Adverse Childhood Experiences and Adult Well-Being: Impacts by Type, Timing, and Early Childhood Intervention

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Dedication

This dissertation is dedicated to my family, whose unconditional love, support, and faith in me mean more than I can express, and to my friends in Minneapolis, who helped to make my graduate school years some of the best of my life thus far.

Abstract

Despite an extensive literature describing the detrimental effects of Conventional Adverse Childhood Experiences (ACEs-C) (e.g., abuse, neglect, and household dysfunction) on physical and mental health, large-scale studies have not assessed links to broader measures of well-being. Furthermore, the observed dose-response relationships in physical and mental health outcomes have been found for predominately middle-class Caucasian samples in relatively high-resource environments. The original ACE survey also neglected to assess experiences more common in high-risk contexts ("Expanded" ACEs; e.g., witnessing or victimization in a violent crime; foster care). Importantly, although effective preventive interventions like high-quality early childhood education (ECE) can reduce rates of abuse and neglect, little is known about how ECE participation affects the incidence and consequences of ACEs. Given the ACE literature's clear policy and practice implications, these gaps warrant investigation.

This study evaluates 1) associations between ACEs and educational attainment, income, crime, depressive symptoms, smoking, and self-rated health in a primarily African-American sample, 2) differential effects of timing and type of ACE, 3) the potential compensatory effects of early childhood intervention on ACEs, and 4) moderation of intervention effects on adult outcomes by sex and demographic risk.

Follow-up data were analyzed for 88% of the original 1539 participants in the Chicago Longitudinal Study (N = 1352), a prospective large-scale investigation of the impact of an ECE program and early experiences on life-course well-being. Retrospective report and administrative records were used to assess ACEs from birth to 18 and outcomes at age 37.

Over two-thirds of the study sample experienced ≥1 Conventional or Expanded ACE (ACEs-CE), and over half experienced ≥1 Conventional ACE (ACEs-C). After controlling for demographic risk and intervention status, participants reporting ACEs were more likely to have poor outcomes than those without ACEs, and for several domains of adult well-being, the relations between ACEs and outcomes increased in a graded fashion. Participants with ≥4 ACEs-C from birth to 18 had a significantly increased likelihood of incarceration (OR = 3.71; p <.06), lifetime smoking history (OR = 3.40; p <.001) and current depressive symptoms (OR = 3.10; p <.05). High ACEs-C experienced only in the early childhood period (≥2 prior to age 5) were also associated with increased likelihood of lifetime incarceration (OR = 2.23; p <.05), smoking (OR = 3.46; p <.001), and current depressive symptoms (OR = 2.56; p <.05). It should be noted that, while Expanded ACEs may be an important and informative type of adversity, they did not substantially increase predictive power over ACEs-C for most outcomes.

Child abuse and neglect from birth to 18 related to crime, education and income, whereas household dysfunction was associated with smoking and depression. Participants with any CAN completed, on average, .5 fewer grades than those without CAN (β = -.57; p < .01), and were about half as likely to obtain a BA or AA degree (OR = 0.51; p < .01). They were also about half as likely to make an income above the average entry wage (OR = 0.51; p < 01), and twice as likely to have been incarcerated or arrested for a felony (OR = 2.16; p <.01 and OR = 2.13; p <.001, respectively). Participants in the HD group had nearly twofold increased odds of smoking (OR = 1.79; p <.01) and were over twice as likely to report significant depressive symptoms (OR = 2.19; p <.05) compared to the group without HD. Early intervention significantly moderated the association between ACEs-CE and highest grade completed (β = 0.59; p <.05) and attainment of a BA or AA degree (OR = 2.17; p <.05).

Overall, these findings suggest that ACEs exert detrimental effects on adult well-being in low-SES children above and beyond the effects of demographic risk and poverty, and speak to the need to continue to support underserved communities in active ways. Although ameliorating poverty and its impacts continues to be high priority, greater investments in interventions aimed at reducing the incidence and counteracting the effects of ACEs are also imperative.

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Chapter 1

Introduction

Decades of research have indicated that adult health problems can be traced to environmental influences in childhood (Felitti et al., 1998; Shonkoff, Boyce, & McEwen, 2009). A specific cluster of these influences have widely come to be termed Adverse Childhood Experiences (ACEs) in the public health, prevention, child development, and medical fields, and they have been found to exert impacts through both physiological and psychosocial avenues (Perry & Pollard, 1998; Shonkoff et al., 2009). While the majority of research on these cumulative experiences of child abuse, neglect, and household dysfunction has focused on physical and mental health outcomes (Dong et al., 2004; Felitti et al. 1998; Ramiro, Madrid, and Brown 2010; Surtees et al., 2003), evidence increasingly traces the origins of disparities in educational, socioeconomic, and crime outcomes to ACEs as well (Gilbert et al., 2009; Giovanelli, Reynolds, Mondi, & Ou, 2016; Mersky & Topitzes, 2010).

Extensive research also indicates that the effects of ACEs can be amplified by poverty (Odgers & Jaffee, 2013; Wade et al., 2016). Moreover, the context of poverty and minority status poses discrete risks and challenges above and beyond those associated with more universal adverse experiences (Williams & Jackson, 2005; Duncan & Brooks-Gunn, 1993). Despite this, the preponderance of ACEs research to date has been conducted on primarily white, educated, middle class populations (Cronholm et al., 2015), with limited exceptions (e.g., Flaherty et al., 2013; Thompson et al., 2014; Turner & Lloyd, 2004; Wade et al., 2016) see Appendix A for a brief overview of the most notable ACE studies. Further, much of the research has strictly defined ACEs as a set of

ten stressors defined by the "ACE Study" conducted by Kaiser Permanente and the Centers for Disease Control and Prevention (CDC). Adverse experiences that are much more likely to occur in an impoverished environment are beginning to be explored (Copeland-Linder, Lambert, Chen, & Ialongo, 2011; Cronholm et al., 2015; Finkelhor, Shattuck, Turner, & Hamby, 2013; Turner & Lloyd, 2004), but the distinct contributions of these experiences to adverse outcomes, as well as the similarities and differences between these experiences and traditionally defined ACEs, are not clear.

Despite public and policy enthusiasm for ACE research in recent decades, methodological issues abound, particularly regarding the validity of retrospective reporting, the role of type and timing of events, and experiences outside of the home. Prospective longitudinal studies are scarce, and researchers often do not measure beyond a "count" of cumulative ACEs in the overall population. While it is important to continue to augment the body of literature linking ACEs and adverse outcomes in adulthood, attention to these effects over the long-term without attending to subgroup differences may obscure important information. Collecting and investigating information of this type would greatly improve methodological rigor and inference.

The focus of this introduction is an examination of the current state of the field of ACEs research. *The first portion* will be focused on providing an overview of how life stress as it has historically been operationalized and how the field came to its current conceptualizations and measurement of ACEs. The *second portion* will orient the reader to the best-known ACE studies, which were undertaken by the CDC in the 1990s and early 2000s. *The third portion* will discuss the overlapping theoretical frameworks and explanatory models that researchers have relied upon to explain the relation between

ACEs and adverse outcomes. *The fourth portion* of the introduction will be focused on the current evidence for the detrimental impacts of the most commonly cited ACEs, in the areas of abuse, neglect, and household dysfunction. The *fifth portion* will argue that the current conceptualization of ACEs may be inadequate for minorities and individuals living in high-crime and high-poverty areas, and that for the purpose of generalizability, the field must address this gap. That is, the generic ACE tool does not take into account context, and our conclusions about the relationship between ACEs and adult outcomes may be skewed by the omission of individuals who had adverse experiences that are not being measured (Cronholm, et al., 2015). The limited research into this question will be reviewed, and suggestions will be made regarding expanding the ACE questionnaire. The *sixth portion* will examine the additional ways in which the field has expanded the depth and breadth of evidence regarding ACEs beyond the original studies. Relatedly, this portion will also critique extant research on ACEs, both conceptually and methodologically. The current study will attempt to address the aforementioned limitations in a longitudinal sample of African Americans growing up in inner-city Chicago.

It should also be made clear that the focus of this dissertation is on stressors, rather than trauma specifically. Stressors may be traumatic or lead to trauma, but the two should not be conflated, as childhood stressors need not be traumatic to be significant. Trauma occurs when serious emotional and mental stress occurs and is not resolved. Characterization of an event as traumatic necessarily implies a subjective appraisal of the event, which the current ACE literature generally does not take into account (cf Finkelhor, Shattuck, Turner, & Hamby 2013).

Additionally, the ACE research has emerged from a long tradition of the broader study of the effects of stressors in the fields of developmental psychology and medicine, among others. As such, while the majority of this dissertation focuses on the modern construct of ACEs in particular (i.e., ACE counts similar to those in the questionnaire completed by the original CDC/Kaiser sample; see Appendix B), for a more complete understanding of the ACE framework it is important to review the historical context of the research on stress and on life events in general.

Life Stress Research. The impacts of stress over the life course have been studied in developmental psychology and medicine since the latter half of the 20th century. At that time, researchers began to investigate the proximal and distal effects of stressful events on both children and adults, attempted to parse out differential effects of chronic versus acute and positive versus negative stressful experiences, grappled with the relative importance of subjective ratings of distress, and eventually many increased focus on cumulative life events.

The term "ACEs" and the current ACE research as it is known today emerged in the medical field, but both medicine and developmental psychology had been studying the impacts of life stress since the mid-20th century. Developmental psychology in particular has been far more rigorous in investigating mechanisms of resilience to life stress (Garmezy, 1985; Masten, 1989; Rutter, 1987). The seminal Kauai Longitudinal Study (KLS; Werner, 1993) was one of the first to investigate the links between risks like stress in infancy, poverty, and household dysfunction including parental mental illness and adult outcomes in a multiracial sample of children on the Hawaiian island of Kauai. The KLS took a far more comprehensive and nuanced approach than ACE research

historically has, including using both self-report and administrative records and investigating resiliency and protective factors. and the ACE field would do well to incorporate some of these aspects of methodology and research design.

