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# The Complex Interplay of Adverse Childhood Experiences, Race, and Income

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An extensive research base shows evidence of racial disparities in health outcomes, and a growing body of evidence points to associations between adverse childhood experiences (ACEs) and poor health. This study uses data from the 2011 and 2012 Wisconsin Behavioral Risk Factor Surveillance System surveys to identify the relative contributions of ACEs, race, and adult income to predicting three sets of adverse adult health outcomes. The authors found that controlling for demographic factors, ACEs strongly predict health risk behaviors, indicators of poor general health, and chronic health conditions. Adult low-income status is associated with poor general health and chronic health conditions, but not health risk behaviors. African American race is marginally associated only with indicators of poor general health, and this association is attenuated when ACEs and adult income are controlled. These findings suggest a complex interplay among ACEs, race, and income.

KEY WORDS: *childhood trauma; health disparities; income; race*

The Adverse Childhood Experiences (ACEs) Study and related research on toxic stress during childhood has provided significant evidence to support associations between childhood adversity and adult chronic disease, high-risk health behaviors, mental health problems, and early death (Felitti et al., 1998). An ACE is a potentially traumatic experience that occurs before the age of 18, such as enduring child physical or sexual abuse; having a household member who was incarcerated, who was mentally ill, or who abused drugs or alcohol; or being exposed to domestic violence or parental divorce. ACEs have been associated with many physical health issues, including asthma, cancer, cardiovascular disease, hypertension, chronic obstructive pulmonary disease (COPD), diabetes, and premature death (Anda, Brown, Dube, et al., 2008; Brown et al., 2010, 2009; Brown, Young, Anda, Felitti, & Giles, 2006; Chartier, Walker, & Naimark, 2010; Corso, Edwards, Fang, & Mercy, 2008; Edwards et al., 2005; Felitti, 2002; Felitti & Anda, 2008). Individuals reporting ACEs are also more likely to engage in risky behaviors, such as smoking, substance use, and sexual promiscuity, all of which can lead to deleterious physical and mental health outcomes (Anda, Brown, Felitti, Dube, & Giles, 2008; Anda et al., 2007; Chapman, Dube, & Anda, 2007; Chartier et al., 2010; Edwards, Anda, Gu, Dube, & Felitti, 2007;

Kendall-Tackett, 2002; Rothman, Edwards, Heeren, & Hingson, 2008).

A related line of research suggests that prolonged exposure to toxic stress in childhood is associated with changes in brain architecture, which in turn heighten the risk of engaging in risky behaviors that can lead to a host of negative physical and mental health outcomes (Evans, 2003; Shonkoff & Garner, 2012). The emerging field of epigenetics has also contributed considerably to the growing knowledge of the impact of early experiences and toxic stress on genetic inclinations and adult health outcomes (Baylin & Schuebel, 2007; McEwen & Seeman, 1999; Shonkoff & Garner, 2012). ACEs are hypothesized to influence health over the life course. Specifically, ACEs can lead to assaults on neurodevelopmental trajectories, which in turn influence cognitive and socioemotional abilities associated with learning and the capacity to form healthy relationships. As a child ages, disadvantages in these developmental areas increase the likelihood of engaging in health risk behaviors and being exposed to unsafe circumstances, which then heighten the odds of poor health outcomes into adulthood.

The incidence of ACEs has been shown to vary significantly by race. Most commonly, black adults report experiencing ACEs at a higher rate than white adults (Gjelsvik, Dumont, Nunn, & Rosen, 2014;

Public Health Management Corporation, 2013; Reinert, Campbell, Bandeen-Roche, Sharps, & Lee, 2015). Other research has shown that adults who experienced ACEs differ, by race, in the types of health problems they experience as adults (Gjelsvik, Dumont, & Nunn, 2013), as well as in the strength of the associations between ACEs and adult health outcomes (Jackson, Knight, & Rafferty, 2010).

