted to children 11 years of age or less at the time of the incident and therefore represent childhood maltreatment.

A control group of children without documented histories of childhood abuse and/or neglect ($N$ = 667) was matched with the abuse/neglect group on age, sex, race/ethnicity, and approximate family social class during the time that the abuse and neglect cases were processed. This matching was important because it is theoretically plausible that any relationship between child abuse and neglect and subsequent outcomes is confounded with or explained by social class differences (Adler et al., 1994; Bradley & Corwyn, 2002; Conroy et al., 2010; MacMillan et al., 2001; Widom, 1989b). The matching procedure used here is based on a broad definition of social class that includes neighborhoods in which children were reared and schools they attended (Watt, 1972).

Children who were under school age at the time of the abuse and/or neglect case were matched with children of the same sex, race, date of birth (± 1 week), and hospital of birth through the use of county birth record information. For children of school age, records of more than 100 elementary schools for the same time period were used to find matches with children of the same sex, race, date of birth (± 6 months), class in elementary school during the years 1967 to 1971, and home address, preferably within a five-block radius of the abused/neglected child. Overall, matches were found for 74% of the abused and neglected children. Non-matches occurred for a number of reasons. For birth records, non-matches occurred in situations when the abused and neglected child was born outside the county or state or when date of birth information was missing. For school records, non-matches occurred because of lack of adequate identifying information for the abused and neglected children or because the elementary school had closed and class registers were unavailable. Re-analyses of earlier findings were conducted using only matched pairs, and the results did not change with the smaller sample size (Widom, 1989b; Widom, DuMont, & Czaja, 2007).

The initial phase of the study compared the abused and/or neglected children to the matched comparison group on juvenile and adult criminal arrest records (Widom, 1989b). A second phase involved locating and interviewing the abused and/or neglected and comparison

groups during 1989–1995, approximately 22 years after the incidents of abuse and neglect (*N* = 1,196). Subsequent follow-up interviews were conducted in 2000–2002 (*N* = 896) and again in 2003–2005 (*N* = 806). This paper uses information collected during 2003–2005 as part of a medical status examination that included physical tests, blood collection through venipuncture, a comprehensive health interview, and other assessments.

Although there was attrition associated with deaths, refusals, and our inability to locate people over the various waves of the study (71% to 80% response rate over more than 25 years of the study), the composition of the sample of individuals with histories of neglect and matched controls at the four time points has remained about the same (49–52% male, 59–65% non-Hispanic Whites, 34–35% non-Hispanic Blacks, 6% of other backgrounds, and 51% Neglected). There were no significant differences in demographic characteristics of the groups across the waves of the study. The current sample is 49% male, 59% non-Hispanic White, 35% non- Hispanic Black, and 51% neglected. Thirteen percent of neglected children also experienced physical or sexual abuse. Because of race and ethnic differences in health status (Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Orsi, Margellos-Anast, & Whitman, 2010) and because the sample was composed primarily of non-Hispanic Whites and Blacks, we excluded participants of other ethnic backgrounds from these analyses (6.6%) for a final sample of 675 neglected and control children. Based on the Hollingshead Index (Hollingshead, 1975), the socioeconomic status of the sample is skewed towards the lower end of the socioeconomic spectrum, with 55% of the sample having unskilled/menial jobs.

## Procedures

Interviewers were blind to the purpose of the study and to the inclusion of an abuse/neglect group. Participants were also blind to the purpose of the study and were told that they had been selected to participate as part of a large group of individuals who grew up in that area during the late 1960s and early 1970s. One of the strengths of this research is the fact that the respondents and interviewers are kept blind to the purpose of the study. Thus, demand characteristics typically associated with studies of this sort, where participants know they are selected for participation because of their history of abuse or neglect, are minimized. Similarly, the biases associated with interviewers "pulling" for certain kinds of information are also kept to a minimum. Kinard (1985) argued that keeping participants blind to the purpose of research may sometimes be the most ethical practice. Kinard's argument is relevant here because many of these individuals were abused or neglected in early childhood and may be unaware of these early childhood experiences or may not define those experiences as abuse or neglect. In these cases, it would be destructive and unethical to inform them of their early history. Institutional Review Board approval was obtained for each wave of the study, and participants provided written or oral (for those with limited reading ability) informed consent. Individuals were compensated for their participation with a modest payment at each wave of the study.