The medical roots of what is currently called ACE research, i.e., questionnaire type counts of adversity prior to age 18 as defined above, can be traced to mid-20th century medical research indicating that stress could contribute to health problems (e.g., cardiovascular disease; Wolff, Wolf, & Hare, 1950; Hinkle & Wolf, 1952). In the 1960s, Holmes and Rahe (1967), inspired by this growing body of evidence that social stress was related to onset of a broader range of illnesses and more diffuse and subtle health outcomes (Rahe, Meyer, Smith, Kjaer, & Holmes, 1964), undertook one of the first targeted studies of life events themselves. They approached the question broadly, asking about 43 life events "derived from clinical experience" and asking participants to quantify the degrees of "readjustment" these events required. The events in question ranged from generally positive events such as marriage (centered at an arbitrary readjustment level of 500) and outstanding personal achievement to generally negative events like incarceration and death of a spouse. Many critiques of this approach led to the proposal of numerous alternative frameworks in subsequent undertakings.

Over the course of the following decade, "stress from the impact of life events [had] become an important variable in psychosomatic and psychological research" (Horowitz et al., 1977), and researchers interested in improving upon Holmes and Rahe's scale tackled various conceptual and methodological issues. The approach of measuring readjustment was criticized; for example, Dohrenwend and Dohrenwend (1974) hypothesized that measuring events independent of subjective psychological appraisal

would help to avoid confounding stress and adaptation. Sarason, Johnson, & Siegel (1978) disagreed, asserting that subjective ratings of the stressfulness of events is a crucial aspect of life stress research. Dohrenwend and Dohrenwend's approach has been influential, as much of the life stress research that followed did not measure subjective distress. Other novel approaches included weighting items by recency or for certain subgroups in order to parse out differential effects (Holmes & Masuda, 1974; Horowitz, Schaefer, Hiroto, Wilner, & Levin, 1977; Ross & Mirowsky, 1979). While these methods were not adopted widely by the field, some researchers have begun to revisit these approaches in the 21st century (e.g., Turner & Lloyd, 2004; Flaherty et al., 2013).

Another important methodological question in the latter part of the 20th century was whether or not the valence of life events is critical in explaining outcomes. That is, when attempting to explain maladaptive outcomes, should researchers emulate Holmes and Rahe's approach in measuring both positive and negative life events? While positive life events have been found to have destabilizing effects in certain populations (e.g., individuals with bipolar disorder, Borderline Personality Disorder, and Major Depressive Disorder; Johnson et al., 2000; Giovanelli, Hoerger, Johnson, & Gruber, 2013; Kelly, Soloff, Lynch, Haas, & Mann, 2000), in normative populations, long-term maladaptive outcomes were by and large found to be associated with life events of negative valence (Paykel, Prusoff, & Myers, 1975; Taylor, 1991; Vinokur & Selzer, 1975). As a result, the preponderance of research on adverse outcomes began to focus on adverse events exclusively. This greater effect of negative events was hypothesized to due to negative events' evocation of more activity at all levels of functioning, putting a strain on an individual's psychological, cognitive, behavioral, physiological, and affective resources

(Taylor, 1991). While the body has ameliorative and adaptive processes are mobilized to facilitate recovery in the aftermath of a stressful event (Taylor, 1991), the over-activation of these processes can have serious health consequences and was found to be much more likely to occur with negative events. As such, life stress research in normative populations today focuses on negative events almost exclusively.

Investigators also debated the merits of focusing on the role of more ongoing, chronic stressors as opposed to discrete major life events (e.g. Kanner, Coyne, Schaefer, & Lazarus, 1981). Research indicated that ongoing stressors, as opposed to major one-time events, are actually more strongly associated with somatic health (DeLongis, Coyne, Dakoff, Folkman, & Lazarus, 1982; Compas, 1987). This is reflected in current ACEs research, which assesses for experience of abuse, neglect, and household dysfunction. While some may conceptualize these categories as singular traumatic events, research has shown that maltreatment and dysfunction are more likely to be chronic and ongoing than discrete events (Gilbert & Widom, 2009; Odgers & Jaffee, 2013).

Although physical health was the primary focus of the original life stress research, investigators also recognized early on that other areas, such as mental health (Vinokur & Selzer, 1975; Costantini, Braun, Davis, & Iervolino, 1973) and academic performance (Sarason et al., 1978) can be affected as well. In recent years, perhaps in part due to the large-scale ACE research being conducted by medical doctors, as well as technological advancements in the precision of measures of physiology and stress reactivity (e.g., Hypothalamic Pituitary Adrenal axis functioning, Gunnar & Quevedo, 2007), the focus has largely remained on physical and mental health outcomes, with little focus on sociological issues like crime or education (cf Werner, 1993).

In the 1990s, Turner and Lloyd (1995) published findings indicating that, while adverse events independently increased the probability of adverse outcomes, the experience of several adversities was the most powerful predictor of subsequent psychiatric and substance use disorders. This study, hailed by the authors as "the first evidence on the mental health significance of cumulative adversity where such adversity is indexed by a wide array of potentially traumatic events" (Turner & Lloyd, 1995) was a harbinger of a precipitous increase in life stress studies investigating cumulative early adversity in the medical field, which came to be termed ACE studies. Up until that time, few researchers in the medical field had examined the cumulative effects of adversities in the way it is conceptualized today; however, it bears repeating that the field of developmental psychology identified the potential importance of this framework several decades before Turner & Lloyd's 1995 investigation (Rutter & Quinton, 1977; Sameroff, 1975; Sameroff & Seifer, 1983; Werner & Smith, 1992). For example, in 1977, Rutter and Quinton found that a measure of six household adversities was significantly related to mental disorder, and the aforementioned KLS (Werner, 1993) also used a count of early adversity. Cumulative ACE studies have since found that individuals who reported more ACEs are at heightened risk for a host of negative adult health outcomes, including the leading causes of death (Dube et al., 2003; Felitti et al., 1998). Findings from the Kaiser/CDC ACE Studies indicate that incidences of substance abuse, obesity, depression, chronic lung disease, and heart disease increase in a graded fashion as the number of ACEs increase. Other researchers have replicated these findings (Anderson, Tiro, Price, Bender, & Kaslow, 2002; Chapman et al., 2004; Turner, Finkelhor, &

Ormrod, 2006) and found similar effects for outcomes such as personality disorders (Afifi et al., 2010) and substance abuse (Mersky, Topitzes, & Reynolds, 2013).

Relatedly, a robust body of evidence has also emerged indicating that ACEs co-occur (Arata, Langhinrichsen-Rolin, Bowers, & O'Brien, 2007; Dube et al., 2003; Edwards, Holden, Felitti, & Anda, 2003; Finkelhor, Ormrod, & Turner, 2007). For example, Dube and colleagues (2001) reported that the mean number of comorbid outcomes was three times as high for those with the highest ACE scores as for those with the lowest ACE scores (Dube et al., 2001), indicating that risk factors tend to accumulate over time. This idea on a population-level is sometimes termed the "Matthew Effect," in which "the rich get richer and the poor get poorer," and is another major reason that the field has turned to measuring cumulative adversity.

The structure of the current ACE literature, with assessment of cumulative, negative, often chronic stressors has evolved from an extensive canon of life stress research in the latter part of the 20th century.

Overview of the First Large-Scale ACE Studies

The early life events research focused on demonstrating a temporal relationship between events that required social readjustment and adverse outcomes. As mentioned above, in the 1990s researchers began to focus on a specific sub-category of life stress research; specifically, they focused on how extreme stressors and adverse events in childhood could affect health outcomes decades later in adulthood, utilizing large-scale retrospective longitudinal models. The genesis of this specific body of literature specifically began with the Kaiser Permanente health maintenance organization (HMO) and the CDC Adverse Childhood Experiences Study, followed by another collaboration

between the CDC and state health departments, the Behavior Risk Factor Surveillance Survey.

Kaiser/CDC ACE study. From 1995 to 1997, Felitti and colleagues, in a collaboration with Kaiser Permanente and the CDC, recruited participants insured by Kaiser Permanente for a study of health status and health risk behaviors over two waves of data collection. In this seminal study, researchers collected information on self-reported experiences of abuse, neglect, and family dysfunction in a non-clinical sample of 17,421 San Diego adults.

In the original ACE study, ACEs were measured and operationalized as two broad categories: 1) abuse and 2) household dysfunction. Within the category of abuse, the questionnaire asked if the participant had experienced physical, sexual, or emotional/psychological abuse. Within the category of household dysfunction, the questionnaire asked about substance abuse, depression, suicidality, domestic violence, or criminal behavior in the household (Felitti et al., 1998). In the second wave of the questionnaire, participants were additionally asked about parental divorce and emotional and physical neglect (Dube et al., 2001), and the vast majority of Kaiser ACE research has been based on this later iteration (see Appendix B for survey wording).

The Behavioral Risk Factor Surveillance System (BRFSS)/CDC ACE study. In 1984, the CDC began the BRFSS, a collaboration with state health departments to conduct health-related telephone surveys. As of 2016, the CDC collects data from over 400,000 adults from all 50 states and US territories yearly through this collaboration. The survey consists of questions on a wide variety of health conditions and health behaviors, with core sections and optional modules. An ACE measure was added as one such

optional module in 2009. Importantly, the same ACE items used in the Kaiser/CDC ACE Questionnaire are used in the BRFSS. In addition to using the information collected for prevention and intervention programs and tracking, researchers from individual states have published studies based on state-level data (e.g., North Carolina, Austin & Herrick, 2014; Washington state, Nurius et al., 2015; Wisconsin, O'Connor, Finkbiner, & Watson, 2012), replicating the relationship between ACEs and poor outcomes on a similar scale. Like the Kaiser participants, the majority of participants in the BRFSS who complete the ACEs module white, and many have education levels higher than the average for the United States. Before a review of the research supporting the inclusion of specific ACEs in the Kaiser and BRFSS studies, it is important to ground the ACE research in the theoretical bases supporting how and why stressors in childhood and adolescence are uniquely predictive of later outcomes.