In addition to the growing body of research on ACEs and their link to disparities in health, an extensive body of research has documented health disparities by race, attributed at least partially to socioeconomic differences by race (Adler & Rehkopf, 2008; Jackson et al., 2010; Nazroo, 2003; Shonkoff & Garner, 2012; Williams & Jackson, 2005). In addition, research has shown a link between low socioeconomic status (SES) and physical health outcomes (Adler & Rehkopf, 2008; Adler & Stewart, 2010; Shavers, 2007). Braveman and Egerter (2008) showed that adults in poverty are five times more likely to report fair or poor health compared with those with higher incomes. Adler and Stewart (2010) argued that there is a greater difference in health outcomes by SES than by race, and other researchers have shown that low SES is the most important source of racial differences in health outcomes (Hayward, Crimmins, Miles, & Yang, 2000).

What has been missing from both the health equity research and the ACE studies is an attempt to focus on the relative contributions of race, income, and ACEs in models predicting adult health outcomes. A search of Google Scholar using the terms “adverse childhood experiences” or “ACE” and race/racial variation/differences identified a few studies that explored associations between cumulative ACEs and adult health outcomes, controlling for both race and income. Only one study, however, moved beyond simply controlling for race and income (or a proxy for income) to try to unpack these relationships. Reinert and colleagues (2015) found that the association between ACEs and both mental and physical health outcomes is stronger for white respondents than for black respondents, and when controlling for income, these associations lose statistical significance only for black respondents. To continue to understand the nature of health inequities, it is important to investigate more deeply the role that childhood adversity plays in contributing to negative health outcomes attending to both race and income. Although this analysis is purely descriptive

in nature, it represents a contribution toward understanding whether and how childhood adversity may play a role in explaining racial disparities in adult health problems.

## METHOD

### Sample

States and U.S. territories use the Behavioral Risk Factor Surveillance System (BRFSS), a nationwide health surveillance system, to collect data on a range of general and chronic health conditions as well as risk factors, including, in some states, data on ACEs. Data are collected annually by telephone surveys of the adult population, with a total of 500,000 interviews completed nationally in 2011 and 2012. The present analysis focuses on these two combined years of data collected on the adult population in Wisconsin as part of the BRFSS. Although the BRFSS has been conducted since 1984, 2011 was the first year that data collection included cell phone numbers, thus making it possible to capture a broader sample of Wisconsin residents. In total, 9,039 Wisconsin residents from varying geographical locations across the state, income levels, and races and ethnicities were surveyed.

The BRFSS data have some limitations with respect to their generalizability. Specifically, the data do not include information on some of the most disadvantaged Wisconsin residents, including people who are homeless, incarcerated, or institutionalized or who lack a landline or cell phone. Moreover, nearly 15 percent of respondents did not complete the ACE portion of the survey, resulting in an effective sample size of 7,780. Those who did not respond to the ACE questions are, on average, more socioeconomically disadvantaged. As a result of these limitations, the findings presented in this analysis may underestimate the prevalence of ACEs in the state and potentially bias the observed associations between ACEs and adult health.

The Wisconsin BRFSS survey also captures a small (albeit representative) number of respondents who are Asian and Native American or some from minority ethnic groups, including Latino respondents. These population subgroups were too small to yield reliable statistical estimates in multivariate analyses. Thus, the present analysis focuses on how ACE–adult health associations differ for black and white respondents only.

## Measures

Table 1 provides an overview of each ACE included in the BRFSS survey, along with the percentage of the Wisconsin combined 2011 and 2012 samples that reported each ACE. The present analysis focuses on a count of the number of ACEs rather than specific ACE types. This approach has been used in a number of studies and has been shown to be a more robust predictor of adult health outcomes than reliance on any one type of ACE (Anda et al., 2007; Anda, Brown, Dube, et al., 2008; Anda, Brown, Felitti, et al., 2008; Edwards et al., 2005). Just under a quarter of respondents (23.7 percent) reported only one ACE, 22.3 percent reported two or three ACEs, and 16.1 percent reported four or more ACEs (approximately 38 percent reported no ACEs).

