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Childhood Adversity and Depression in Young Adults: Associations by Sex and Race/Ethnicity

By

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Master of Public Health

Epidemiology

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Childhood Adversity and Depression in Young Adults: Associations by Sex and Race/Ethnicity

By

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Bachelor of Arts
The University of North Carolina at Chapel Hill
2014

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Abstract

Childhood Adversity and Depression in Young Adults:
Associations by Sex and Race/Ethnicity
By Katelyn Chiang

Background: Nearly six in ten adults in the United States have reported exposure to at least one adverse childhood experience. Childhood adversity exposure varies by sex, race/ethnicity, and educational attainment and is associated with increased risk of health outcomes such as substance abuse, cardiovascular disease, and depression. Some children may be less resilient to childhood adversity and more vulnerable to these negative consequences than others. Studies examining the relationship between childhood adversity and adult depression by racial and ethnic groups have found disparate results.

Objective: To estimate the effect of childhood adversity on depressive symptomology in young adulthood and determine if this association differs by sex and race/ethnicity.

Methods: Participants enrolled in the National Longitudinal Study of Adolescent to Adult Health (N=7,071) reported exposure to childhood adversity during three time points in adolescence and young adulthood and also completed a modified Center for Epidemiologic Studies Depression Scale during young adulthood. A cumulative childhood adversity score was assessed from a summation of reported adverse maltreatment, neglect, and family dysfunction experiences. High depression symptomology was characterized as CES-D scores of 11 or greater.

Results: After adjusting for covariates, experience of four or more childhood adversities was associated with a nearly 2-fold increase in prevalence of depressive symptomology in young adulthood (PR=1.94, 95% CI: 1.51, 2.50). Results indicate a threshold effect and dose response relationship. Neither sex by childhood adversity nor race/ethnicity by childhood adversity interactions reached statistical significance. However, results indicate non-Hispanic white and non-Hispanic Asian participants exposed to four or more childhood adversities have elevated prevalence of high depressive symptomology (PR=2.01, 95% CI: 1.36, 2.97; PR=4.85, 95% CI: 1.67, 14.07).

Conclusion: Non-Hispanic whites and non-Hispanic Asians may face an increased burden of childhood adversity compared to non-Hispanic blacks and Hispanics due to racial and ethnic disparities in resiliency. Future research should further examine the effect of childhood adversity on adult mental health in Asian Americans.

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Chapter 1: Introduction and Background

"...we need a better understanding of factors that confer resilience and vulnerability to understand the pathways linking childhood adversities and adult mental health outcomes. It is unrealistic to think that we could protect all children from all adversities, but can we identify factors that bolster resilience and focus our efforts on the most vulnerable subgroups?"

Scott, Varghese, and McGrath (1)

Childhood Adversity

Childhood adversity is characterized as experiencing maltreatment, neglect, or family dysfunction during childhood. This adversity is manifested through experiencing physical, sexual, or psychological abuse; physical or emotional neglect; and family dysfunction such as parental substance abuse, mental illness, incarceration, and separation or divorce and domestic violence during childhood (2, 3). There is no standard definition for childhood adversity, with different research studies employing different summations of the aforementioned criteria. More generally, McLaughlin has proposed that childhood adversity be defined as "experiences that are likely to require significant adaptation by an average child and that represent a deviation from the expectable environment" (4).

Despite a standardized definition, childhood adversity is estimated to affect the majority of Americans. In 2010, 59.3% of U.S. adults reported experiencing at least one adverse childhood experience (ACE) in their lifetime, with 14.3% reporting experiencing 4 or more ACEs during childhood (5). Experience of at least one ACE is reported by a

similar proportion of males (58.0%) and females (60.8), though prevalence of experiencing five or more ACEs is disproportionately higher in females (10.3%) compared to males (6.9%) (2).

Experience of at least one ACE is more prevalent among non-Hispanic blacks (62.6%), Hispanics (64.4%), and non-Hispanic other races (62.3%) than among non-Hispanic whites (58.3%). Experience of five or more ACEs follows a slightly different pattern, with prevalence lower among non-Hispanic blacks (4.9%) than among non-Hispanic whites (8.9%), Hispanics (9.1%) and non-Hispanic other races (11.7%)9 (2).

Disparity in ACE prevalence can also be seen along the educational attainment gradient, with higher prevalence of at least one ACE and five or more ACEs in those with lower educational attainment compared to those with more education (65.5% and 14.9% respectively in individuals without a high school degree compared to 59.1% and 8.7% in those with a high school degree and 58.7% and 7.7% of those with education beyond high school) (2).

Childhood adversity is associated with several adverse health outcomes in adults. Numerous studies have linked childhood adversity to physical health conditions such as cardiovascular disease, obesity, sexually transmitted infections, and sleep problems. Childhood adversity has also been found to be associated with mental health conditions such as psychosis, suicidal ideation, posttraumatic stress disorder, anxiety, and depression. Additionally, childhood adversity is associated with risky behaviors such as substance use and smoking and is also associated with increased healthcare utilization (6, 7).

Depression in Young Adults

Though not as prevalent as childhood adversity, depression is still common in the United States. In 2009-2012, 7.6% of all Americans age 12 and older and 7.4% of adults age 18-39 experienced moderate or severe depressive symptoms in the past two weeks (8). Estimated prevalence of depression in young adults has modestly increased over the past decade. In 2014, 9.6% of young adults age 18-25 reported experiencing a major depressive episode within the past 12 months, up from 8.8% in 2005. In this same study, prevalence of depression was found to be higher among young adult females (11.8%) compared to young adult males (7.4%) and higher among non-Hispanic white young adults (11.1%) compared to non-Hispanic backs (6.1%), Hispanics (7.8%), and non-Hispanic other races (9.9%) (9). If left untreated, depression can have substantial impacts on daily functioning and quality of life in addition to an increased risk of cardiovascular disease, hypertension, stroke, diabetes, obesity, Alzheimer's disease, and cancer (7).