Theoretical Frameworks

A number of theoretical frameworks have been applied to the study of ACEs in previous medical and developmental research. Key aspects of neurodevelopmental theories, cumulative effects theories, and transactional-ecological theories will be briefly reviewed. These theories overlap considerably and are not easily disentangled, but they will be addressed separately for clarity.

Neurodevelopmental theories. Neurodevelopmental theories are frequently invoked to explain the relations between cumulative ACEs and negative outcomes. Such theories emphasize what Hertzman (1999) termed the "biological embedding of early experiences," or, the processes by which ACEs alter the structure and functioning of neurophysiological systems and presumably, physical, cognitive, and socio-emotional

outcomes. Research has shown that alterations at the neurobiological level, relating to stress physiology, may partially explain outcomes through effects on behavior and mental health. Specifically, research has indicated that ACEs can lead to prolonged inflammation and systemic pathology, especially when ACEs are severe or chronic, or occur during sensitive periods (e.g., early childhood, puberty) (Anda et al., 2006; Anderson & Teichner, 2008; Bremner, 2003b; Cicchetti & Cannon, 1999; Crews, He, & Hodge, 2007; Gunnar & Quevedo, 2007; Pervanidou & Chrousos, 2012; Perry & Pollard, 1998).

It is important to note that neurodevelopmental research has most commonly focused on early and extreme ACEs such as neglect in institutional orphanages or severe, chronic abuse (Chugani et al., 2001; Gunnar & Quevedo, 2007; Mehta et al., 2009). Neurodevelopmental theories may therefore have less explanatory power in contexts of less acute ACEs (e.g., household dysfunction). This idea is particularly compelling in light of evidence that, even in cases of severe early ACEs, neurobiological effects may not be permanent (Gunnar et al., 2007). Additionally, at this time, neurodevelopmental theories may have relatively limited utility for informing large-scale prevention and intervention strategies. Instead, given the alterable nature of these variables through environmental supports, the ways in which the aforementioned brain alterations manifest in behavioral and psychosocial functioning are of particular interest.

Cumulative effects theories. A number of researchers have hypothesized that ACE-related alterations in neurophysiological functioning influence health outcomes via cumulative effects, and the measurement of cumulative ACEs is predicated in part on this idea. According to cumulative effects theory, risk and protective factors tend to accumulate over time, and as they accumulate, they progressively increase the probability

of negative outcomes, often in a graded fashion (Dannefer, 1987; Evans, Li, & Whipple, 2013; Pollard, Hawkins, & Arthur, 1999; Rutter, 1979). This pattern has been borne out in ACE research reporting dose-response relationships between cumulative ACEs and a panoply of physical, mental, and behavioral health outcomes. For example, Anda and colleagues (2006) asserted that, "the graded relationship of the ACE score to 18 different outcomes in multiple domains […] theoretically parallel[s] the total exposure of the developing central nervous system to the activated stress response during childhood […] with resulting impairment in multiple brain structures and functions." While researchers like Anda have primarily focused on health or health risk behaviors, there is evidence that ACEs also impact more distal psychosocial outcomes. This is illustrated by recent research supporting dose-response relationships between cumulative ACEs and social and economic well-being. For example, Giovanelli and colleagues (2016) reported that cumulative ACEs predicted educational attainment, juvenile and adult involvement in the criminal justice system, and employment outcomes in emerging adulthood in a low-income sample, suggesting that neurophysiological alterations observed in changes to health status may be expressed behaviorally and socially in complex ways. The recognition of the reverberation of these effects beyond physical health problems is an important step in identifying effective, scalable prevention and intervention efforts.

Transactional-ecological theories. Neurodevelopmental and cumulative effects theories are both necessary but insufficient frameworks for understanding the variance in outcomes among ACE-affected individuals and the processes that underlie these outcomes. As such, there is a critical need for research that takes a multiple-levels-of-analysis approach to examine the interactions among processes at varying points on the

social ecology that shape the development of ACE-affected individuals. Approaches such as these, often termed “transactional-ecological” models (also known as stress-process, life-course, generative mechanism, developmental cascade, or pathway model), offer a framework for integrating neurodevelopmental, cumulative effects, and resilience theories. As Cicchetti and Cannon (1999, p. 375) noted regarding the application of neurodevelopmental theory to the study of psychopathology, “An integrated perspective wherein an appreciation of the complex neural, psychological, and social-contextual processes that cohere to bring about normal and pathological outcomes is necessary in order to advance understanding of the genesis and epigenesis of mental disorders.”

Transactional-ecological models (Cicchetti & Lynch, 1993), which emerge from a long tradition of stress-process research in developmental psychology, can be seen as combining Bronfenbrenner’s (1992, 2005) ecological systems theory, in which development is understood as occurring in multiple nested systems, and Sameroff and Chandler’s transactional model (1975), in which development is conceptualized as the product of ongoing, reciprocal interactions among an individual and his or her contexts over time. This model allows investigators to organize complex interacting factors at multiple levels of the environment over time, and thus, to begin parsing out the processes that may underlie outcomes associated with ACE exposure (Davies, 1999; Guterman, 2000). Through this lens, ACEs can be seen as primary stressors that reduce adaptive capacities on many levels during sensitive developmental periods, increase the likelihood of encountering additional adverse experiences and secondary stressors (e.g., social and behavioral problems), and consequently, increase the probability of maladaptation (Ben-Shlomo & Kuh, 2002; Dong et al., 2004; Nurius et al., 2015). This process

Resilience theory. A primary focus of previous ACE research has been describing the association between ACEs and maladaptive outcomes, with limited attention paid by the medical field to the ACE-affected individuals who do *not* experience negative outcomes (see Nurius et al., 2015 and Bethell, Newacheck, Hawes, & Halfon, 2014 for notable exceptions). For example, Chapman and colleagues (2004) reported that 46% of ACE Study participants who grew up with a mentally ill family member went on to experience major depression as adults – nearly twice the rate of peers who had not grown up under such circumstances. However, it is unclear what differentiates these individuals from the 54% of participants who also had a mentally ill family member but did not go on to develop major depression. Developmental psychology, by contrast, has rarely investigated the impacts of stress without also investigating mechanisms of resilience or protective factors (Caspi, Elder, & Bern, 1988; Furstenberg et al. 1987; Werner, 1993).

Transactional-ecological models are ideal for theorizing about specific factors that promote resilience, or, "good outcomes in spite of serious threats to adaptation or development" (Masten, 2001). Processes occurring at every level of the bioecological system—from genetic, biological, and temperamental influences, to social and contextual processes—interact to shape the development of ACE-affected individuals (Belcher, Volkow, Moeller, & Ferré, 2014; Cicchetti & Garmezy, 1993; Heim & Binder, 2012; Luthar, 2006; Masten & Obradović, 2006; Rutter, 1990). Early investigations into mechanisms of transmission of the effects of life stress developmental psychology focused primarily on resilience as a construct rooted in individual temperamental differences, which then led them to make adaptive choices. As Werner (1993) so eloquently stated about the resilient subjects in the KLS:

> "When we examined the links between protective factors within the individual and outside sources of support or of stress, we noted a certain continuity that appeared in the life courses of the high-risk men and women who successfully overcame a variety of childhood adversities. Their individual dispositions led them to select or construct environments that, in turn, reinforced and sustained their active, outgoing dispositions and rewarded their competencies. In spite of occasional deviations during transitional periods such as adolescence, their life trajectories revealed cumulative interactional continuities."

They concluded that resilience was in large part due to inherent temperamental factors that led their participants to create supportive ecosystems for themselves. Others have defined resilience as a type of competency or a set of supportive structures. This definition, while perhaps still suggesting an underlying temperamental inclination towards adaptability, implies that resilience may lie in more alterable psychosocial factors. Bethell and colleagues (2014, p. 2108) reported that resilience, operationalized as the ability to "[stay] calm and in control in the face of a challenge," explained the relations between ACEs and children's school engagement. In another notable investigation of resilience in ACE-affected individuals, Nurius and colleagues (2015) reported that high levels of social and personal resources explained the effects of ACEs in an adult sample, such that participants with high ACEs but positive views of their community and high levels of social support had comparable psychological wellbeing to participants with low ACE scores. Nurius and colleagues also reported that participants who had high ACE scores but healthy sleep and exercise patterns missed many fewer

obligations due to mental illness than high ACE participants who had poor sleep and exercise habits.

Relatedly, research points to another promising pathway to resilience through ACEs: evidence-based early childhood education programs. These types of intervention programs have been shown to have positive impacts on children and produce significant financial returns to society across a broad range of areas, including reduced welfare and incarceration rates, higher educational attainment, reduced mental illness, and increased economic productivity and health insurance coverage (Reynolds, Temple, White, Ou, & Robertson, 2011; Belfield, Nores, Barnett, & Schweinhart et al., 2005). Importantly, such programs have been found to be most cost-effective for the children exhibiting the highest degree of psychosocial risk upon program entry (Schweinhart et al., 2005; Karoly & Bigelow, 2005). Specifically, the Chicago Longitudinal Study Child-Parent Center early childhood intervention program has been found to have compensatory benefits for children growing up in the highest-poverty neighborhoods, experiencing high demographic and economic risk factors, and whose parents were high school dropouts (Reynolds et al., 2007; Reynolds, Temple, Ou, White, & Robertson, 2011). Mechanisms of the effect of the CPC program are predicated on the 5-Hypothesis Model (5HM). The 5HM is based on cumulative advantage theory through a developmental ecological lens, hypothesizing that early enrichment can lead to increased competencies on many levels of the child's ecological system (i.e., family support, school support, cognitive abilities, motivation, and social adjustment), which accumulate and positively impact a child's developmental trajectory and success across domains. The CPC program has been shown to reduce the risk, and mitigate the effects, of maltreatment specifically (Temple &

Reynolds, 2007; Karoly, Kilburn, & Cannon, 2006) through 5HM pathways, with evidence suggesting that the 5HM explains maltreatment reduction in CPC participants, specifically through bolstering social adjustment, school support, and family support (Mersky, Topitzes, & Reynolds, 2011). Less research has been conducted on the effects of these programs on cumulative ACEs, but existing evidence suggests that investigation of protective effects of early childhood intervention programs in the face of ACEs is warranted, as similar mechanisms may be at play.