The dependent variables are three dichotomous adult health indicators: health risk behaviors, general poor health, and chronic or severe illness. Specifically, health risk behaviors include tobacco use, binge drinking, behaviors that put one at risk for HIV infection, failure to wear a seat belt when in a vehicle, lack of exercise, and failure to attend regular medical checkups. General poor health outcomes refer to health concerns that, while considered adverse, are not particularly anomalous. This includes being obese, reporting over 10 bad mental health days in the past month, reporting over 10 bad physical health days in the past month, having lost permanent teeth or had them removed, and rating one's overall health as "fair" or "poor." Chronic or

severe illnesses include kidney disease, stroke, angina, cancer, COPD, asthma, adult-onset diabetes, arthritis, and memory loss. From each item within the health risk behavior and general poor health indicators, summary scores were created. Respondents were coded as "high risk" (and thus assigned a "1" on the relevant dichotomous outcome) if their scores fell into the top 20 percent of all respondents for each of these two indicators. Chronic illness is measured by whether respondents report any of the previously listed chronic conditions (coded as "1") compared with none of them.

Key independent variables of interest in this analysis were ACEs, race, and adult income status. ACEs are operationalized as three dichotomous variables representing different numbers of ACEs (that is, one ACE, two to three ACEs, four or more ACEs), in which no ACEs constitute the reference category. Race was classified using self-reported information from respondents. Respondents who identified as black were classified accordingly for this measure and assigned a "1" (respondents who identified their race as white constitute the reference category). Six percent of the sample reported their race as black. Respondents were also asked to report their overall annual income from all sources by ascribing to the most relevant income range provided in the BRFSS survey. Just over a quarter of the sample reported an annual income under \$25,000 (reference group = \$25,000 or over). Different strategies for operationalizing income were

**Table 1: Adverse Childhood Experience (ACE) Measures and Prevalence**

ACE	Measure	% Indicated
Domestic violence	How often did your parents or adults in your home ever slap, hit, kick, punch, or beat each other up?	15.8
Physical abuse	Before age 18, how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking. Would you say—	16.3
Emotional abuse	How often did a parent or adult in your home ever swear at you, insult you, or put you down?	38.1
Sexual abuse <sup>a</sup>	How often did anyone at least five years older than you or an adult ever touch you sexually?	10.2
	How often did anyone at least five years older than you or an adult try to make you touch them sexually?	
	How often did anyone at least five years older than you or an adult force you to have sex?	
Mental illness	Did you live with anyone who was depressed, mentally ill, or suicidal?	15.2
Alcohol abuse	Did you live with anyone who was a problem drinker or alcoholic?	23.6
Drug use	Did you live with anyone who used illegal street drugs or who abused prescription medications?	9.5
Incarceration	Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?	7.2
Divorce/separation	Were your parents separated or divorced?	23.9

<sup>a</sup>The sexual abuse ACE item is assigned a 1 if any of the three items occurred once or more; 0 = never on all sexual abuse items. All other items are assigned a 1 if they ever occurred during childhood.

tried but did not generate meaningful differences in results.

Control variables included a number of dichotomized demographic characteristics: respondent gender (male = 1), age (dichotomized as 18 to 34 [reference group], 35 to 49, 50 to 64, 65 and above), number of children (no children [reference group], one child, two or more children), marital status (never married [reference group], married, divorced or separated, widowed), and education level (less than high school education, high school degree only [reference group], more than high school education). Finally, a dichotomous indicator of the survey year was included (assigned a “1” for 2012; reference group = 2011).

Table 2 presents select population point estimates for the analysis sample by race and by income level. Black respondents were more likely to report high health risk behaviors and negative general health outcomes but were no less likely to report having a chronic health condition. This last finding may be influenced by the sample composition, because there were over three times as many white respondents as black respondents over the age of 65. Those with incomes less than or equal to \$25,000 were more likely to have negative outcomes for all three adult health indicators than those with incomes greater than \$25,000. Black respondents and those with lower incomes were more likely to report four or more ACEs than white respondents and those with higher incomes, respectively. Black respondents were nearly four times more likely to have lower incomes than white respondents. Together, these associations suggest a complex relationship between ACEs and adult health, which may be influenced by race and adult income level.