The Association between Childhood Adversity and Depression in Adults

Childhood adversity has been found to be significantly associated with depression in a number of different populations. In their seminal ACE Study, Felitti et al. found that exposure to ACEs was significantly associated with depression in adulthood among 9,508 Kaiser Permanente's San Diego Health Appraisal Clinic patients in 1995-1996. Notably, Felitti et al. found a strong dose-response relationship between childhood adversity and adult depression. Survey respondents who reported two of more weeks of depressed mood in the past year had 1.5-times the odds of being exposed to one ACE compared to those who experienced no ACEs (OR=1.5, 95% CI: 1.3, 1.7). The odds ratios grew to 2.4

(95% CI: 2.0, 2.8), 2.6 (95% CI: 2.1, 3.2), and 4.6 (95% CI: 3.8, 5.6) among those exposed to 2, 3, and 4 or more ACEs, respectively (10).

Using the same ACE Study data, Chapman et al. found similar associations between ACEs and lifetime depressive disorders and depressive disorders occurring in the past year assessed using a screening instrument composed of Diagnostic Interview Schedule (DIS) and Center for Epidemiologic Studies Depression Scale (CES-D) items. Risk of depression increased as exposure to ACEs increased. Women had higher risk of lifetime depression when exposed to all seven different ACEs than did men and also saw a stronger dose response relationship to cumulative adversity exposure, though these differences did not reach statistical significance. Women who were exposed to 5 or more ACEs had 5-times the risk of lifetime history of depressive disorder than their unexposed counterparts (OR=5.0, 95% CI: 3.7, 6.7) and men had a 2.4-fold increase in risk (OR=2.4, 95% CI: 1.5, 3.7). Women who were exposed to 5 or more ACES had 6.4-times the risk of recent depressive disorder compared to women who did not experience any ACEs (OR=6.4, 95% CI: 4.7, 8.7), higher than the 2.6-fold increase seen among men (OR=2.6, 95% CI: 1.5, 4.6) (11).

Similar results have been found beyond the ACE Study, which consisted of a largely non-Hispanic white, middle-class population. Waite and Shewokis replicated the ACE Study in an urban, majority ethnically minority population in 2009-2010, examining the association between 10 different ACE types and self-reported depression in adulthood among 801 participants. They found significant associations between depression and emotional abuse (OR=2.99, 95% CI: 2.03, 4.58), physical abuse (OR=2.96, 95% CI: 2.20, 3.99), sexual abuse (OR=2.82, 95% CI: 2.07, 3.85), emotional neglect (OR=2.57,

95% CI: 1.92, 3.44), battered mother (OR=1.40, 95% CI: 1.06, 1.86), household substance abuse (OR=1.90, 95% CI: 1.38, 2.62), mental illness in household (OR=2.52, 95% CI: 1.90, 3.36), and parental separation or divorce (OR=3.30, 95% CI: 2.44, 4.46). Non-significant associations were found for physical neglect (OR=1.24, 95% CI: 0.93, 1.66) and criminal household member (OR= 1.28, 95% CI: 0.96, 1.71) (12).

Remigio-Baker et al. also examined the association between ACEs and current depressive symptoms assessed using the Patient Health Questionnaire (PHQ-8) among 3,305 racially-diverse, female 2010 Behavioral Risk Factor Surveillance System (BRFSS) respondents in Hawaii. A dose-response was found between cumulative ACE exposure and depressive symptomology, with odds ratios increasing from 2.11 (1.16, 3.81), 2.90 (1.51, 5.58), 3.94 (2.13, 7.32), and 4.04 (2.26, 7.22) for exposure to 1, 2, 3 or 4, and 5 or more ACEs respectively. Remigio-Baker et al. also found verbal abuse to have the strongest magnitude of association (OR=3.21, 95% CI: 2.03, 5.09) of the ACE types and that neither current smoking or binge drinking modified the relationship between cumulative ACE exposure and depressive symptomology (13).

While increased allostatic load from the “toxic stress” of childhood adversity is well-accepted as an explanation for childhood adversity’s strong association with poor physical health, the pathway linking childhood adversity and poor mental health involves changes in brain structure and function (14).The prevailing theory to explain how experiencing childhood adversity could increase the risk of depression in adulthood is that adversities experienced early in life result in neurodevelopmental abnormalities that modify brain structure and function. There are multiple pathways linking abnormal neurodevelopment with depression including altered fear conditioning and emotional

regulation and reduced reactivity to reward (15-19). Thus, exposure to childhood adversity alters an individual's brain structure and function, altering how he or she will one day respond to everyday life and additional stressors.

The Role of Sex and Race/Ethnicity in the Link between Childhood Adversity and Depression in Adults

It cannot be assumed that all individuals will have similar reactions to the toxic stress associated with exposure to childhood adversity. Researchers have posited than men and women may differ in their response to adverse experiences. Differences in sensitivities to interpersonal stressors, self-blame attribution, feelings of shame, and coping mechanisms between men and women could explain divergent adult mental health outcomes for those experiencing similar stresses in childhood (20).

There are also multiple theories to explain the roles race and ethnicity play on the association between childhood adversity and later depression. The theory of double jeopardy suggests that minorities already exposed to other stressors such as racism and poor socioeconomic circumstances will react worse to the additional stress of childhood adversity. Conversely, the theory of resilience posits that cultural factors and experience in stressful environments will help to protect minorities from the health consequences of additional stressors. And finally, according to the theory of racial invariance, because those exposed to childhood adversity are likely exposed to similar social circumstances, health which is a function of social circumstances will be the same for these individuals regardless of race and ethnicity (21). To date, only limited research has been conducted

studying the effect of childhood adversity on mental health outcomes among different sexes, races, and ethnicities.

Arnow et al. surveyed 5,673 adult Kaiser Permanente patients in Northern California in 2002 to assess if gender moderates the association between childhood maltreatment and adult depression. However, no significant interactions between gender and emotional abuse (p=0.33), physical abuse (p=0.83), sexual abuse (p=0.43), emotional neglect (0.08), physical neglect (p=0.05), or any abuse or neglect (0.16) were found in the relationship between childhood maltreatment, assessed using the Childhood Trauma Questionnaire (CTQ), and adult major depressive disorder, assessed using the Patient Health Questionnaire (PHQ-8) (20).