These empirical examples illustrate the value of employing a contextual theoretical approach to identify the processes that shape development following ACEs. Further, studies suggesting that resiliency can be bolstered or constructed through action also illustrate the potential utility of such information for informing intervention efforts.

Research on Individual Conventional ACEs

The selection of abuse, neglect, and household dysfunction for the original Conventional ACE questionnaire was based on a robust literature supporting these factors as strong predictors of maladjustment. Questions on emotional and physical abuse and domestic violence were adapted from the Conflict Tactics Scale (CTS) (Straus, 1990). Questions on sexual abuse were adapted from Wyatt (1985). Questions about emotional and physical neglect, were adapted from the Childhood Trauma Questionnaire (CTQ) (Bernstein, Fink, & Handelsman). The questions on parental separation and divorce were written by Kaiser ACE study authors (Dube et al., 2003).

While cumulative ACEs have been found to be more predictive of maladaptive adult outcomes (Turner & Loyd, 1995), a brief review of the consequences of discrete ACEs is warranted. Regarding evidence on consequences, it should be noted that

evidence of the physical and mental health correlates of these experiences is quite extensive, but information on broader indicators of well-being such as educational attainment and socioeconomic variables is more limited. Additionally, this review is focused only on ACEs assessed in the current study. Psychological maltreatment, including emotional abuse and emotional neglect are generally considered Conventional ACEs, but were not able to be assessed. As such, please refer to Appendix D for a review of the research base on these important forms of maltreatment.

Abuse and neglect. Child abuse and neglect are well-known predictors of disruptions in cognitive, socio-emotional, and behavioral development and subsequent maladaptive outcomes in adulthood, including increased rates of physical and mental health problems, reduced occupational prestige and economic productivity, and increased incarceration rates (Cicchetti & Toth, 1995; Erickson et al., 1989; Gilbert & Spatz-Widom, 2009; Hildyard & Wolfe, 2002; Leeb, Lewis, & Zolotor, 2011; Norman et al., 2012; Rogosch, Dackis, & Cicchetti, 2011), and a large body of research indicates that different types of abuse and neglect may have differential affects in both the short and long-term.

Physical abuse. Physical abuse is broadly defined as a non-accidental physical injury to a child (US Department of Health and Human Services [USDHHS]).

In the Kaiser ACE studies, physical abuse was measured by the following questions: “How often did a parent, stepparent, or adult living in your home 1) push, grab, slap, or throw something at you? 2) hit you so hard that you had marks or were injured?” (Dube et al., 2003).

The short- and long-term consequences of physical abuse have been extensively documented (see Malinosky-Rummell & Hanson, 1993; Springer, Sheridan, Kuo, & Karnes, 2007 for in-depth reviews). Generally, physically abused children have been found to be more aggressive and noncompliant, and perform more poorly on measures of cognitive skills (Erickson et al., 1989).

Adults with a history of childhood physical abuse are more likely to engage in violent and criminal behavior and have academic difficulties in college (Malinowsky, Rummell & Hanson, 1993). Psychologically, physical abuse has also been found to be predictive of substance abuse (Cohen & Densen-Gerber, 1982; Kroll, Stock, & James, 1985; Schaefer, Sobieraj, & Hollyfield, 1988); self-injurious and suicidal behavior (Cavaiola & Schiff, 1988; Deykin, Alpert, & McNamarra, 1985; Briere & Runtz, 1988), depression; anxiety; anger; and physical illnesses in the cardiopulmonary, constitutional, and musculoskeletal domains in adulthood (Springer et al., 2007).

Evidence also suggests that physical abuse can have later socioeconomic consequences. Zielinski (2009) found that adults in the large National Comorbidity Survey (NCS) who had experienced childhood physical abuse were at higher risk for employment problems, more likely to fall below the poverty line and in the lowest income quartile, less likely to have health insurance, and more likely to rely on Medicaid.

Contact sexual abuse. Contact child sexual abuse (CSA) is broadly defined as "contacts between a child and an adult or other person significantly older or in a position of power or control over the child, where the child is being used for sexual stimulation of the adult or other person" (American Psychological Association Guidelines for Psychological Evaluations in Child Protection Matters, 1999).

In the CDC ACE studies, CSA was measured by the following question: “During the first 18 years of life, did an adult, relative, family friend, or stranger [at least 5 years older] ever 1) touch or fondle your body in a sexual way, 2) have you touch their body in a sexual way, 3) attempt to have any type of sexual intercourse with you (oral, anal, or vaginal), or 4) actually have any type of sexual intercourse with you (oral, anal, or vaginal)?”

Like physical abuse, the consequences of CSA have been extensively studied (see: Jumper, 1995; Putnam, 2003). In Erickson’s (1989) study of maltreated children in the classroom, sexual abuse has been found to predict anxiety, inattention, withdrawal, and aggression. Further, it was reported that “interactions with teachers were marked by a high level of dependency, with a strong need for approval and physical closeness and a high incidence of assistance seeking evidenced” (Erickson et al 1989 in Cicchetti & Toth, 2009). This finding of maladaptive behaviors in children who have been sexually abused has been extensively replicated (Nagy, Adcock, & Nagy, 1994; Fergusson, Horwood, & Lynskey, 1996). In particular, increased sexualized behavior is often seen, particularly when the abuse is proximal and children are young (Cosentino, Meyer-Bahlburg, Alpert, Weinberg, & Gaines, 1995; Friedrich et al., 2001; McClellan et al., 1996; Paolucci, Genuis, & Violato, 2001; Putnam, 2003). In terms of neurobiological sequelae, the hypothalamic pituitary adrenal (HPA) axis, an indicator of stress reactivity, has also been found to be dysregulated in children experiencing CSA (DeBellis et al., 1999a). DeBellis and colleagues have also found neuroanatomical alterations in sexually abused children as well.

Regarding consequences in adulthood, there may be heterotypic continuity. That is, the underlying mechanism remains the same, but the manifestation of the process looks different across development (Rutter & Sroufe, 2000). Regarding problematic or risky sexual behavior; a history of CSA is associated with increased risks of arrest for prostitution and other criminalized sexual behavior (Widom & Ames, 1994), and teen pregnancy (Fiscella, Kitzman, Cole, Sidora, & Olds, 1998). According to Putnam's (2003) review, in adults, a history of CSA has been found to be associated with a host of psychiatric disorders, including depression, borderline personality disorder, somatization disorder, substance abuse disorder, post-traumatic stress disorder, dissociative identity disorder, and bulimia nervosa (Beitchman et al., 1992; Bifulco, Brown, & Adler, 1991; Ernst, Angst, & Földényi, 1993; Fergusson et al., 1996a; Mullen, Martin, Anderson, Romans, & Herbison, 1993; Polusny & Follette, 1995; Ussher and Dewberry, 1995).

Like physical abuse, sexual abuse in childhood can also have later socioeconomic consequences. Regarding education, research drawing from the longitudinal Christchurch Health and Development Study (CHDS) indicated that exposure to childhood sexual abuse was significantly associated with educational attainment (e.g., graduating from high school, attending college, graduating from college). Importantly, family, socioeconomic, and individual factors explained these associations, providing evidence for potential moderators and mechanisms and underscoring the complex developmental processes that can lead from ACEs to maladaptive outcomes (Fergusson, Boden, & Horwood, 2007).

CSA has long been seen as a major risk factor for poor adjustment, even in the absence of other dysfunctional family characteristics. Despite documented concerns with

the accuracy of self-report of CSA (Feldman-Summers & Pope, 1994), information gathered from those who do accurately report is valuable to illuminate correlates and consequences.

Physical neglect. Physical neglect is defined as "the failure to provide needed food, clothing, shelter, medical care, or supervision to the degree that the child's health, safety, and well-being are threatened with harm" (US DHHS).

In the Kaiser ACE studies, physical neglect was measured by the five following CTQ items, some of which were reverse scored*: 1) "I didn't have enough to eat." 2) "I knew there was someone there to take care of me and protect me.*" 3) "My parents were too drunk or too high to take care of me." 4) "I had to wear dirty clothes." 5) "There was someone to take me to the doctor if I needed it.*" (Dube et al., 2003).

Research indicates that physically neglected children have more extreme cognitive and academic delays when compared to physically abused children. Cognitively, children in the Mother-Child Project who had been physically neglected were more impulsive and less flexible than other maltreated children, and by kindergarten, intellectual performance and academic achievement was the lowest of all groups (Egeland, Sroufe, & Erickson, 1983; Erickson, Egeland, & Pianta, 1989), a finding that was replicated in a later investigation by Eckenrode, Laird, & Doris, 1993. Neglected children in the Mother-Child Project sample were also more likely to be retained in school (65%, as compared to 50% of physically abused children) or otherwise identified as needing academic intervention (Erickson et al., 1989). Longitudinal follow-up in this same sample in adulthood found that physical and cognitive neglect predicted cardiometabolic risk, self-report of health quality, and number of health problems

(Johnson et al., 2017), while physical and sexual abuse did not. Socially, physically neglected children have been found to be more withdrawn and prone to both internalizing and externalizing problems (Erickson et al., 1989; Hildyard & Wolfe, 2002).

Regarding mental health, physically neglected children have been found to have poorer coping skills, low agency and self-esteem, and high frequencies of pathological behaviors (e.g., tantrums, tics, soiling, self-harm) (Egeland & Sroufe, 1981; Hildyard & Wolfe, 2002). Manly, Kim, Rogosch, & Cicchetti, (2001) investigated outcomes related to abuse and neglect and found that physically neglected children were more prone to internalizing than non-maltreated children and children experiencing other types of maltreatment. However, Evans & Burton (2013) also found that out of five types of child maltreatment, physical neglect was most strongly predictive of certain externalizing behaviors like juvenile crime (violent, nonviolent, property offending, and status offending).