## Measures

**Childhood neglect—**Childhood neglect was assessed through review of official records processed during the years 1967 to 1971. Neglect cases reflected a judgment that the

parents' deficiencies in child care were beyond those found acceptable by community and professional standards at the time. These cases represented physical neglect, that is, extreme failure to provide adequate food, clothing, shelter, and medical attention to children.

**Health indicators—**A medical status examination was performed by a licensed registered nurse (RN) in the participant's home or other quiet location of the person's choice. Each participant was provided with a copy of the measured health results and received by mail, a written interpretation of all test results reviewed by a licensed physician, along with recommendations for consultation with a health professional, if indicated.

A total of 45 milliliters of blood was collected for all the medical screens and assays. Nurses observed universal precautions during all draws, using standard venipuncture procedures, through a single venipuncture using a small gauge butterfly needle and multiple draw adapter. Routine blood work was performed at the University Hospital Pathology Laboratory, Newark, New Jersey. Nurses measured health outcomes (systolic and diastolic blood pressure, height, weight, and airway resistance). Per recommended guidelines (Shishehbor, Bhatt, & Topol, 2003), CRP was coded as *above normal* for 1 milligram/liter or higher and *normal* for below 1 milligram/liter.

Blood pressure was assessed with the participants seated and using standard blood pressure cuffs. The average of two assessments separated by about five minutes was used. Systolic and diastolic blood pressures were combined into an indicator of hypertension (yes/no), with *yes* defined as a participant's systolic blood pressure over 140 mmHG or diastolic over 90 mmHG.

Pulmonary functioning was assessed using a peak air flow meter (Respironics model # HS755). Height and sex were used to categorize the highest of three peak air flow meter readings (liters/minute): *low* (1) or *normal* or *high* (0). We use a dichotomous variable because clinical risk is calculated based on a participant's sex and height and, thus, the same reading could be considered an elevation for one participant but not another.

**Childhood family poverty—**Prior studies of family poverty have used either a single criterion (e.g., public assistance receipt; Eckenrode et al., 1993) or multiple separate variables (e.g., parental income, welfare receipt; Bright & Jonson-Reid, 2008). However, these approaches do not permit us to capture the range of information about childhood poverty characterizing our sample. Thus, a composite variable was developed using information collected during the 1989–1995 interview (Nikulina, Widom, & Czaja, 2011; Schuck & Widom, 2005). The childhood family poverty variable represented the average of two social (i.e., maternal and paternal levels of education) and four material (family's welfare receipt when the participant was a child, paternal and maternal employment, and growing up in a single-parent household vs. living with two parents until 18 years of age) poverty indicators. For inclusion in the analyses, at least two assessments of childhood family poverty were required: 625 people (93% of the sample) had data on at least two and 492 (73%) had data on at least four of six childhood family poverty variables. The childhood family poverty variables were standardized and averaged across the number of variables for

which each participant had data. The resulting composite is distributed, $M = .07$, range: −2 to 1.61, $SD = .63$.

**Neighborhood poverty—**Information from the 1970 U.S. Census was used as an indicator of neighborhood poverty (Nikulina et al., 2011; Schuck & Widom, 2005). Children were coded into 132 census tracts based on their 1967–1971 addresses. Because of the way cases and controls were selected and matched, many participants came from the same census tracts and, therefore, had the same data values for the neighborhood poverty variable. Six variables were used to create the childhood neighborhood poverty composite: percent of families in the tract living on public assistance, below the poverty line, in single-parent homes, in the same house for at least five years, and in owner-occupied homes; and percent of people with at least a college degree. All of the variables were coded in the direction of higher numbers indicating more poverty and scores were standardized ($M = 0$, $SD = 1.00$). Most (98.6%) of the tracts had information on all six variables. For the composite score, an average of the standardized indicators was calculated for each tract, $M = -.02$, $SD = .66$, range: −1.82 to 1.41, as used previously (Nikulina et al., 2011).