Widom et al.'s study of 1,039 individuals with documented court cases of childhood neglect during 1967-1971 in a Midwestern metropolitan area and their matched controls found a significant positive adult depressive response to childhood neglect in non-Hispanic whites but not non-Hispanic blacks or Hispanics. Among non-Hispanic whites, individuals with major depressive disorder, assessed using DSM-III-R diagnosis criteria, were 1.60-times more likely to have been neglected as children compared to their non-neglected matched controls (OR=1.60, 95% CI: 1.11, 2.31). Non-significant associations were found for non-Hispanic blacks (OR=0.79, 95% CI: 0.47, 1.33) and Hispanics (OR=2.72, 95% CI: 0.23, 32.17). Widom et al. did not provide information on interaction statistical significance, so it is unknown if these racial and ethnic differences reach significance (21).

After examining data from 60,598 2010 BRFSS adult respondents from 10 states that completed the ACE module, Lee and Chen found no significant sex or race/ethnicity

differences in the association between reported experience of child abuse, household challenges, or a combination of the two and current major depressive disorder assessed using the PHQ-8 screen or reported lifetime diagnosed depression (22).

Data from a population of incarcerated adults shows a more mixed picture. Roxburgh and MacArthur examined associations between childhood adversity and adult depression among 13,328 incarcerated respondents of the 2004 Survey of Inmates in State and Federal Correctional Facilities, a nationally representative sample of inmates serving at least 4 weeks in prison (23).

They found that race/ethnicity was a significant modifier on the association between depression score, assessed using an 8-item screening tool similar to the K6 and CES-D and three of four childhood adversities – physical assault, sexual assault, and living in foster care – but not parental substance abuse. Sex was not found to be a significant modifier on the association between depression score and any of the aforementioned childhood adversities (23).

The effect of physical assault on depression was strongest in African American women (0.77-point increase in score) followed by white men (0.59-point increase), Hispanic men (0.59-point increase), African American men (0.49-point increase), and Hispanic and white women (no score increase). The effect of sexual assault was strongest in African American men (1.23-point score increase), followed by white men (0.87-point increase), Hispanic men (0.87-point increase), African American women (0.58-point increase), and Hispanic and white women (no score increase). The effect of foster care was strongest in Hispanic women (1.05-point score increase), followed by African American women (0.88-point increase), Hispanic men (0.70-point increase), white

women (0.60-point increase), African American men (0.53-point increase), and white men (0.25-point increase). Though no distinct pattern placing any one race/ethnic or sex group at greater risk for depression exists, African Americans, Hispanic men, and white men all exhibited consistently increased depression scores after reporting experience of physical assault, sexual assault, and living in foster care (23).

Schilling et al. surveyed 1,093 socio-economically disadvantaged Boston-metro students during their senior year of high school in 1998 and two years later to explore the effect of ACEs on mental health. In contrast to other studies, Schilling et al. examined sex and racial/ethnicity modifications in both the associations between individual adversities and depression and a summation of adversities and depression. Neither sex nor race/ethnicity were found to be significant modifiers on the association between cumulative ACEs and later depressed mood. Of the ten ACEs examined, a significant sex difference was only found in the association between sexual abuse or assault and later depressed mood assessed using the CES-D scale ($p<0.05$). The association was stronger in males ($b=1.41$) compared to females ($b=0.61$). A significant racial/ethnic difference was only found in the association between witnessing an injury or murder and later depressed mood assessed using the CES-D scale ($p<0.05$). The association was stronger in whites ($b=0.565$) compared to blacks ($b=0.004$) and Hispanics ($b=0.289$) (24).

In addition to Schilling et al., Youssef et al. are the only researchers to date to examine racial/ethnic differences in the association between cumulative childhood adversity and adult depression. Youssef et al. assessed childhood adversity exposure using the ACE questionnaire and depressive symptomology using the Beck Depression Inventory (BDI) of 413 adults in the southeastern United States in 2008. Differences in

the association were found between those of European and African ancestry (p=0.05) but not between males and females (p=0.59). Those with European ancestry experienced depression score increases of 2.1 and 7.3 points respectively when exposed to 1-2 and 3-4 ACEs compared to 0 ACEs (b=2.1, 7.3). Depression score increases were substantially lower in those with African ancestry who saw increases of 0.8 and 3.3 points respectively when exposed to 1-2 and 3-4 ACEs compared to 0 ACEs (b=0.8, 3.3). However, at the highest level of cumulative adversity, no racial differences were seen. Participants with European ancestry (b=11.1) and African ancestry (b=12.6) experienced similar increases in depression scores (25).

Across the literature, there is little support for the hypothesis that males and females have different depression responses to similar childhood adversity exposure. Results from Arnow et al., Lee and Chen, Roxburgh and MacArthur, and Youssef et al. all indicated no significant sex by adversity interactions (20, 22, 23, 25). The only significant sex by adversity interaction was found in Schilling et al.'s examination of the association between sexual abuse or assault and later depressed mood which found saw stronger effects in males compared to females. However, no other significant sex differences were found in the multiple other ACE and depression associations, nor was a significant sex difference found for the association between cumulative ACEs and depression (24).

The limited existing literature examining differences in childhood adversity and later depression in adulthood by racial and ethnic groups is less straightforward and offers support for all three theories. Findings from Schilling et al. and Lee and Chen suggest that there are no differences in the association between racial and ethnic groups

(22, 24). However, Widom et al.'s research suggests that non-Hispanic whites may be less resilient to childhood adversity than non-Hispanic blacks and Hispanics (21). Notably, results from Youssef et al.'s research supports both theories. In this case, Youssef et al.'s findings suggest that racial and ethnic differences in the adversity and depression association may only occur at certain levels of adversity exposure (25). Roxburgh and MacArthur's research is the only study to yield results supporting the double jeopardy hypothesis, suggesting that African Americans may be more affected by childhood adversities than other racial and ethnic groups (23).

These differing results likely stem in part from different study designs, analytic methods, and populations. Roxburgh and MacArthur's incarcerated study population likely experienced substantially different experiences from Arnow et al.'s study population consisting of Kaiser Permanente patients in Northern California (20, 23). Similarly, the childhood adversity and later depression association may differ in studies that assess depression in young adults, as was done by Schilling et al., and studies that assess depression in adults across a range of ages, as was done by Lee and Chen (22, 24). Additionally, the literature features studies that examine childhood adversities individually, with a cumulative score, and with cumulative scores broken down into categories of exposure; and also, with depression assessed with a variety of different instruments and survey questions. These measurement differences make it difficult to draw valid comparisons across studies.