Research indicates that neglect has robust distal consequences as well, particularly economic consequences. Adults in the National Comorbidity Survey who reported experiencing neglect in childhood were 90% more likely to fall below the federal poverty line and 80% more likely to have earnings in the lowest income quartile than their non-neglected counterparts (Zielinski, 2009).

Household dysfunction. Household dysfunction in the ACE studies comprises measures of exposure to household substance abuse, mental illness or suicidality in the home, domestic violence, incarceration of a household member, and parental separation or divorce. As with maltreatment, these factors often co-occur with each other and with poverty, although more methodologically rigorous studies match children on other

measures of family adversity or otherwise attempt to control for such covariates (Odgers & Jaffee, 2013). A substantial body of research has attempted to parse out individual contributions of different types of household dysfunction to maladaptive outcomes (Aldridge, 2006; Famularo, Kinscherff, & Fenton, 1992; Repetti, Taylor, & Seeman, 2002). However, most research on the influence of these "household factors" on children has focused on parents or primary caregivers specifically. Much less is known about the discrete (as opposed to cumulative) effects of these factors when they occur in the household in general and what, if any, the differences may be.

Exposure to substance abuse. In the Kaiser ACE studies, exposure to substance use was measured by two questions that asked the respondent whether she or he had lived 1) with a problem drinker or alcoholic or 2) with anyone who used street drugs (Dube et al., 2003).

Household substance abuse has been strongly linked to maltreatment and family conflict, including domestic violence (Black, Bucky, & Wilder-Padilla, 1986; Famularo et al., 1992; Fuller & Wells, 2003; Scannapieco & Connell-Carrick, 2007; Smith & Testa, 2002; Walsh, MacMillan & Jamieson, 2003). Alcoholism is one of the most commonly studied types of substance abuse. Extensive research has shown that children of alcoholics in particular are at increased risk for maladaptive psychological outcomes (Christenson & Bilenberg, 2000; Emshoff & Price, 1999; Jacob & Windle, 2000; Miller & Jang, 1977; Serec et al., 2012;).

Cognitively, children of alcoholics without fetal alcohol syndrome have been found to perform more poorly on cognitive tasks overall (Diaz et al., 2008), evincing lower academic achievement, poorer verbal and problem-solving skills (Sher, Walitzer,

Wood, & Brent, 1991; Tarter, Jacob, & Bremer, 1989), and attentional deficits (Tarter, Jacob, & Bremer, 1989). However, Noll, Zucker, Fitzgerald, & Curtis (1992) found that cognitive functioning was related to parental alcoholism primarily when the quality of the home environment (as measured by the Home Observation for Measurement of the Environment [HOME] score) was impacted, and that findings across developmental domains were attenuated when socioeconomic status and HOME scores were considered (Noll et al., 1992). Nuanced approaches such as this serve as a reminder that these contextual factors can be important third variables.

Children of alcoholics show differences in social and behavioral functioning as well, evincing higher levels of hyperactivity and antisociality (Black et al., 1986; Diaz et al., 2008; Sher et al., 1991) and delays in social and fine motor development (Noll et al., 2002). Imaging studies have corroborated this, specifically suggesting differences in response inhibition circuitry in children from alcoholic households (Hardee et al., 2014). Furthermore, parental alcoholism has been associated with increased risk for externalizing disorders such as disruptive behavioral disorders, as well as substance use in offspring (Hussong, Huang, Serrano, Curran, & Chassin, 2012; Reich, Earls, Frankel, & Sheika, 1993). In spite of these findings, Schuckit, Smith, Radziminski, & Heyneman, (2000) found that after controlling for demographic and antisocial disorder family history, children of alcoholics in their study were not at a higher risk for externalizing disorders. However, considering other evidence of psychological effects of parental alcoholism, along with the high comorbidity of alcoholism in the household with other household dysfunction and maltreatment, it is prudent include parental alcoholism in a measure of cumulative adversity.

In terms of long-term consequences, when compared to adults who were not raised with an alcoholic in their household, adult children of alcoholics have been found to be at a higher risk for alcoholism themselves (though it should be noted that heritability has been estimated at around 50%; Verhulst, Neale, & Kendler, 2015); at a higher risk of marrying an alcoholic; and exhibit more physical illnesses, social problems, and antisocial behavior (Black et al., 1986; Sher et al., 1991; Rydelius, 1981). These results have often been found to be moderated by sex, with males generally being more susceptible to the repercussions of parental alcoholism (Rydelius, 1981; Miller & Jang, 1977).

Parental hard drug use is often studied under the broader term of "drug and alcohol use," but some research has investigated the effects of parental hard drug use in particular. As parental hard drug use rarely occurs in the absence of other unsafe environmental factors (Barnard & McKegany, 2004; Taplin & Mattick, 2013)**,** nearly all of the research on hard drug use focuses on the aforementioned associated heightened risk of abuse and neglect (Barnard & McKegany, 2004). There is a strong evidence base indicating that parental drug use can be damaging through several different avenues; however, the differential effects of parental drug use controlling for alcoholism, poverty, maltreatment, and other factors are largely unknown.

Exposure to mental illness/suicidality in the home. Household mental illness in the CDC ACE studies was "defined by an affirmative response to 1 or both of the following questions: 1) Was anyone in your household mentally ill or depressed? and 2) Did anyone attempt to commit suicide?" (Dube et al., 2003).

Much of the research on household mental illness has focused on effects of parental depression, which has been associated with cognitive, emotional, and behavioral delays (Carter, Garrity-Rokous, Chazan-Cohen, Little, & Briggs-Gowan, 2001; Hoffman, Crnic, & Baker, 2006; Quevedo et al., 2012) and disruption of the attachment relationship (Jameson, Gelfand, Kulcsar, & Teti, 1997).

Psychologically, children living with mental illness in the household are at an increased risk of psychiatric disturbance and behavioral and emotional problems themselves in both the short and long-term (Beardselee, Versage, & Gladstone, 1998; Beidel & Turner, 1997; Rutter & Quinton, 1984).

Similarly, children in families where suicide occurs have been found to have negative behavioral trajectories, both due to pre-existing risk factors and subsequent pathology (Cerel, Fristad, Weller, & Weller, 1999; Chapman, 2004). Children whose parents attempt or complete suicide are also at an increased risk of mental health problems and suicidality themselves (Pitman, Osborn, King, & Erlangson, 2014; Shepherd & Barraclough, 1976). In the immediate aftermath, they are also at heightened risk for Post-Traumatic Stress Disorder (Pfeffer et al., 1997).

While heredity is potentially relevant to all ACEs, it is particularly salient when studying the effects of parental mental illness and suicidality. The high genetic loading of many mental illnesses has been extensively documented (Sullivan, Neale, & Kendler, 2000; McGuffin et al., 2003; Wray & Gottesman, 2012). Heritability estimates for disorders with a strong genetic basis like schizophrenia and bipolar disorder range from 50-80% (Rutter & Plomin, 1997). However, the environmental context is also nearly universally recognized as playing a critical part in the phenotypic expression of mental

illness (Nicholson, Sweeney, & Geller, 1998; Rutter & Plomin, 1997; Uher, 2009), with twin and family studies demonstrating that genetic diatheses do not fully explain outcomes in children with mentally ill kin (Cadoret, O'Gorman, Heywood, & Troughton, 1985; von Knorring, Cloninger, Bohman, & Sigvardsson, 1983). For example, in a study comparing children of healthy mothers and children of mothers with either unipolar depression, bipolar disorder, or medical illness (e.g., diabetes), children of medically ill mothers without mental illness were still significantly more likely to be diagnosed with a mental illness in childhood and adolescence than children whose mothers did not have medical or mental illness (Hammen, Burge, Burney, & Adrian, 1990). In recent decades, research methodologies like behavior genetics approaches (Plomin, DeFries, Knopik, & Neiderheiser (2013) and theoretical models like Bronfenbrenner's bioecological systems theory (Bronfenbrenner, 2005) have shifted the question from *whether* the environmental context can contribute to outcomes to *how* and *how much* it contributes. Specifically, explanations for the environment's role in the transmission of mental illness center on neurological and behavioral developmental disruption resulting from exposure to trauma; chronic stress; stigma; and maladaptive behaviors, affect, and cognitions (Cerel, Fristad, Weller, & Weller, 1999; Goodman & Gotlib, 1999).

Exposure to domestic violence. Although domestic violence is broadly defined as "pattern of abusive behavior in any relationship that is used by one partner to gain or maintain power and control over another intimate partner" (US Department of Justice [DOJ]), and can therefore be perpetrated by men or women in same or opposite-sex intimate relationships, the ACE studies focused specifically against violence against a participant's mother perpetrated by a male intimate partner (Intimate Partner Violence;

IPV). This is likely due to the much higher prevalence of IPV in this context (World Health Organization, 2005).

In the ACE studies, participants were specifically asked about violence against their mother with the following questions: How often did your father (or stepfather) or mother's boyfriend do any of these things to your mother (or stepmother)? 1) Push, grab, slap, or throw something at her, 2) kick, bite, hit her with a fist, or hit her with something hard, 3) repeatedly hit her over at least a few minutes, or 4) threaten her with a knife or gun, or use a knife or gun to hurt her (Dube et al., 2003).

Prevalence rates of exposure to IPV range from 10-20% of children per year (Carlson, 2000). It is important to note that children exposed to IPV are indeed at increased risk of being victims of abuse themselves; estimates of children in battered women's shelters who have themselves been abused range from 40-70% (Campbell & Lewandowski, 1997). Studies of the effects of IPV on children have reached varying conclusions, partly due to differences in now IPV is defined, as well as a host of mediating and moderating factors such as severity, chronicity, and timing of the violence; other existing risk factors; and whether or not the children were also victims of violence themselves (Fantuzzo & Mohr, 1999).