**Covariates—**We controlled for other factors (gender, smoking, hypertension medication, asthma, BMI or other pulmonary disease diagnoses) linked in the literature to these health outcomes and used information obtained concurrently with physical health in the 2003–2005 interviews. Smoking was defined as self-reported total pack years, i.e., the number of cigarettes smoked per day divided by 20 cigarettes per pack, multiplied by the number of years of smoking (Widom, Czaja, Bentley, et al., 2012). Participants also reported whether they take hypertension medication and whether a doctor has ever told them that they have asthma or another pulmonary disease. Body Mass Index was assessed by a registered nurse and calculated using weight in kilograms over squared height in meters. Weight was assessed using a digital scale (Bentley & Widom, 2009). Height was measured with the participant standing erect against a closed door or wall.

## Data Analyses

We first assessed preliminary relations among predictors and covariates using correlations and Chi-squares. Then, in order to assess whether each predictor is related to each outcome independently, bivariate relationships were examined between the independent variables (childhood neglect, race, gender, family and neighborhood poverty), covariates, and outcomes (indicators of adult health) through the use of correlations and odds ratios with SPSS version 20 (IBM, 2011). Because our goal is to examine the impact of the independent variables together, it is necessary to conduct multilevel models. Thus, to assess whether childhood neglect, poverty, and race are independent or interacting predictors of physical health, hierarchical linear models (HLM) were run. Because participants are nested within census tracts, the regression assumption of independence could be violated. HLM accounts for clustering of participants within childhood neighborhoods and was run with MPlus version 6 (Muthen & Muthen, 1998–2004).

To assess whether childhood neglect, race, childhood family poverty, and childhood neighborhood poverty predicted outcomes uniquely, all four predictors (and controls for age

and gender) were included in the same model. Within-level predictors included participant-level characteristics of childhood neglect, race, childhood family poverty, and controls. Childhood neighborhood poverty was a level 2, between-level predictor. Random intercepts were estimated in HLM as main effects.

To assess interactions between level 1 predictors of race, gender, neglect, and family poverty, interaction terms were created by multiplying the centered interacting predictors and entering them into the model after the main effects. To assess interactions with neighborhood poverty, random slopes were estimated to determine whether the relations between childhood neglect, gender, race, and childhood family poverty and outcomes varied by childhood neighborhood poverty.

Main effects models were first tested, then interactions were introduced sequentially and the fit of the models with the interactions was compared against that of the main effects models. As recommended (Kline, 2005), sequential, *a priori* determined, introduction of interactions was based on theoretical and conceptual consideration. First, level 1 variable (race, gender, family poverty) interactions with childhood neglect were entered, followed by level 1 variable interactions (gender and race) with family poverty, followed by the gender by race interaction. Level 2 interactions with neighborhood poverty and slopes of level 1 variables (neglect, family poverty, gender, race) were introduced last. At each point significant findings were retained and model fit assessed. As HLM with categorical outcomes and with random slopes are relatively new procedures, few indices are available to assess model fit (Muthen, 2009). Comparative fit indices (log likelihood difference testing) were used in the current study to compare relative fit of the models and determine which models best explain the data.

Finally, we included other covariates in our final models to see whether they changed the relations between predictors and outcomes. For CRP, we included BMI and smoking; for pulmonary functioning, we included a diagnosis of asthma or another pulmonary disorder and smoking. For hypertension, we included smoking, hypertension medication, and BMI.