Advancing Research to Explore Modifiers of the Relationship Between Childhood Adversity and Young Adult Depression

There have been numerous calls to move beyond simply examining the association between childhood adversity and adult health outcomes. Not only have countless studies found positive associations between childhood adversity and the leading causes of death, strong dose response relationships have also been noted (10). McLaughlin has suggested that researchers focus attention on the pathways between childhood adversity and poor adult health, risk factors, mechanisms, and moderators (4). Clinicians Scott, Varghese, and McGrath have suggested further study of the "factors that confer resilience and vulnerability" in the hope that we can eventually identify those subgroups most at risk (1).

Indeed, it is the later suggestion that this paper will attempt to answer. Research has found significant associations between childhood adversity and a variety of mental health outcomes, including depression in adulthood (10). However, though prevalence of both childhood adversity and depression diagnoses and symptomology differ by sex, race, and ethnicity, research examining the effects of sex and race/ethnicity on the association between childhood adversity and depression in adulthood is limited (2, 9). A closer look at this association modified by sex, race, and ethnicity will help to uncover whether particular group-specific factors, possibly social and/or cultural, might be responsible for buffering or magnifying the effects of childhood adversity on depression in young adulthood.

Chapter 2: Manuscript

1. Introduction

Childhood adversity is estimated to affect the majority of Americans. In 2010, 59.3% of U.S. adults reported experiencing at least one adverse childhood experience (ACE) in their lifetime, with 14.3% reporting experiencing 4 or more ACEs during childhood (5). Childhood adversity is associated with several adverse health outcomes in adults. Numerous studies have linked childhood adversity to physical health conditions such as cardiovascular disease, obesity, sexually transmitted infections, and sleep problems. Childhood adversity has also been found to be associated with mental health conditions such as psychosis, suicidal ideation, posttraumatic stress disorder, anxiety, and depression. Additionally, childhood adversity is associated with risky behaviors such as substance use and smoking and is also associated with increased healthcare utilization (6, 7).

Childhood adversity has been found to be significantly associated with depression in a number of different populations. In their seminal ACE Study, Felitti et al. found that exposure to ACEs was significantly associated with depression in adulthood. Notably, Felitti et al. found a strong dose-response relationship between childhood adversity and adult depression (10). Numerous additional studies have found similar relationships across various populations (11-13). If left untreated, depression can have substantial impacts on daily functioning and quality of life in addition to an increased risk of cardiovascular disease, hypertension, stroke, diabetes, obesity, Alzheimer's disease, and cancer (7).

Experience of at least one ACE is reported by a similar proportion of males (58.0%) and females (60.8), though prevalence of experiencing five or more ACEs is disproportionately higher in females (10.3%) compared to males (6.9%). Experience of at least one ACE is more prevalent among non-Hispanic blacks (62.6%), Hispanics (64.4%), and non-Hispanic other races (62.3%) than among non-Hispanic whites (58.3%). Experience of five or more ACEs follows a slightly different pattern, with prevalence lower among non-Hispanic blacks (4.9%) than among non-Hispanic whites (8.9%), Hispanics (9.1%) and non-Hispanic other races (11.7%) (2).

It cannot be assumed that all individuals will have similar reactions to the toxic stress associated with exposure to childhood adversity. Researchers have posited than men and women may differ in their response to adverse experiences. Differences in sensitivities to interpersonal stressors, self-blame attribution, feelings of shame, and coping mechanisms between men and women could explain divergent adult mental health outcomes for those experiencing similar stresses in childhood (20).

There are also multiple theories to explain the roles race and ethnicity play on the association between childhood adversity and later depression. The theory of double jeopardy suggests that minorities already exposed to other stressors such as racism and poor socioeconomic circumstances will react worse to the additional stress of childhood adversity. Conversely, the theory of resilience posits that cultural factors and experience in stressful environments will help to protect minorities from the health consequences of additional stressors. And finally, according to the theory of racial invariance, because those exposed to childhood adversity are likely exposed to similar social circumstances,

health which is a function of social circumstances will be the same for these individuals regardless of race and ethnicity (21).

To date, only limited research has been conducted studying the effect of childhood adversity on mental health outcomes among different sexes, races, and ethnicities. Across the literature, there is little support for the hypothesis that males and females have different depression responses to similar childhood adversity exposure. Results from Arnow et al., Lee and Chen, Roxburgh and MacArthur, and Youssef et al. all indicated no significant sex by adversity interactions (20, 22, 23, 25). The only significant sex by adversity interaction was found in Schilling et al.'s examination of the association between sexual abuse or assault and later depressed mood which found saw stronger effects in males compared to females. However, no other significant sex differences were found in the multiple other ACE and depression associations, nor was a significant sex difference found for the association between cumulative ACEs and depression (24).

The limited existing literature examining differences in childhood adversity and later depression in adulthood by racial and ethnic groups is less straightforward and offers support for all three theories. Findings from Schilling et al. and Lee and Chen suggest that there are no differences in the association between racial and ethnic groups (22, 24). However, Widom et al.'s research suggests that non-Hispanic whites may be less resilient to childhood adversity than non-Hispanic blacks and Hispanics (21). Notably, results from Youssef et al.'s research supports both theories. In this case, Youssef et al.'s findings suggest that racial and ethnic differences in the adversity and depression association may only occur at certain levels of adversity exposure (25).

Roxburgh and MacArthur's research is the only study to yield results supporting the double jeopardy hypothesis, suggesting that African Americans may be more affected by childhood adversities than other racial and ethnic groups (23).

There have been numerous calls to move beyond simply examining the association between childhood adversity and adult health outcomes. Not only have countless studies found positive associations between childhood adversity and the leading causes of death, strong dose response relationships have also been noted (10). McLaughlin has suggested that researchers focus attention on the pathways between childhood adversity and poor adult health, risk factors, mechanisms, and moderators (4). Clinicians Scott, Varghese, and McGrath have suggested further study of the "factors that confer resilience and vulnerability" in the hope that we can eventually identify those subgroups most at risk (1).