Regarding mental health outcomes, a 2003 meta-analysis of 41 studies revealed that exposure to domestic violence increases children's emotional and behavioral problems (Wolfe, Crooks, Lee, McIntyre-Smith, & Jaffe), and this risk increases with co-occurring child abuse. Children who are exposed to IPV are at increased risk of internalizing disorders such as depression and anxiety (Carlson, 2000; Teicher, Samson, Polcari, McGreenery, 2006), post-traumatic stress responses (Lewandowski, 1997), and

externalizing disorders like aggression and conduct problems (Cappell & Heiner, 1990; Narayan, Englund, & Egeland, 2013) in both the short and long-term.

Socially, these children may experience difficulties with peer relationships (Carlson, 2000), lower social competence, and poorer academic performance (Fantuzzo & Mohr, 1999). Cognitively, children exposed to IPV are at increased risk of developmental delays and impaired cognition (Gleason, 1995). Meta analyses indicate that no clear pattern has emerged regarding moderation of effects by sex and age, which may partly be due to a limited number of longitudinal studies on children exposed to IPV (Evans, Davies, & DeLillo, 2008).

Limited longitudinal data does suggest that in adulthood, individuals who were exposed to IPV are at heightened risk of being perpetrators or victims of domestic violence, as well as for depression, and delinquent behavior (Carlson, 2000; Narayan, Englund, & Egeland, 2013; Herrera & McCloskey, 2001).

***Parental separation or divorce*.** Parental separation or divorce was assessed in the CDC ACE studies through the following question: “Were your parents ever separated or divorced?” (Dube et al., 2003).

Decades of research, beginning with Bowlby’s finding of a relation between delinquency and parent-child separation (Bowlby, 1946), has shown that the absence of a parent (presumed to be an attachment figure) from the household can have deleterious effects on functioning, achievement, and overall well-being (Amato & Anthony, 2014; Kelly & Emery, 2003).

It is difficult to draw causal conclusions about outcomes observed in children of divorced parents. Many have suggested that selection or pre-existing child behaviors may

be the driving forces behind effects, rather than divorce itself (Ginther & Pollak, 2004). Amato and Anthony attempted to parse the causal effects of divorce with a child fixed-effects model and found strong causal effects of divorce on many aspects of child functioning in expected directions (e.g., reading and mathematics scores, interpersonal skills, internalizing and externalizing problems), though the authors noted that the effect sizes were small (Amato & Anthony, 2014). Woodward, Fergusson, & Belsky (2000) investigated the effects of timing of divorce or separation on children's attachment and bonding outcomes in mid-adolescence adjusting for confounding factors. They found that age can indeed moderate the effects, with children who were younger when parents divorced displaying more maladaptive relationship perceptions and parental attachment in mid-adolescence (Woodward, Fergusson, & Belsky, 2000). Regarding behavioral outcomes, Juby & Farrington (2001) reported that children of divorced parents were more likely to engage in delinquent behavior than children whose parent had died.

In adulthood, Gilman, Kawachi, Fitzmaurice, and Buka (2003) found that experiencing divorce in childhood predicted depression independent of socioeconomic status and parental conflict, though the association between family disruption and depression was stronger in individuals reporting high parental conflict.

All of the extant research to the author's knowledge conflates separation and divorce, and does not measure the differential effects. While parental separation and divorce could be seen as functionally equivalent if the separation is permanent, periodic separation and reunion could have unique consequences, as it could create chronic household instability.

Incarceration of a household member. In the CDC ACE studies, this experience was assessed with the question "Did anyone in your household go to prison?" (Dube et al., 2003). Due to the way the question was worded, it is impossible to know what proportion of participants who responded in the affirmative were referring to parents as opposed to other individuals living in the household, but as with other household dysfunction variables, the vast majority of the extant research focuses on parents.

The preponderance of ACEs research has been conducted in the United States, which is the nation with the highest imprisonment rate in the world. By one estimate, over half of state inmates and nearly 1/3 of federal inmates are parents (US DOJ, 2008). For children born in 1990, nearly one in 25 white children and an astounding one in four black children had experienced parental incarceration by the time they were fourteen years of age (Western & Wildeman, 2009), suggesting that parental imprisonment is a common ACE, particularly for the black community.

A 2009 meta-analysis of 16 studies, conducted by Murray, Farrington, Sekol, Olsen, & Murray showed that antisocial behavior and mental health problems were strongly associated with parental incarceration. A follow-up meta-analysis of 40 studies, conducted by Murray, Farrington, & Sekol (2012), supported the association of parental imprisonment and antisocial behavior, and additionally for poor educational performance.

Longitudinal studies indicate that these effects may carry into adulthood. An extensive body of research conducted by Murray & Farrington (2005, 2008a, 2008b) has found that boys who had experienced parental incarceration before age 10 had a twofold increased risk for internalizing and externalizing problems and criminality up to age 48 when compared to boys whose parents had been incarcerated before they were born, boys

whose parents had never been incarcerated, and boys who were separated from their parents for other reasons (e.g., divorce, death).

ACEs in a High-Risk Context

While ACE studies and related measures of the home environment have consistently demonstrated the harmful effects of early adversity, previous samples have predominantly comprised middle-income participants. As such, generalizability of ACE findings to minority populations and high-risk contexts is limited. All participants in the Kaiser/CDC studies were enrolled in private health insurance plans, nearly three-quarters were white, and nearly three-quarters had attended college. Living in high-poverty, low-resource neighborhoods may exacerbate the deleterious effects of adversity or alter the patterns of influence on later well-being (Odgers & Jaffee, 2013). Additionally, some studies have shown that responses to adverse experiences may differ based on minority status (Odgers & Jaffee, 2013; Widom, Czaja, Wilson, Allwood, & Chauhan, 2012). Rosenberg and Dorhenwend approached this issue somewhat obliquely in 1975, investigating whether there were racial and experiential differences on the subjective amount of "readjustment" a participant estimated was required by certain events, but assessment of the potential amplification of the effects of ACEs by the resource-taxing effects of poverty and minority status has been limited (Odgers & Jaffee, 2013). Additionally, studies on stressors urban, underserved communities suggest that these populations may experience some qualitatively different adverse experiences, most of which traditional ACE questionnaires do not measure (Cronholm et al., 2015; Finkelhor et al., 2013). Experiences such as witnessing neighborhood violence or living in a household with limited finances are chronic stressors that have not been explored

longitudinally in an ACE framework, though evidence from the larger literature on risk and resilience indicates that these experiences can be impactful. For purposes of generalizability, more research into ACEs in high-risk and racial and ethnic minority populations is needed. It should be noted that while poverty and minority status are clearly not one in the same, they are highly correlated and therefore at times discussed together.

The Role of poverty in ACEs. Research has shown that individuals living in both urban and rural poverty are more likely to have problems in adulthood (e.g., physical and mental health ailments; health compromising behaviors) (Kawachi & Berkman, 2003; Boyce & Jemerin, 1990; Escalona, 1982; Marmot et al., 2008; Russell, Carr-Hill, & Illsley, 1984; US DHHS, 1985; Werner, 1989). These disparities have been documented cross-culturally and across healthcare systems (Kawachi & Berkman, 2003; Marmot et al. 2008).

Children living in both urban and rural poverty are more likely to be exposed to more (and potentially different) ACEs than non-impoverished peers (Bradley & Corwyn, 2002; Cronholm et al., 2015; Evans, Vermeylen, Barash, Lefkowitz, & Hutt, 2009; Halonen et al., 2014; Larkin & Park, 2012; Parker, Greer, & Zuckerman, 1988; Shonkoff et al., 2009). One study that was conducted specifically in an ACE framework found that in a sample of 801 low-income minority participants, almost all of the participants (94%) had experienced at least one ACE, compared to 67% in the original ACE sample. Furthermore, about half (49%) had experienced four or more, compared to 17% of participants in the original study (Lynch, Waite, & Davey, 2013). Furthermore, Wade and

colleagues (2016) have found that low socioeconomic status may amplify the effects of ACEs.

The connection between growing up in disadvantaged neighborhoods and an increased likelihood of experiencing ACEs can also work in reverse; that is, experiencing ACEs can augment the negative effects of living in a disadvantaged neighborhood (Odgers & Jaffee, 2013). Parker, Greer, & Zuckerman (1988) argue that, "children living in poverty experience double jeopardy. First, they are exposed more frequently to such risks as medical illnesses, family stress, inadequate social support, and parental depression. Second, they experience more serious consequences from those risks than do children from higher socioeconomic status."

The potential mechanisms through which poverty renders children more susceptible to the effects of ACEs are numerous. Consistent with the transactional-ecological perspectives, Odgers and Jaffee conceptualize poverty and inequity as "macrolevel forces that shape the contexts in which children experience and ultimately respond to adversity" (2013). Researchers investigated the specific ways in which these variables can shape a child's relationship to stressors. Bradley and colleagues (1994) hypothesize that both intrinsic (e.g., neurobiological alterations, limited competencies, lack of confidence that the environment can meet their needs; diminished self-efficacy) and extrinsic (e.g., limited access to healthcare, food, and other basic necessities; understimulating and chaotic environment; lower quality parenting) contribute "in synergistic fashion" to this amplification of the effects of stress (Bradley et al., 1994).

Poverty as an ACE. *In* light of the psychosocial risk conferred by poverty, some have argued that poverty in itself is an ACE (Sameroff, Seifer, Barocas, Zax, &

Greenspan, 1987). Notably, the large-scale ACE studies do not generally ask about experiences relating to income or living in an impoverished community, and furthermore, they focus exclusively on in-home and within-family experiences. However, transactional-ecological approaches suggest that the full spectrum of the individual's environment and broader context must be taken into account. It is important to recognize that discrete aspects of growing up in an impoverished environment can have effects on children's functioning commensurate with the effects of other experiences of adversity. As such, it has been suggested that if researchers do not measure experiences specific to an impoverished environment, they may be missing or masking the effects of influential adverse experiences.