## Results

Preliminary analyses in Table 1 show the bivariate associations between predictors and covariates. Table 2 presents the results of bivariate analyses of the relations between the predictors (childhood neglect, race, gender, and childhood family and neighborhood poverty) and covariates with each of the indicators of physical health (CRP, pulmonary functioning, and hypertension). Multivariate results are presented in Table 3. We report the results of each outcome separately.

### CRP

Based on bivariate analyses, Table 2 shows that family poverty predicted risk for elevated CRP. In multivariate HLM, the best-fit and most comprehensive model for CRP was a significantly better fit for the data than the original, main effects only model (results not shown; assessing main effects of childhood neglect, race, gender, family and neighborhood poverty without interactions; log likelihood difference test, $\chi^2$ (1) = 8, $p < .05$). We then

added controls for smoking and BMI and found that the model with controls (Table 3) was also a significantly better fit than the original model, although the effects of family poverty, neglect and their interactions did not change with the addition of these covariates. The final model (with all controls) indicates that CRP elevation is predicted by being Black. There was also a significant interaction of race and neglect. Among the White, but not Black participants the direction of the association was positive between neglect and CRP elevation, *OR* = 2.18, *95% CI* 1.29, 3.67. Childhood family and neighborhood poverty were not significant predictors of CRP elevation in multivariate analyses. Women were more likely to have elevated CRP.

### Pulmonary Functioning

Bivariate analyses revealed that only childhood neglect predicted out-of-range pulmonary functioning scores (Table 2). The final HLM model for out-of-range pulmonary functioning was a significantly better fit for the data than the original main effects model (not shown, log likelihood difference test, $\chi^2(4) = 12.28$, $p < .05$). We then added controls for smoking behavior and diagnoses of asthma or another pulmonary disorder to the model. The model with controls (Table 3) was also a significantly better fit for the data then the original main effects model, and the effects of childhood poverty (family and neighborhood), neglect, and race and their interactions did not change with addition of the controls. The final model revealed that childhood neglect was no longer a significant predictor of pulmonary functioning, although there was a significant interaction of childhood neighborhood and family poverty. For those growing up in lower poverty neighborhoods, but not in higher poverty neighborhoods, the association between family poverty and pulmonary functioning was positive ($B = .99$, $p < .10$). There was also a gender by race interaction: White women, but not Black women, were at increased risk for poor pulmonary functioning relative to men, *OR* = 5.22, 95% *CI* =1.14, 23.90.

### Hypertension

Table 2 also shows that being Black significantly predicted hypertension in bivariate analyses. In multivariate HLM, the best-fit most comprehensive model without controls (not shown) was a significantly better fit for the data than the main effects only model (not shown; log likelihood difference test, $\chi^2$ (2) = 5.42, $p < .05$), and the final model with controls for smoking, hypertension medication, and BMI was also a significantly better fit for the data than the main effects model (Table 3). A race by poverty interaction emerged and Blacks, but not Whites, growing up in childhood family poverty were at increased risk for hypertension, *OR* = 1.78, *95% CI* .97, 3.26. Being Black continued to remain a significant predictor of hypertension in multivariate analyses. Childhood neglect and neighborhood poverty did not predict hypertension in middle adulthood. Men were at increased risk for hypertension, compared to women.

## Discussion

Using data from a prospective cohort design study, we examined whether race, childhood neglect, and childhood family and neighborhood poverty predicted physical health in middle adulthood. These findings are the first from a prospective study that focuses on *childhood*

*neglect* and *adult* physical health indicators and illustrate the challenges of disentangling the contributions of different childhood experiences to adult health outcomes.

Our bivariate results showed that childhood neglect predicted poorer lung functioning 30 years later, childhood family poverty predicted elevated CRP, and being Black predicted hypertension. However, controlling for the effect of childhood neighborhood and examining the effects of childhood neglect, race, and childhood family poverty simultaneously, we found that these long-term health consequences were complex and more often the result of race and interactions between our predictor variables.