Indeed, it is the later suggestion that this study will attempt to answer. Research has found significant associations between childhood adversity and a variety of mental health outcomes, including depression in adulthood (10). However, though prevalence of both childhood adversity and depression diagnoses and symptomology differ by sex, race, and ethnicity, research examining the effects of sex and race/ethnicity on the association between childhood adversity and depression in adulthood is limited (2, 9).

In this study, I will examine the effect of childhood adversity on depressive symptomology in a nationally-representative sample of young adults in the United States. Furthermore, I will identify if this relationship is modified by sex and race/ethnicity and examine group-specific effects. A closer look at this association modified by sex, race, and ethnicity will help to uncover whether particular group-specific factors, possibly

social and/or cultural, might be responsible for buffering or magnifying the effects of childhood adversity on depression in young adulthood.

2. Methods

Data was collected from The National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is a nationally-representative longitudinal study of adolescents who were in grades 7-12 in 1994-1995. A clustered sampling design was used to identify 145 schools across the United States, and 90,118 students completed an initial in-school questionnaire. In-home questionnaires were completed by 20,745 students sampled for inclusion in the Add Health longitudinal cohort. Adolescents and an identified parent both participated in Wave I (1995) interviews spanning various topics related to health, behaviors, and life experiences. Participants have been re-interviewed in subsequent waves of in-home data collection taking place in 1996 (Wave II), 2001-2002 (Wave III), 2008 (Wave IV), and 2016-2018 (Wave V). Response rates were 79%, 89%, 77%, and 80% for Waves I-IV respectively. Further details on study sampling methods and design have been described elsewhere (26, 27). Approval for this study was provided by the Emory University Institutional Review Board.

2.1 Measurement

2.1.1 Exposure

Childhood adversity information was collected at various data collection waves. Maltreatment and neglect were measured in Wave III when participants were ages 18-26 and included questions about physical abuse, sexual abuse, being left alone, and neglect

by parents or adult caregivers. Family dysfunction was characterized by questions about foster care and homelessness in Wave III, parental disability and parental death in Wave II when participants were in grades 8-12, and parental incarceration in Wave IV when participants were ages 24-32. Parental alcoholism was assessed using parental responses to the Wave I Parent Survey when participants were in grades 7-12. Detailed definitions for adversity items are described below.

Maltreatment

Experience of physical abuse and sexual abuse was characterized as a response of at least one time for the questions "How often had your parents or other adult care-givers slapped, hit, or kicked you?" and "How often had one of your parents or other adult care-givers touched you in a sexual way, forced you to touch him or her in a sexual way, or forced you to have sexual relations?" during Wave III.

Neglect

Experience of being left alone and neglected was characterized as a response of at least one time for the questions "By the time you started 6th grade, how often had your parents or other adult care-givers left you home alone when an adult should have been with you?" and "How often had your parents or other adult care-givers not taken care of your basic needs, such as keeping you clean or providing food or clothing?" during Wave III.

Family dysfunction

Experience of parental disability was characterized as an affirmative response to at least one of the questions “Is she [resident mother] disabled--that is, mentally or physically handicapped?” and “Is he [resident father] disabled--that is, mentally or physically handicapped?” during Wave II. Experience of parental death was characterized as an affirmative response to at least one of the questions “Is she [biological mother] still living?” and “Is he [biological father] still living?” during Wave II.

Experience in living in foster care and being homeless was characterized as affirmative responses for the questions “Did you ever live in a foster home?”, “Have you ever been homeless for a week or longer--that is, you slept in a place where people weren't meant to sleep, or slept in a homeless shelter, or didn't have a regular residence in which to sleep?”, and “Have you ever stayed in a homeless shelter?” during Wave III.

Experience of parental alcoholism was characterized as an affirmative response to at least one of the questions “Does {NAME]'s biological mother currently have alcoholism?” and “Does {NAME]'s biological mother currently have alcoholism?” posed to a participant’s resident parent during Wave I.

Experience of parental incarceration was characterized as an affirmative response to at least one of the questions “(Has/did) your biological mother ever (spent/spend) time in jail or prison?”, “(Has/did) your [mother figure] ever (spent/spend) time in jail or prison?”, “(Has/did) your biological father ever (spent/spend) time in jail or prison?”, and “(Has/did) your [father figure] ever (spent/spend) time in jail or prison?” during Wave IV. Experiences of parental incarceration were only coded as positive if the participant indicated that the parent’s first incarceration occurred before the participant was aged 19.

Cumulative Adversity

A total adversity score was created by summing the aforementioned adversities to assess cumulative adversity throughout childhood and adolescence (28). 9,665 participants were missing responses for at least one adversity measure, with 34% missing responses for only one or two adversities. Non-endorsement of adversity for adversity measures with missing responses were imputed for the 3,291 participants missing only one or two adversity measures. A total adversity score was not assessed for participants missing responses to three or more adversity measures and these participants were later excluded from analysis. Participants were further assigned as exposed to 0, 1, 2-3, and 4 or more childhood adversities based on their total adversity score.

2.1.2 Outcome

Depressive symptoms in young adulthood were assessed in Wave IV using a modified short-form version of the Center for Epidemiologic Studies Depression (CES-D) scale. The 10-item CES-D scale included Likert-type questions for four negative affect items, three positive affect items, two somatic complaint items, and one interpersonal relations item. Participants were asked how often various items were true during the past seven days: bothered by things that usually don't bother you, could not shake off the blues, even with help from your family and your friends, felt you were just as good as other people (reverse coded), had trouble keeping your mind on what you were doing, felt depressed, felt that you were too tired to do things, felt happy (reverse coded), enjoyed life (reverse coded), felt sad, and felt that people disliked you. Response options included never/rarely, sometimes, a lot of the time, and most of the time or all of

the time. CES-D item responses were summed to create a total CES-D score. A total CES-D score was not assessed for participants who were missing or refused responses to any of the items and these participants were later excluded from analysis. Consistent with past studies that have utilized this modified 10-item CES-D scale for Add Health data, participants with total CES-D scores of 11 or higher were classified as having high depressive symptomology (29, 30).