One way to accomplish this is by assessing adverse experiences relating to socioeconomic status as well (Brooks-Gunn, Duncan, Klebanov, Sealand, 1993). This idea is not a new one, and it was first proposed in the early days of life stress research by Rabkin & Struening (1976), who suggested that we must "consider the appropriateness of various life event items for members of different socioeconomic and ethnic groups" (Rabkin & Struening, 1976).

Despite this precedent, the Kaiser ACE questionnaire does not ask about experiences that may be more common for low-income or marginalized individuals and the major studies have not included significant samples from these populations. Additionally, children, in high-poverty contexts or not, do not exist inside the vacuum of the family life. A broader ACE framework with community-level indicators and information about socioeconomic status is necessary to illuminate potential consequences, mechanisms, and moderators of ACEs for individuals in high-risk

contexts. Some studies have incorporated the idea of poverty as an ACE into research design, but more often than not, the blunt tools of income level or occupational prestige are used to assess socioeconomic status (Danese et al., 2008; Finkelhor et al., 2013), and often as a moderator of ACE effects in adulthood rather than as childhood adversity (Cronholm et al., 2015). While this type of research is important to replicate and underscore the risks associated with poverty, the quality of the environment both inside and outside of the home is clearly not identical across impoverished families (Galster, 2012). More specific reports of hardship associated with lower socioeconomic status (e.g., reported difficulty affording food, clothing, medical care, or housing; low neighborhood safety; discrimination) more clearly operationalize stress on both the child and the family unit, and therefore illuminate the adverse effects of poverty in a more nuanced way.

Large-scale investigations into ACEs in impoverished and minority populations. One example of progress in this area is the Public Health Management Corporation (PHMC) for the Institute for Safe Families' Philadelphia Urban ACE Study, funded by the Robert Wood Johnson Foundation. Recognizing that the majority of participants in the large-scale ACE studies were college educated, Caucasian, and middle-class, the PHMC began to investigate ACEs in Philadelphia, where the population is more socioeconomically and racially diverse than those in previous studies. They assessed nine of the CDC ACEs, leaving out parental separation/divorce, designating this scale the "Conventional ACE Score." They then created an "Expanded ACE Score" by adding ACEs reflecting "stresses associated with growing up in an urban community." In the Expanded ACE Score the authors additionally assessed neighborhood safety and trust,

bullying, witnessing violence, discrimination, and foster care status. These measures were chosen via literature reviews and focus groups conducted with urban youth (Wade, Shea, Rubin, & Wood, 2014). Cronholm (2015) found that over a quarter of respondents endorsed having experienced Expanded ACEs, and nearly 14% of respondents endorsed *only* the expanded ACEs, indicating that, in impoverished contexts in particular, adversity in the form of indicators at the community-level is going undetected with the current ACE questionnaire.

Furthermore, in the PHMC Urban ACE Study, African-American participants were found to report expanded ACE scores significantly higher than white participants (Cronholm et al., 2015). When compared to the Kaiser study, participants in this sample reported higher rates of six out of the nine conventional ACEs as well. These findings provide further support for the assertion that high-risk and low-income populations may be exposed to higher levels of adversity.

A more recent study utilizing this same sample (Wade et al., 2015) found that higher Conventional ACE scores were associated with a broader range of outcomes, including health risk behaviors, and physical and mental illness, whereas Expanded ACE scores were associated with sexually transmitted infections and substance abuse. The authors also found that SES moderated the associations between both Conventional and Expanded ACEs such that lower income participants were at significantly increased risk for poor outcomes than their higher SES counterparts with the same number of ACEs.

The lack of a dose-response pattern between Expanded ACEs and health outcomes in the Urban ACE study suggests that that expanded ACEs may exert effects in unique, indirect ways (cf. Giovanelli, Reynolds, Mondi, & Ou, 2016). It should also be

noted that, while not an “ACE” study, the aforementioned Kauai Longitudinal Study (1993) is also an early example of a study that operationalized poverty as adversity in a non-Caucasian sample.

Finkelhor and colleagues (2013) conducted another major study investigating an Expanded ACE questionnaire, with the aim of determining which contextual ACEs might be most appropriate for inclusion in an ACE battery, rather than measuring specific outcomes. The authors chose twenty community-level items assessing lifetime victimization and adversity in addition to the ten original ACE items. To measure subjective distress, each child also completed selected subscales of the Trauma Symptom Checklist for Children (TSCC). The authors regressed the original ACE scale items on the distress scores and found strong associations and a dose-response relationship between number of adversities and distress scores, as would be expected from previous research. Finally, the authors pooled and the original and extended items and regressed them on the distress scores. Based on these regression analyses, the following items were added to this revised ACE scale: property victimization by a non-sibling, peer victimization by a non-sibling, exposure to community violence, socioeconomic status, bad accident or illness of someone close, below-average grades, parents always arguing, and no good friends at the time of the interview. Parental separation or divorce and incarceration of a household member were removed from the scale because they did not significantly contribute to the model when all items were entered. This analysis is an important contribution to the ACE literature because it provides evidence that it is possible to strengthen the predictive power of the ACE scale further, in addition to adding to our knowledge base of more proximal effects of ACEs. Finkelhor’s

investigation has the clear limitation of being cross-sectional and therefore unable to investigate the predictive power of these ACEs over time. It is possible that some ACEs that cause distress in the short-term (e.g., below-average grades) may not have lasting effects. Conversely, an ACE may not cause significant distress to a child in the short-term, but may have serious consequences later in life. Indeed, the authors themselves point out that the TSCC "may be better associated with the impact of some childhood events, such as violence exposure, than others, and may not necessarily be reflective of what could best predict long-term health effects (Finkelhor, 2013)."

While Finkelhor did include socioeconomic status as an ACE, the study used a continuous measure comprising household income and parental education level instead of more nuanced measures of privation. It is important to note, however, that the authors do suggest using food scarcity as a potential additional domain of child adversity for future studies, in addition to parental death. An additional methodological concern is response bias, both due to the 43% response rate, and the method of data collection requiring the child to respond to questions about violence exposure via the phone interview. It is possible that children who were exposed to abuse and neglect may underreport these experiences due to fear of ramifications from caregivers or social services, or a lack of privacy during the interview. Another key point about the Finkelhor (2013) and Cronholm et al., (2015) investigations into expanded ACEs is that a significant percentage of participants are white and educated. In the Cronholm investigation, participants were still nearly half white, and 90% had a high school degree (nearly 60% had some college or a college degree). In the Finkelhor investigation, although the sample was more diverse than the Kaiser study, over half of the sample was white, and

only 15% of participants were black. Three studies to this author's knowledge have investigated ACEs in large or primarily African-American populations. First, Copeland-Linder, Lambert, Chen, & Ialongo (2011) addressed both the dearth of ACE research on minorities and the lack of context-specific ACEs in a study examining just expanded ACEs (referred to as contextual stress) and health compromising behaviors in urban African American adolescents. Contextual stress was defined as racial discrimination, violence in the community, and neighborhood disorder. In the two-year follow-up, the latent contextual stress variable was associated with aggression and substance use in boys, and substance use alone in girls. They also investigated mediators and found that self-worth and competence buffered boys from the effects of contextual stress on substance use. This study is an important step in the right direction, though it was not conducted in a traditional ACE framework, as the original ACEs were not measured in addition to the contextual ACEs.

Second, Mersky and colleagues (2013) explored impacts of ACEs in the Chicago Longitudinal Study cohort, a primarily (over 90%) African-American urban population which is also the sample used in the present investigation. They found strong relations between number of ACEs and poor outcomes in the domains of health, mental health, and substance use in early adulthood. In this investigation, however, the authors did not measure key ACEs such as parental incarceration or domestic violence, and expanded the ACE measure to the high-risk context in a very limited way (e.g., witnessing a shooting or stabbing). It should be noted that Mersky has recently developed an expanded ACE scale as well (unpublished) with all of the original ACEs and additional nuanced measures of SES, homelessness, foster care placement, and other neighborhood and

school experiences. Further investigation into ACEs in this cohort was conducted by the current author, along with colleagues Reynolds, Mondi, & Ou (2016), with a Conventional ACE measure more closely replicating the CDC ACE questionnaire. Results showed that ACEs consistently predicted a diverse set of adult socioeconomic, educational, health, and crime outcomes, and named investigation of mechanisms as a future direction.

A final notable example in regards to generalizing ACE effects to low-income and minority populations is a more recent study by Mouton, Hargreaves, Liu, Fadeyi, & Blot (2016). Authors investigated ACEs and cancer risk behaviors in a sample of over 22,000 men and women in the Southern Community Cohort Study (SCCS). Over half of the participants were African-American, over half made less than $25,000 per year, and approximately half had not attended school beyond 12th grade. In this study, authors found that African-Americans were not more likely to report ACEs, but that lower income participants, participants in poorest neighborhoods by census tract, and participants with less than a high school education were more likely to report ACEs and more likely to report ≥4 ACEs. One limitation is that, unlike in the two previously mentioned studies, Mouton and colleagues did not inquire about ACEs that may be more common in low-income or minority populations. Furthermore, to date, focal outcomes in this sample have been limited to different types of cancers and cancer risk behaviors.

Expanded ACEs. As discussed above, researchers have increasingly recognized the importance broadening our definition of ACEs to gain a more accurate picture of risk in underserved populations (Finkelhor, Shattuck, Turner, & Hamby, 2013; Mersky, Topitzes & Reynolds, 2013). This will serve to both strengthen predictive power and

create a more complete picture of the mechanisms through which adversity leads to poor outcomes. While there is some evidence that myriad adverse experiences can affect development and are more pervasive in certain groups, there are several for which the evidence is particularly strong. There is also some precedence for characterizing the following experiences as ACEs specifically. These are briefly reviewed below. As with the Conventional ACEs, there are several types of expanded ACEs that were not included in this study but which warrant further attention. See Appendix D.