Although childhood neglect predicted poorer pulmonary functioning in bivariate models, we found that the effect of childhood neglect on pulmonary functioning disappeared with the inclusion of race, family poverty and neighborhood poverty, suggesting that this health outcome is better accounted for by childhood family and neighborhood poverty (which emerged as interacting factors). Additionally, there were no main effects of neglect in our multivariate results. These findings suggest that a participant's race needs to be considered when examining the long term health effects of childhood neglect, as we found that neglect predicted CRP elevation for Whites, not Blacks in our sample. Second, our findings indicate that in the context of other childhood factors, childhood neglect does not seem to uniquely place children at risk for long-term hypertension and pulmonary disease problems. One possibility is that these findings highlight the resilience of children experiencing neglect that does not show up in other studies without the controls that are included here. Future research should examine protective mechanisms for neglected children, particularly neglected children placed in foster care. About 60% of the neglected children in our sample were in foster care placements and it is possible that characteristics of good out-of-home placements had a protective effect that might have modified the potentially negative trajectories often seen in neglected children (Harden, 2004; Pollak et al., 2010).

It should be noted that this study is unusual in its prospective examination of the roles of childhood neglect, race, and childhood family and neighborhood poverty on adult health indicators, its use of an analytic strategy that permits one to look at children nested in neighborhoods, and where assessments are physical and not based on self-reports. These new results are interesting because a similar approach showed that childhood neglect had a unique and lasting influence on risk for mental health problems and arrest in adulthood (Nikulina et al., 2011).

Our findings are consistent with previous research indicating that childhood poverty has an influence on adult physical health outcomes (Adler & Rehkopf, 2008; Case et al., 2002) and extends that literature by highlighting the importance of interactions. In our multivariate results, childhood neighborhood poverty interacted with childhood family poverty to put children at risk for poor lung functioning at age 41. It was the children living in poor families in lower poverty neighborhoods that were at higher risk for poor lung functioning than the children living in higher poverty neighborhoods. While this is surprising on one level, one possible way to interpret this finding is to consider economic relative deprivation theory (Runciman, 1966; Turley, 2002). That is, relative deprivation theory postulates that it is the relative difference between the individual's poverty and the average of the community

in which s/he resides that is important for determining outcomes, in this case, physical health. Past research has linked relative deprivation in adulthood to health status in adulthood (Marmot & Smith, 1997; Pham-Kanter, 2009; Subramanyam, Kawachi, Berkman, & Subramanian, 2009). Our research links childhood poverty to adult health status. We also observed an interaction between family poverty and race, where Black children were at increased risk for hypertension if they grew up in family poverty but not White children.

These new findings provide further evidence that Black and White children appear to respond to adverse childhood environments in different ways. The current work builds on recent work (Widom, Czaja, Wilson, et al., 2012) suggesting that the risk for psychopathology and being arrested for Black and White children differs in response to neglect. These findings also build on prior studies that reported differences in the effects of socio-economic status for Whites and Blacks on physical health outcomes (Jackson, Triber, Turner, Davis, & Strong, 1999; Wickrama, Wickrama, & Bryant, 2006), although there is a need for more research into race differences in response to adversity.

In our study, race predicted CRP and hypertension elevations, despite controlling for neglect and childhood family and neighborhood poverty and their interactions. These findings suggest that growing up Black appears to put children at increased risk for adult health problems that cannot be explained by childhood family and neighborhood poverty and childhood neglect and their interactions. Other factors, perhaps associated with being a minority in the United States, may be contributing to this risk (Sanders-Phillips, Settles-Reaves, Walker, & Brownlow, 2009; Williams, 1999), although there is ongoing controversy and inconsistent findings in regard to the role of racism and discrimination in influencing a person's physical health (Brondolo, Love, Pencille, Schoenthaler, & Ogedegbe, 2011; Sanders-Phillips et al., 2009; Williams, 1999). Furthermore, other factors more proximal to our middle adulthood health assessment and factors that may differ by race, such as such as health risk behaviors (e.g. smoking, exercise;Fernander, Shavers, & Hammons, 2007; Kershaw, Mezuk, Abdou, Rafferty, & Jackson, 2010) and adult SES (Adler & Rehkopf, 2008; Hasnain-Wynia et al., 2010), may be responsible for the differences in CRP elevation and blood pressure reported here. Macro-level constructs such as barriers to access and utilization of preventative healthcare (Fiscella et al 2000; Fiscella et al, 2002) may also explain the racial disparities in health assessments observed here.