## Analysis

Logistic regression was used to model each of the three health outcomes. Logit coefficients are shown in exponentiated form. Initial models exclude the dichotomous variables for ACE counts and adult income, but include dichotomous control variables for race and other demographic characteristics. Final models include ACE and income variables, as well as demographic controls.

## Findings

Table 3 presents the results of logistic regression models. In the first models for each health outcome, race is marginally associated with poor general health, controlling for other demographic characteristics. Specifically, black respondents were 51 percent more likely to have one or more indicators of poor general health compared with those of white respondents. Black and white respondents have an equivalent rate of health risk behaviors and chronic health conditions, controlling for ACEs and other demographic characteristics.

In the second models for each health outcome, the ACE count has a relatively linear and statistically significant effect. For example, in the model for health risk behaviors, individuals with one ACE were 26 percent more likely ( $p < .10$ ) to report high levels of health risk behaviors than those with no reported ACEs; those with two to three ACEs were 56 percent more likely ( $p < .001$ ), and those with four or more ACEs were 131 percent more likely ( $p < .001$ ) to do so compared with individuals with no reported ACEs. This linear pattern is also evident in the models for general health and severe or chronic conditions. With respect to adult income, respondents with

**Table 2: Descriptive Statistics (N = 7,779)**

Variable	White	Black	Statistical Significance Level	Income > 25K	Income < 25K	Statistical Significance Level
Risk behavior	21.52	30.42	**	18.86	31.30	****
General poor health	9.84	16.77	**	6.14	22.23	****
Chronic condition	44.93	43.88		40.12	58.88	****
Black				3.34	12.13	****
0 ACEs	38.97	20.77	****	39.88	32.29	***
1 ACE	23.96	18.27	*	24.94	19.83	***
2–3 ACEs	22.04	27.15		21.51	24.72	*
4 + ACEs	15.03	33.80	****	13.67	23.16	****
Income < \$25,000	23.58	55.23	****			

Note: ACE = adverse childhood experience.  
\* $p < .1$ . \*\* $p < .05$ . \*\*\* $p < .01$ . \*\*\*\* $p < .001$ .

**Table 3: Logistic Regression Models Predicting Health Outcomes (N = 7,779)**

Variable	Risk Behavior		General Poor Health		Chronic Condition	
	1	2	1	2	1	2
Black	0.96 (0.21)	0.80 (0.18)	1.51* (0.37)	1.18 (0.29)	1.21 (0.23)	0.94 (0.17)
1 ACE		1.26* (0.15)		1.53*** (0.24)		1.59**** (0.15)
2–3 ACEs		1.56**** (0.19)		2.05**** (0.31)		1.87**** (0.19)
4 + ACEs		2.31**** (0.30)		3.53**** (0.58)		3.10**** (0.38)
Income < \$25,000		1.45**** (0.16)		3.27**** (0.43)		2.12**** (0.22)

Note: Exponentiated coefficients; standard errors in parentheses. Controls (not shown) for respondent age, gender, marital status, education level, number of children, and Behavioral Risk Factor Surveillance System survey year. ACE = adverse childhood experience.

\* $p < .1$ . \*\* $p < .05$ . \*\*\* $p < .01$ . \*\*\*\* $p < .001$ .

incomes under \$25,000 were significantly more likely to report high levels of health risk behaviors and general health problems, as well as the presence of a chronic health condition. Specifically, those with incomes under \$25,000 were 45 percent more likely to engage in health risk behaviors, 227 percent more likely to report poor general health, and 112 percent more likely to report a severe or chronic condition than those with higher incomes.

When ACEs and income are controlled simultaneously, race loses statistical significance in its marginal association with poor general health, and the associations between race and both health risk behaviors and chronic health conditions are attenuated. Additional models (not shown) were analyzed in which controls for ACEs were added while excluding adult income and in which adult income was added while excluding ACEs. This afforded an assessment of whether ACEs or adult income contributed more to explaining the association between race and general health status. The inclusion of ACEs and of adult income, separately, each reduced the strength of the association between race and general health, but statistical significance of this association was lost in the model that included only adult income.