2.1.3 Covariates

Covariates included in analyses included race/ethnicity, sex, childhood socioeconomic status, and adult socioeconomic status. Race/ethnicity was queried in Wave I, and participants were classified into mutually exclusive categories based on self-identification with Hispanic or Latino origin; and black or African American, Asian, Native American, other, or white race.

Participant's childhood household receipt of food stamps in the last month was assessed in the Wave I Parent Survey from a resident parent's positive affirmation to the question "Last month, did you or any member of your household receive: food stamps?" and used as a proxy for childhood socioeconomic status. Participant's educational attainment was assessed at Wave IV based on responses to the question "What is the highest level of education that you have achieved to date?" and used as a proxy for adult socioeconomic status.

2.2 Analytic Sample

Data was available for 20,774 Add Health participants. Participants with non-positive or missing sample weights were excluded from the analytic sample. The analytic sample was further restricted to participants who identified as non-Hispanic white, non-Hispanic black, Hispanic, or non-Hispanic Asian and who had complete exposure, outcome, and covariate information. A detailed description of steps taken to identify the final sample is displayed in Figure 1. The final analytic sample size was 7,071.

2.3 Analytic Methods

Descriptive statistics were assessed using SAS version 9.4. Prevalence ratios were obtained using SAS-callable SUDAAN release 11.0.1. Crude results for the association between cumulative childhood adversity and depressive symptomology in young adulthood were first obtained from a model absent of any covariates. Adjustment for race/ethnicity, sex, childhood household receipt of food stamps, and educational attainment then yielded adjusted results. As all covariates were deemed to be necessary to most accurately control for confounding, all were included in final model results. Next, sex by adversity and race by adversity interactions were individually tested. Though interactions were not found to be statistically significant, results were further stratified by sex and race/ethnicity to better examine patterns and differences between groups.

3. Results

3.1 Descriptive Results

Selected study population characteristics are shown in Table 1. The majority of the study population reported exposure to no adversities (36%) or a single adversity (31%). Exposure to two to three adversities was reported in over a quarter of the study population (27%) with 7 percent reporting exposure to four or more adversities during childhood. The most commonly reported adversity was being left alone by a parent or adult caregiver when an adult should have been present (39%) followed by being physically abused by a parent or adult caregiver (28%) and parental alcoholism (15%).

Reporting exposure to four or more adversities was more than twice as likely among the 16 percent of participants displaying high depressive symptomology in young adulthood compared to those without high depressive symptoms (13% vs. 6%). Similarly, those with high depressive symptomology in young adulthood were less likely to report exposure to no adversities (27%) compared to their counterparts who were not depressed (37%).

Childhood adversity and depressive symptomology results stratified by sex and race/ethnicity are shown in Table 2. Statistically significant differences in exposure to childhood adversity and in depressive symptomology in young adulthood was found among racial and ethnic groups. More non-Hispanic white participants reported exposure to no adversities (38%) during childhood compared to their non-Hispanic black (32%), Hispanic (35%), and non-Hispanic Asian (29%) counterparts. Exposure to four or more adversities during childhood was most common in non-Hispanic black (8%) and Hispanic

(7%) participants. Similarly, high depressive symptomology in young adulthood was most common in Hispanic (18%) and non-Hispanic black (18%) participants.

Between males and females, a statistically significant difference was found among the proportion of participants displaying high depressive symptoms in young adulthood. High depressive symptomology was more common in females (19%) compared to males (12%).

3.2 Modeling Childhood Adversity and Depression

Results of modeling the prevalence for high depressive symptomology in young adulthood across various childhood adversity exposure levels are shown in Table 3. After adjusting for race, sex, childhood household receipt of food stamps, and educational attainment, participants reporting exposure to two or three adversities during childhood had a 35 percent increased prevalence of high depressive symptomology in young adulthood compared to participants who reported exposure to no adversities during childhood (PR=1.35, 95% CI: 1.14, 1.60). Those exposed to four or more adversities in childhood had nearly double the prevalence for high depressive symptomology in young adulthood compared to participants unexposed to adversity (PR=1.94, 95% CI: 1.51, 2.50). In addition to a dose response relationship, a threshold effect appears to also be present in the association as exposure to a single adversity during childhood had a modest effect on the prevalence of high depressive symptomology in young adulthood that does not meet statistical significance (PR=1.12, 95% CI: 0.92, 1.36).

3.3 Modeling Childhood Adversity and Depression by Sex and Race/Ethnicity

Additional models including sex by childhood adversity and race/ethnicity by childhood adversity interaction terms yielded results with no significant sex (p=0.6971) or race/ethnicity (p=0.1069) interactions. Despite non-significant interactions, adjusted results stratified by sex and race/ethnicity are shown in Table 4. Though no significant differences in the association between childhood adversity and high depressive symptomology in young adulthood were found across sexes or racial and ethnic groups, notable results remain.

Males appear to experience a somewhat greater mental health burden when exposed to the same amount of adversities as their female counterparts, especially at the highest level of adversity. Among males, those exposed to four or more adversities in childhood had 2.37-times the prevalence of high depressive symptomology in young adulthood compared to males unexposed to adversity (PR=2.37, 95% CI: 1.53, 3.66). In females, the effect of experiencing four or more adversities resulted in just 1.75-fold increase in the prevalence of high depressive symptomology in young adulthood compared to those unexposed to adversity (PR=1.75, 95% CI: 1.27, 2.42). Notably, however, this effect was not statistically significantly different between males and females (p=0.6971).

Exposure to just one adversity during childhood led to a significant increase in the prevalence of high depressive symptomology in only non-Hispanic black participants (PR=1.70, 95% CI: 1.15, 2.51). Across the other racial and ethnic groups, minor adversity exposures appeared to confer no additional prevalence of depressive symptoms.

By contrast, exposure to the highest levels of adversity increases prevalence of high depressive symptomology across all racial and ethnic groups. Non-Hispanic black and Hispanic young adults reporting experience of four or more childhood adversities had similar prevalence of high depressive symptomology compared to their unexposed counterparts (non-Hispanic black PR=1.75, 95% CI: 0.96, 3.21; Hispanic PR=1.76, 95% CI: 1.00, 3.11).