In conclusion, our findings suggest the importance of a participant's race in contributing to poor health outcomes, even beyond the risk explained by childhood neglect and childhood poverty in the family and neighborhood. A recent review by Williams and colleagues (2010) underscored the importance of studying complex associations of SES with race, beyond simply controlling for SES when studying race effects. The results of our study reinforce this conclusion by highlighting the importance of interactions among these factors. Clearly, more research is needed to disentangle these complex relationships and multiple influences on physical health and development from childhood into adulthood.

Although not the primary focus of the current study, gender differences were observed in the prediction of all outcomes. Women in our sample displayed higher levels of CRP, a risk factor for cardiac and inflammation problems, whereas men were at increased risk for

hypertension. These findings are consistent with other studies assessing cardiac risk profiles for men and women (Leuzzi et al., 2010; Rollini, Mfeukeu, & Modena, 2009). Race interacted with gender to predict poorer peak airflow functioning, suggesting that White women were at higher risk for problems in pulmonary output compared to White men, whereas no difference in peak air flow was found between Black men and women. Women have been shown to be more likely to develop peak air flow irregularities in response to air pollution (Oftedal et al., 2008) and to have a diagnosis of asthma (Kynyk, Mastronarde, & McCallister, 2011). Sex hormones have also been implicated in the observed gender differences in physical health overall, however, the causes remain largely unclear (Kynyk et al., 2011; Leuzzi et al., 2010).

Despite the numerous strengths of the current study, limitations need to be acknowledged. The findings of the current study are based on cases of childhood neglect drawn from official court records and, thus, most likely represent the most extreme cases processed in the system (Groeneveld & Giovannoni, 1977). This means that these findings are not generalizable to unreported or unsubstantiated cases of child neglect (Widom, 1989b). Because these official cases of childhood neglect are skewed toward the lower end of the socioeconomic spectrum, these findings cannot be generalized to neglect that occurs in middle- or upper-class children and their families. Consequences of childhood neglect for upper or middle class children may be different from children in the current study (Widom, 2000). The current findings also represent the experiences of children growing up in the late 1960s and early 1970s in the Midwest part of the United States. It is possible that children neglected at a later time may manifest different consequences.

Finally, the current research demonstrates the importance of considering contextual factors when studying consequences of childhood neglect and poverty. All four factors (childhood neglect, childhood family and neighborhood poverty, and race) are important for physical health in adulthood and, most importantly, interact. This research highlights the importance of targeting childhood adversities (both at the family and neighborhood level) and of recognizing that there may be different consequences for neglected children of different races. These findings also suggest that poor adulthood health can be linked to experiences in childhood and that early interventions may be warranted to prevent the onset of negative physical health outcomes.

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## Table 1

Bivariate relations among predictors and covariates.