In the second models, several control variables (not shown) also exhibit statistically significant relationships with one or more health outcomes. Men have a higher likelihood of health risk behaviors and a lower likelihood of severe or chronic conditions than women but are not statistically different than women in their risk for general health problems. Compared with respondents under 35 years of age,

older respondents have an increased risk of general health problems and severe or chronic conditions that increases linearly with age. Conversely, respondents 50 years of age and older are less likely to report high levels of health risk behaviors than respondents under 35 years of age. In the final models, married respondents are less likely than respondents who have never married to report high levels of health risk behaviors, and widowed respondents are more likely than respondents who have never married to score high on indicators of general poor health. Those with more than a high school education are less likely to report high levels of health risk behaviors than respondents with only a high school education, whereas respondents with less than a high school degree are more likely to report poor general health and the presence of a chronic condition than respondents with only a high school education. Finally, respondents to the 2012 BRFSS survey were slightly less likely to report high levels of health risk behaviors than respondents to the 2011 BRFSS survey.

## DISCUSSION

A key finding of this analysis is that despite the extensive literature on health disparities by race, black adults who responded to the Wisconsin BRFSS survey are no more likely than white adults to report high levels of health risk behaviors and severe or chronic health conditions once other demographic characteristics are controlled. Black adults are initially marginally more likely than white adults to report higher rates of poor general health; however, this finding loses statistical significance when adult income and ACE variables are controlled.

One possible explanation for this finding is that past research pointing to strong health disparities by race have failed to account for childhood experiences that could be partially driving observed associations between race and health. Indeed, black respondents to the BRFSS ACE module exhibit significantly higher rates of ACEs overall, and ACEs in and of themselves are associated with poorer health outcomes in the sample. Thus, models predicting health outcomes that fail to control for ACEs would likely overestimate coefficients associated with race. This may be the case for poor general health status in our analysis, and although the associations between race and both poor general health and chronic conditions are not statistically significant in the initial models, the inclusion of ACE and income controls somewhat attenuates these associations. Although this sample is more heavily made up of older white respondents than older black respondents (which could account for bivariate differences in rates of severe or chronic conditions), black respondents were no more likely than white respondents to report severe or chronic conditions, even when controlling for age and other demographic characteristics. This same phenomenon was observed for health risk behaviors. These findings for risk behaviors and chronic conditions run counter to the extant literature.

In supplemental analyses (not shown), we added in each demographic variable separately to models predicting health risk behaviors controlling only for race. In bivariate logistic models, black respondents are more likely to report health risk behaviors than white respondents. Only when the marital status variables were added to the model did the coefficient for race lose statistical significance, suggesting that marital status was confounding the observed association between race and health risk behaviors. In supplemental analyses for chronic health conditions, we correlated individual health conditions with race and found that reporting one's race as black was negatively associated with having cancer but positively associated or unassociated with other chronic conditions. Among all respondents who reported having cancer, skin cancer was the most common type and was more prevalent among white respondents. We then ran the final multiple regression model for severe or chronic conditions excluding skin cancer and found that black respondents were indeed more likely to report chronic conditions under this scenario (although the coefficient

was statistically insignificant). This finding is more in line with the existing literature.

Another key finding from our analyses is that ACEs have a consistent and strong association with all three poor health outcomes that increases with the number of ACEs. This finding is consistent with past research that has shown an increasing impact of the number of ACEs experienced on an array of adult health outcomes. The pathways by which this association arises are not clear, although it has been theorized that the cumulative load of multiple ACEs may tax the stress response system in ways that weaken physiological functioning, leaving our bodies more susceptible to illness (Evans, 2003; McEwen & Seeman 1999). The finding that the number of ACEs is strongly associated with all three health outcomes in the present study suggests that there may be both physiological and behavioral mechanisms at work.