A high depressive symptomology response was more prevalent for non-Hispanic white and non-Hispanic Asian participants when exposed to four or more childhood adversities. Non-Hispanic white young adults exposed to four or more adversities had double the prevalence of high depressive symptomology compared to their unexposed counterparts (PR=2.01, 95% CI: 1.36, 2.97). Among non-Hispanic Asian young adults, reported experience of four or more adversities in childhood conferred a nearly 5-fold increased prevalence of high depressive symptomology compared to their unexposed counterparts (PR=4.85, 95% CI: 1.67, 14.07). Though notably, as was the case across sexes, differences in this association across racial and ethnic groups did not reach statistical significance (p=0.1069).

4. Discussion

My research yielded several interesting results, some expected and others more unexpected. After adjusting for race, sex, childhood household receipt of food stamps, and educational attainment, I found both a threshold effect and dose response for the effect of childhood adversity on depressive symptomology in young adulthood. These findings were expected and agree with the considerable literature examining this

association. Also in agreement with the literature, is the finding that this association does not differ between males and females. Childhood adversity appears to be associated with similar depressive symptomology in young adult males and females.

Examination of the childhood adversity and young adult depressive symptomology relationship by racial and ethnic groups yielded less straightforward results, particularly when compared to two studies with similar study populations and methods. No significant race/ethnicity by adversity interaction was found, indicating that no significant differences in the association were seen across racial and ethnic groups. Similar findings were found in Schilling et al.'s multi-racial and multi-ethnic study; however, Youssef et al. did find significant interaction in their study restricted to only Americans of European and African descent (24, 25).

Though no significant race/ethnicity by adversity interaction was found, results stratified by racial and ethnic groups generate notable findings. Non-Hispanic black young adults were the only racial and ethnic group to show a sizeable and significant increase in depressive symptomology prevalence when reporting exposure to just one childhood adversity. Additionally, results for non-Hispanic black young adults do not show a dose response effect as is seen in the larger study population and other racial and ethnic groups. Non-Hispanic black young adults appear to consistently show moderately strong depressive symptomology responses across all levels of childhood adversity exposure. By contrast, results among non-Hispanic white, Hispanic, and non-Hispanic Asian young adults illustrate the expected dose response trend seen in the literature.

Finally, while exposure to the highest level of childhood adversity was positively associated with increased prevalence of depressive symptomology in all racial and ethnic

groups, a stronger association was seen in non-Hispanic white young adults and especially in non-Hispanic Asian young adults. Exposure to four or more adversities resulted in a 2-fold and nearly 5-fold increase in depressive symptomology prevalence for these groups respectively.

Again, when compared to results from Youssef et al., my study presents contrasting findings. At odds is my finding of a consistent, non-dose response relationship in non-Hispanic black young adults, divergent from Youssef et al.'s strong dose response among participants of African ancestry. Also in discordance with Youssef et al. are my results which did not find supporting evidence for their trend showing similar adversity and depressive symptomology effects across racial groups at higher exposures to childhood adversity but stronger effects for participants of European ancestry at lower exposures of adversity (25).

My findings offer some support for both the racial invariance and racial differences in resiliency hypotheses. If the importance of statistical significance is deemphasized, there do appear to be differences in the childhood adversity and depressive symptomology in young adulthood relationship across racial and ethnic groups, with non-Hispanic white and non-Hispanic Asian young adults more susceptible to poor mental health outcomes than their non-Hispanic black and Hispanic counterparts when exposed to the highest levels of childhood adversity.

It is possible that non-Hispanic black and Hispanic young adults have different life experiences that offer partial protection to the negative consequences of childhood adversity. Non-Hispanic black and Hispanic children may be exposed to more life stressors that help them to build more resilience than non-Hispanic white and non-

Hispanic Asian young adults. Resilience disparities could also be explained by cultural factors such as religion, church attendance, and extended kinship networks which have been shown to be offer protective health benefits for African Americans. The "Latino paradox" may also help to explain increased resilience buffering effects in Hispanic young adults. Perhaps as researchers have speculated, Hispanic children may be conferred limited protection to the negative effects of childhood adversity through strong community cohesion and cultural heritage that help to buffer the effects of toxic stress (21). It is possible that non-Hispanic whites and non-Hispanic Asians lack exposure to these cultural and social factors, are in turn less resilient, and are thus more susceptible to the deleterious effects of childhood adversity (21, 31). However, as the literature concerning resiliency in Asian Americans is limited, it is unknown if Asian American children, adolescents, and young adults are more or less resilient than their counterparts in other racial and ethnic groups.

4.1 Strengths and Limitations

There are multiple strengths of this research worth noting. First, this study is strengthened by the longitudinal cohort study design of Add Health. All but one childhood adversity was measured in childhood or adolescence, reducing recall bias and exposure misclassification. Additionally, collecting exposure and outcome data separately reduces dependent error misclassification, as participants displaying high depressive symptomatology may be more likely to magnify and thus report past adverse experiences than participants displaying lower depressive symptoms. This study is also strengthened by its relatively large sample size and inclusion of Asian participants. Not

only was I able to measure relatively precise estimates, I was also able to explore the childhood adversity and depressive symptomatology relationship in Asian participants, an association which has not been studied to date.

However, several limitations also exist. While I was able to study effects among Asian participants, because this subpopulation was relatively small, estimates are fairly imprecise. Missing data is also an important concern. Even after imputing childhood adversity data for participants missing just one or two responses for questions contributing to the cumulative adversity scale, 7,536 participants were excluded from analysis for missing exposure, outcome, and covariate data. Additionally, if participants with depression were less likely to participate in Wave IV data collection, and thus be eligible for inclusion into the study, selection bias could be of concern. However, weighted analytic methods utilized in this study for complex sample data help to minimize the impact of this possible bias. Finally, it is possible that parental mental health and wider family history of depression, both unmeasured in Add Health, could confound the childhood adversity and depressive symptomology in young adulthood association.