| | Predictor Variables | | | |
|---|---|---|---|---|
| | **Group (neglect)** | **Neighborhood Poverty** | **Family Poverty** | **Race (Black)** |
| **Predictors** | | | | |
| Gender (Female) | $X^2$ (1) = .51 | $r$ = −.03 | $r$= .02 | $X^2$ (1) = .72 |
| Group (Neglect) | | $r$ = .12*** | $r$ = .37*** | $X^2$ (1) = .17 |
| Neighborhood Poverty | | | r= .40*** | r = .38*** |
| Family Poverty | | | | $r$ = .09* |
| **Covariates** | | | | |
| Age | $r$ = −.01 | $r$ = .13** | $r$ = .05 | $r$ = .06 |
| Smoking | $r$ = .09* | $r$ = −.04 | $r$ = .13** | $r$ = −.27** |
| BMI | $r$ = .02 | $r$ = .10* | $r$ = .08* | $r$ = .06 |
| Asthma diagnosis | $X^2$ (1) = 1.73 | $r$ = −.01 | $r$ = .04 | $X^2$ (1) = 3.37 |
| Other pulmonary diagnosis | $X^2$ (1) = 9.05**[a] | $r$ = .01 | $r$ = .08* | $X^2$ (1) = .32 |
| Hypertension medications | $X^2$ (1) = .79 | $r$ = .03 | $r$= .05 | $X^2$ (1) = 4.34*[a] |

Note: $r$ = bivariate correlation; $X^2$ = chi square;

[a] higher percentage among Blacks or in the neglect group;

* p < 0.05;

** p < 0.01;

*** p < 0.001

## Table 2

Bivariate relations of predictors and covariates with physical health indicators in adulthood.

| | CRP[c] (*N*=528) | | Pulmonary Functioning[c] (*N* =574) | | Hypertension (N= 574) | |
|---|---|---|---|---|---|---|
| | **%** | ***OR* (95% CI)** | **%** | ***OR (95% CI)*** | **%** | ***OR (95% CI)*** |
| Group | | | | | | |
| Neglect | 25.0 | 1.23 (.83,1.84) | 4.6 | 3.23 (1.05, 9.95)* | 28.4 | .91 (.64, 1.34) |
| Control | 29.0 | | 1.5 | | 30.3 | |
| Race | | | | | | |
| Black | 32.0 | 1.40 (.94, 2.00)*t* | 2.3 | .63 (.22,1.79) | 36.3 | 1.70 (1.18, 2.46)** |
| White | 25.0 | | 3.6 | | 25.1 | |
| Gender | | | | | | |
| Male | 21 | 1.82 (1.23, 2.69)** | 2.3 | 1.69 (.63, 4.58) | 35.6 | .57 (.40, .82)** |
| Female | 33 | | 3.8 | | 24.0 | |
| | ***Correlations (r)*** | | | | | |
| Family Poverty | .12** | | .06 | | .00 | |
| Neighborhood Poverty | .09*t* | | .04 | | .03 | |
| **Covariates** | ***Correlations (r) & Chi – Squares ($X^2$)*** | | | | | |
| Age | *r* = .09 | | *r* = .12** | | *r* = .14** | |
| Smoking | *r* = .02 | | *r* = .06 | | *r* = −.09* | |
| BMI | *r* = .32** | | *r* = −.07 | | *r* = .19*** | |
| Asthma diagnosis | $X^2$ (1) = 11.00***a* | | $X^2$ (1) = 5.51**a* | | $X^2$ (1) =8.50***b* | |
| Other pulmonary diagnosis | $X^2$ (1) = 5.21**a* | | $X^2$ (1) = .72 | | $X^2$ (1) = 10.17***b* | |
| Hypertension medications | $X^2$ (1) = 3.06 | | $X^2$ (1) = .09 | | $X^2$ (1) = 15.95****a* | |

Note: *OR*= odds ratios; *CI*= confidence intervals; *M*= mean; *SD*= standard deviation; t = t test value

*a* higher percentage among those participants with “out of range functioning” CRP, pulmonary functioning or hypertension;

*b* higher percentage among those with “in range” functioning on CRP, pulmonary functioning or hypertension;

*c* Results are for “out of range” CRP and pulmonary functioning;

* p < 0.05;

** p < 0.01;

*** p < 0.001;

*t* p < .10;

**Table 3**

Hierarchical Linear Models of childhood neglect, race, family and neighborhood poverty and their interactions predicting C-reactive protein, pulmonary functioning, and hypertension.