A third notable finding is that income level is a strong predictor of all three health outcomes (increased odds of 45 percent to 227 percent), controlling for ACEs and other sociodemographic characteristics. Poverty has long been targeted as a potential explanatory factor for racial disparities in health outcomes, given the disproportionate share of black residents of the United States who have low incomes. In 2013 black Americans had over twice the poverty rate of white Americans (De Navas-Walt & Proctor, 2014). However, it has not yet been fully explored whether the association between low income and poor health outcomes is influenced by the presence of ACEs. In our models, income was strongly associated with all three health outcomes independent of ACEs.

There are several limitations to this analysis. First, although the study of ACEs has relied on multiple measures that capture a range of different adverse experiences during childhood, the ACE measures in the BRFSS are not exhaustive and omit experiences that could have a profound impact on health, such as a parent's death, community violence, and severe childhood neglect. Second, the measurement strategies for ACEs included in the models are, in some cases, quite crude. This may have contributed to inaccurate reporting on the part of respondents to the BRFSS. Relatedly, there may have been some reluctance to report the occurrence of one or more ACEs regardless of the specificity of the measures, given the sensitive nature of these childhood experiences. Third, as described in the Method section, the

Wisconsin BRFSS methodology has limitations that could affect the generalizability of findings. Fourth, only 6 percent of the Wisconsin BRFSS sample respondents identified their race as black, and there were too few sample members who identified as other than black or white to explore the roles of ACEs and adult income in health outcomes for a broader range of racial or ethnic groups. Fifth, the relationships described in this analysis are purely descriptive and should not be interpreted as causally determined. Finally, the results from this study do not tease out the mechanisms by which ACEs lead to elevated risk of poor health outcomes in adulthood. In this study, we focused on race and adult income and their associations with adult health indicators. However, it is important to understand in future research whether childhood income and poverty status, in conjunction with ACEs, better explains the emergence of health outcomes, many of which may have their roots in childhood. Future research that relies on more generalizable samples followed from childhood into adulthood, and a broader set of ACE measures, may shed further light on complex relationships among race, income, and health and the mechanisms that undergird these relationships.

## CONCLUSION

This study attempts to explore racial disparities in health outcomes as a function of both ACEs and adult income status. We did not find disparities by race in terms of health risk behaviors or severe or chronic conditions, before or after controlling for ACEs and adult income. However, we did find that black respondents to the Wisconsin BRFSS were more likely to report poor general health than white respondents and that this association became statistically insignificant when controlling for both ACEs and low-income levels. This finding suggests that ACEs and adult income may partially mediate the relationship between race and health, at least for some health outcomes. We also found that ACEs and low-income status have independent effects on multiple health outcomes.

Several recommendations stem from this analysis. First, other states should consider including the optional ACE module in their annual BRFSS survey and conduct analyses that focus on race, income, and ACEs in models predicting adult health outcomes. It is important to learn whether the patterns observed in the Wisconsin data hold true for other states. Second, social work practitioners in health

care settings require tools for assessing ACEs and for assisting clients with connecting to resources and treatment services designed to address the impact of past trauma, given its potential link to current and future health problems. Third, because ACEs have implications not only for health outcomes but also for risk behaviors that come to the attention of numerous social welfare systems, efforts to develop community capacity for systematically addressing ACEs may be needed. Models for developing and implementing such capacity exist, and quasi-experimental research suggests that they are associated with declines in community-level rates of reported ACEs (Hall, Porter, Longhi, Becker-Green, & Dreyfus, 2012). Fourth, given the consistent and strong inverse association between income and poor health outcomes in our own analysis as well as the extant literature, it is important to consider the role of economic support interventions not only for their ability to influence family stability, but also for their potential to mitigate adverse health trajectories. Finally, it is hoped that the results from this investigation and future efforts to replicate and expand on its findings will help motivate position statements by professional social work groups and organizations, with an emphasis on actionable steps to address the profound impact of ACEs on the well-being of individuals across the life course and their contributions to health inequities. **HSW**

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