4.2 Conclusion and Further Research

Exposure to childhood adversity has serious negative health effects. Among a nationally-representative sample of young adults in the United States, exposure to childhood adversity resulted in significant increases in prevalence of high depressive symptomology in young adulthood. Though racial and ethnic differences in this relationship may not reach statistical significance, these results still offer important

implications for public health and suggestions for future research. Non-Hispanic White and non-Hispanic Asian young adults appear to have stronger negative mental health responses to high levels of childhood adversity exposure, while non-Hispanic black young adults have stronger responses at lower levels of exposure. Clinicians and public health practitioners may need to focus additional resources on these vulnerable racial and ethnic groups. Future research on the association between childhood adversity and later depression should also examine effects in Asian American populations.

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Table 1. Selected characteristics by depressive symptomology in young adulthood, National Longitudinal Study of Adolescent to Adult Health, 1994-2018 (N=7,071)

	Total (%)	High Depressive Symptoms (%)	Low Depressive Symptoms (%)	P-value
Sex				<0.0001
Male	45.06	33.78	47.14	
Female	54.94	66.22	52.86	
Race/ethnicity				0.0422
Non-Hispanic White	56.98	53.88	57.55	
Non-Hispanic Black	20.87	22.70	20.54	
Hispanic	15.75	18.48	15.24	
Non-Hispanic Asian	6.40	4.94	6.67	
Household receipt of food stamps	11.78	18.45	10.54	<0.0001
Educational attainment				<0.0001
Below high school	6.83	13.48	5.60	
High school degree	58.34	65.96	56.93	
Bachelor's degree	25.92	15.80	27.79	
Postgraduate degree	8.91	4.77	9.68	
Maltreatment				
Physical abuse	28.39	34.44	27.27	0.0002
Sexual abuse	4.49	6.28	4.16	0.0406
Neglect				
Left alone	38.57	44.10	37.55	0.0029
Neglect	10.44	14.10	9.76	0.0022
Family dysfunction				
Foster care	1.85	2.35	1.76	0.3831
Homelessness	4.17	6.88	3.66	0.0057
Parental alcoholism	14.63	21.82	13.30	<0.0001
Parental disability	6.49	10.77	5.70	0.0003
Parental incarceration	10.61	14.79	9.84	0.0011
Parental death	4.00	3.53	4.09	0.5124
Childhood adversities				<0.0001
0	35.52	27.36	37.03	
1	30.63	28.96	31.12	
2-3	27.02	31.83	26.13	
4+	6.82	12.85	5.71	
High depressive symptoms	15.60			

Table 2. Prevalence of childhood adversity and depressive symptomology by sex and race/ethnicity, National Longitudinal Study of Adolescent to Adult Health, 1994-2018 (N=7,071)

	Male (%)	Female (%)	P-value	Non-Hispanic White (%)	Non-Hispanic Black (%)	Hispanic (%)	Non-Hispanic Asian (%)	P-value
Maltreatment								
Physical abuse	30.24	26.87	0.0136	26.19	27.56	33.04	39.16	0.0003
Sexual abuse	3.95	4.94	0.1420	3.75	5.61	5.65	4.58	0.1255
Neglect								
Left alone	39.91	37.48	0.1501	37.24	39.79	39.72	43.63	0.1810
Neglect	13.45	7.96	<0.0001	8.70	13.69	11.35	13.06	0.0029
Family dysfunction								
Foster care	1.63	2.03	0.3678	1.70	2.95	1.42	0.65	0.0201
Homelessness	4.68	3.75	0.1417	4.47	4.55	3.31	2.28	0.1273
Parental alcoholism	12.98	15.99	0.0109	16.48	14.20	11.74	6.71	<0.0001
Parental disability	6.29	6.66	0.6337	5.84	8.21	6.96	5.53	0.1352
Parental incarceration	10.07	11.05	0.2804	9.62	14.81	11.30	4.00	<0.0001
Parental death	3.94	4.06	0.8401	2.67	6.76	4.65	5.33	0.0003
Childhood adversities			0.3755					0.0002
0	34.64	36.25		37.87	31.89	34.71	28.48	
1	30.31	30.89		30.65	29.67	29.55	36.21	
2-3	27.61	26.54		25.15	30.26	27.81	31.23	
4+	7.44	6.32		6.33	8.17	7.93	4.08	
High depressive symptoms	11.70	18.80	<0.0001	14.75	16.97	18.31	12.03	0.0398

Table 3. Crude and adjusted estimates of the effect of childhood adversity on high depressive symptomology in young adulthood, National Longitudinal Study of Adolescent to Adult Health, 1994-2018 (N=7,071)

	Crude		Adjusted	
	Prevalence Ratio (95% CI)		Prevalence Ratio (95% CI)	
Childhood Adversities				
0	Reference		Reference	
1	1.19	(0.96, 1.46)	1.12	(0.92, 1.36)
2-3	1.53	(1.29, 1.82)	1.35	(1.14, 1.60)
4+	2.45	(1.89, 3.16)	1.94	(1.51, 2.50)

Table 4. Estimates of the effect of childhood adversity on high depressive symptomology in young adulthood stratified by sex and race/ethnicity, National Longitudinal Study of Adolescent to Adult Health, 1994-2018 (N=7,071)

	Male	Female	Non-Hispanic White	Non-Hispanic Black	Hispanic	Non-Hispanic Asian
	Prevalence Ratio (95% CI)	Prevalence Ratio (95% CI)	Prevalence Ratio (95% CI)	Prevalence Ratio (95% CI)	Prevalence Ratio (95% CI)	Prevalence Ratio (95% CI)
Childhood Adversities						
0	Reference	Reference	Reference	Reference	Reference	Reference
1	1.29 (0.91, 1.83)	1.04 (0.82, 1.31)	0.96 (0.74, 1.23)	1.70 (1.15, 2.51)	1.04 (0.66, 1.64)	1.05 (0.36, 3.06)
2-3	1.64 (1.13, 2.38)	1.21 (0.98, 1.50)	1.32 (1.02, 1.72)	1.49 (1.00, 2.24)	1.22 (0.79, 1.90)	1.91 (0.74, 4.92)
4+	2.37 (1.53, 3.66)	1.75 (1.27, 2.42)	2.01 (1.36, 2.97)	1.75 (0.96, 3.21)	1.76 (1.00, 3.11)	4.85 (1.67, 14.07)

Figure 1. Inclusion and exclusion criteria utilized to identify final analytic sample, National Longitudinal Study of Adolescent to Adult Health, 1994-2018 (N=7,071)