| C-Reactive Protein (CRP) | | Pulmonary Functioning (PF) | | Hypertension | |
|---|---|---|---|---|---|
| **Fixed Effects** | | **Fixed Effects** | | **Fixed Effects** | |
| **Level 1** | ***OR (95% CI)*** | **Level 1** | ***OR (95% CI)*** | **Level 1** | ***OR (95% CI)*** |
| Age | 1.04 (.98, 1.11) | Age | $1.21^{**}$ (1.06, 1.36) | Age | $1.10^{***}$ (1.05, 1.16) |
| Female | $1.74^{*}$ (1.16, 2.69) | Female | .59 (.05, 6.50) | Female | $.39^{***}$ (.26, .60) |
| Black | $2.68^{**}$ (1.38, 5.19) | Black | 3.11 (.45, 19.52) | Black | $1.51^{*}$ (1.0, 2.27) |
| Neglect | $1.68^{t}$ (.96, 3.08) | Neglect | .58 (.07, 4.72) | Neglect | 1.07 (.73, 1.56) |
| Family poverty | $1.44^{t}$ (.97, 2.12) | Smoking | 3.18 (.73, 13.92) | Family poverty | $.67^{t}$ (.44, 1.02) |
| Smoking | 1.02 (.97, 1.03) | Diagnosis of asthma | 1.75 (.55, 5.59) | Smoking | .99 (.97, 1.0) |
| BMI | $1.10^{***}$ (1.07, 1.13) | Diagnosis of other pulmonary disorder | .85 (.26, 2.75) | Hypertension meds. | $2.13^{**}$ (1.30, 3.82) |
| Race by Neglect | $.39^{*}$ (.18, 86) | Neglect by gender | $13.49^{t}$ (.84, 215.8) | BMI | $1.06^{***}$ (1.03, 1.08) |
| **Level 2** | ***B* (*95% CI*)** | Race by gender | $.05^{*}$ (.00, .78) | Race by family poverty | $2.57^{**}$ (1.38, 4.78) |
| Neighborhood poverty on CRP | −.07 (−.40, .21) | **Level 2** | ***B* (*95% CI*)** | **Level 2** | ***B* (*95% CI*)** |
| | | Neighborhood poverty on PF | $1.11^{**}$ (.27, 1.81) | Neighborhood poverty on hypertension | −.14 (−.46, .18) |
| | | Neighborhood poverty on slope of family poverty | $-1.87^{*}$ (−3.4, −.5) | | |
| **Random Effects** | | **Random Effects** | | **Random Effects** | |
| **Level 2** | | **Level 2** | | **Level 2** | |
| Thresholds/intercept | $4.96^{***}$ | Thresholds/intercept of slope | .77 | Thresholds/intercept | $2.600^{***}$ |
| Residual variance | .00 | Thresholds/intercept of PF | $5.75^{***}$ | Residual variance | .00 |
| | | Slope residual variance | $.003^{*}$ | | |
| | | Residual variance PF | $1.22^{t}$ | | |
| **Fit Statistics** | | **Fit Statistics** | | **Fit Statistics** | |
| AIC | 515.46 | AIC | 146.85 | AIC | 614.92 |

| C-Reactive Protein (CRP) | | Pulmonary Functioning (PF) | | Hypertension | |
|---|---|---|---|---|---|
| BIC | 561.51 | BIC | 210.34 | BIC | 662.11 |
| Log likelihood difference | 50*** | Log likelihood difference | 14.07* | Log likelihood difference | 26.49*** |
| Number of participants | 486 | Number of participants | 509 | Number of participants | 539 |
| Number of neighborhoods | 122 | Number of neighborhoods | 127 | Number of neighborhoods | 128 |

Note: Log likelihood difference test= difference from original main effects model (not shown); *OR* =odds ratios; *B*= unstandardized coefficient; *CI* = confidence interval;

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$;

$^{t}p < .10$