Community violence. Evidence shows that children growing up in poverty are exposed to community violence at much higher rates than their higher SES counterparts. Estimates of rates of witnessing community violence in urban youth range from 47 to 96% (Gorman-Smith, Henry, & Tolan, 2004), and in one study, 35% of a sample of primarily African-American and Latino youth reported witnessing a stabbing, 33% reported witnessing a shooting, and 23% reported seeing a dead body in the neighborhood (Miller, Wasserman, Neugebaur, Gorman-Smith, & Kamboukos, 1999). Children who are exposed to community violence show significantly worse outcomes than SES-matched counterparts who were not exposed (Graham-Bermann & Seng, 2005). Most of the research to date has been conducted on mental health outcomes, showing increased risk of depression, posttraumatic stress disorder, and anxiety (Fitzpatrick, Piko, Wright, & LaGory, 2005; Mazza & Reynolds, 1999; Rosenthal, 2000; Singer, Anglin, Song, & Lunghofer, 1995) and health compromising behaviors like suicidal ideation and attempts, sexual promiscuity, substance use, and fighting (Berenson et al. 2001; Kliewer et al. 2006; Lambert, Copeland-Linder, & Ialongo, 2008; Taylor & Kliewer, 2006). Further, African American and urban-dwelling adolescents in particular are

disproportionately more likely to be both victims and witnesses of community violence (Centers for Disease Control [CDC] 2006; DOJ, 2008).

Foster care. Foster care, in addition to the existing ACEs of "parental separation or divorce" is often classified as problematic because it usually represents disruption to an attachment relationship. Further, foster care may be even more impactful than parental separation or divorce because substitute care is more likely to be inadequate and unfamiliar (Herman, Susser, & Struening, 1994). A 1996 meta-analysis reviewing 29 studies published between 1960 and 1992 indicated that adults who were in foster, group, or institutional care as children were more likely to rely on public assistance, perform poorly in and drop out of school, be homeless, be arrested, struggle with chemical dependence, and have worse physical and mental health in adulthood (McDonald, 1996), and many of these findings have been replicated later research (Herman, Susser, & Struening, 1994; Pecora et al., 2006). Among homeless adults, those who report experiencing such out-of-home care in childhood have also been found to have higher rates of severe depressive symptoms (Herman, Susser, & Struening, 1994). Effects of foster care can be seen earlier as well, with heightened behavioral, psychiatric, academic failure, and substance use rates in children and adolescents who have been involved in foster care (Fantuzzo & Perlman, 2007; Pilowski & Wu, 2006). It is important to note, however, that children and adolescents who experience out-of-home placement are also much more likely to have experienced maltreatment and other adverse experiences, so isolated effects of out-of-home placement alone may be difficult to determine.

Family financial problems. As mentioned above, SES is clearly linked to heightened rates of many types of hardships that may be characterized as ACEs, and

family income is highly associated with the quality of a child's environment (Garrett, Ng'andu, & Ferron, 1994). However, experiences vary widely from family to family within socioeconomic strata, especially when race and ethnicity is taken into account, (Braveman et al., 2005) and a dichotomized measure of neighborhood or familial poverty has limited predictive value. Oakes & Rossi, (2003) suggest that more nuanced measures of poverty and risk take the form of material capital (e.g., income and goods), human capital (e.g., occupational prestige), and social capital (e.g., social networks). ACE questionnaires would be improved by assessing specific indicators of some or all of these aspects. For example, many families, even those who are employed and classified as middle-income, are able to afford rent, food, and clothing but have found medical care beyond their means at some point in the past (Budetti, Duchon, Schoen, & Shikles, 1999). Additionally, some families who do not qualify as impoverished based on federal poverty cutoffs may have expenses such as large medical bills or problematic spending habits (e.g., gambling, substance abuse) that render them unable to afford to pay for more basic needs. In this case, a question like "Did you ever feel that your family could not afford to pay for basic needs like food, clothing, or medical bills?" may reveal information above and beyond that gathered through a quantitative measure of income. Furthermore, even a self-report of "family financial problems" in childhood could be useful insofar as it assesses subjective experience of privation.

Frequent family conflict. Research indicates that poorer famileis are more likely to be characterized by high conflict, inconsistent parenting, and coercive family relationships (Conger, Ge, Elder, Lorenz, & Simons, 1994; Habib et al., 2013; McLoyd, 1990; Marcynyszyn, Evans & Eckenrode, 2008). Furthermore, the exacerbation of

familial discord by economic distress in childhood have been found to be associated with internalizing and externalizing problems in childhood and adolescence, substance abuse, and poorer health (Boynton-Jarrett, Ryan, Berkman, & Wright, 2008; Conger et al., 1994; Habib et al., 2013; Paradis et al., 2009). It is hypothesized that this association is partially accounted for by disruption of the parent-child relationship due to factors that have been also been found to increase commensurate with economic hardship, (e.g., marital conflict, parental depressed mood, and parental hostility) (Conger et al., 1994).

There is a significant research base for several additional expanded ACEs, which were not able to be assessed in the current study. See Appendix D for a review of literature supporting the inclusion of neighborhood disorder, discrimination, homelessness, and bullying in future measures of expanded ACEs.

Gaps in the Field

Several investigations, largely modeled off of the CDC ACE studies, have attempted to address some of the gaps in the ACE literature, primarily concerning breadth, depth, and methodological rigor. In addition to the aforementioned expansion of the ACE questionnaire, researchers have begun to investigate expansion of outcomes beyond physical and mental health, more proximal outcomes, the reliability and validity of ACE questionnaires, timing, mechanisms, and the effects of preventive interventions.

Expansion of adult outcomes. In spite of extensive research documenting the interplay among physical health, educational attainment, social mobility, involvement in the criminal justice system, and economic well-being (Binswanger, Redmond, Steiner, & Hicks, 2012; Broberg, Dyregrov, & Lilled, 2005; Matthews & Gallo, 2011; Porche, Fortuna, Lin, & Alegria, 2011; Schnurr, Friedman, & Bernardy, 2002), ACE studies have

by-and-large focused on the health and psychological consequences of ACEs to the exclusion of broader measures of well-being. The aforementioned investigation by Giovanelli et al., (2016) found that ACEs impacted educational, occupational, and criminal outcomes in early adulthood, and Nurius, Green, Logan-Greene, & Borja (2015) found that ACEs predicted subjective well-being, sleep quality, and physical activity in adulthood. Topitzes, Pate, Berman, & Medina-Kirchner (2016) investigated ACEs, health, and unemployment in a sample of 200 African-American men and found that ACEs affected participants' ability to find employment, and that substance use problems and depression helped to explain this link. Additional research assessing the breadth of ACE impacts, and the temporal reach of ACE effects in longitudinal samples, could inform the development of new strategies to reduce the social and economic costs of childhood adversity.

Type and timing. Differential effects of ACEs based on type (e.g., unique effects of household dysfunction vs. abuse and neglect on health outcomes) or timing, though present in the historical context of life stress research, have not been thoroughly investigated in the ACE literature.

As mentioned above, extensive research has shown that the brain is most susceptible to stress-induced alterations of neurobiology and stress reactivity in early childhood (Gunnar & Quevedo, 2007); however, from a developmental approach, adverse events can disrupt a child's functioning across domains at any point in development, and other sensitive periods such as adolescence may also be uniquely affected.

Limited research to date has suggested that ACEs may indeed have differential

effects depending on the timing of the stressors. Flaherty and colleagues (2013) investigated the association between ACEs and health in 14-year-old adolescents and separated ACEs into three groups: ACEs from age 0 to 6, ACEs from 7-12, and ACEs from "the most recent two years" (ages 12-14). They found that only "recent" adversities had consistently strong effects on outcomes. However, timing has not been investigated in a longitudinal cumulative ACE framework, and many stressor checklists do not ask participants to specify the timing of events (Duggal et al., 2000). For example, it is unknown whether long-term outcomes are worse for individuals who have more ACEs in middle childhood as opposed to adolescence. Since many ACEs could be seen as chronic stressors as opposed to singular events (e.g., divorce), the most flexible and parsimonious method may be asking participants to specify age ranges prior to age 18.

Regarding types of ACEs, Ford and colleagues (2014) investigated the factor structure of the ACE questionnaire administered to adults participating in the BRFSS. They found three factors in the ACE questionnaire: Household Dysfunction, Emotional/Physical Abuse, and Sexual Abuse. Their results broadly supported continued use of the current cumulative adversity scoring procedures on the ACE questionnaire, but also suggested that the use of composite subscale scores may be an area of future exploration. Further, this finding points to the opportunity to add additional factors to the existing questionnaire (e.g., neighborhood or contextual factors). Investigating the differential effects of ACEs based on developmental timing is important to illuminate both moderators and mechanisms of maladaptive outcomes.

Reliability and validity. The reliability of retrospective and self-report measures has been an area of contentious debate for decades (Duggal et al., 2000), and has

understandably been called into question in the ACE studies (Widom, Raphael, & DuMont, 2004). To address this issue in the ACE questionnaire specifically, Dube et al., (2004) used Cohen's kappa (Fleiss, 1981) and found that test-retest reliability in a subsample of participants in the ACE study was good to excellent. Other studies using different assessments of maltreatment in childhood have reported similar kappa statistics (Friedrich, Talley, Panser, Fett, & Zinsmeister, 1997; Meyer, Muenzenmaier, Cancienne, & Struening, 1996; Riddle & Aponte, 1999). However, many of these studies have been done in middle life, when a coherent and stable narrative is more likely to be in place (Pinto, Correia, & Maia, 2014). In contrast, Fergusson, Horwood, & Woodward (2000) found that young adult reports of exposure to sexual or physical maltreatment were less stable (kappa = .45). On this issue, Hardt & Rutter (2004) argue that while "retrospective reports have a worthwhile place in research […] little weight can be placed on the retrospective reports of details of early experiences or on reports of experiences that rely heavily on judgment or interpretation."

It follows that while retrospective report studies can provide important information (Dube, Williamson, Thompson, Felitti, & Anda, 2004; Hardt & Rutter, 2004) and point to risk factors, prospective (or, if more feasible, more proximate retrospective) reports are ideal (Brown, Cohen, Johnson, & Salzinger, 1998; Widom et al., 2004). Some prospective longitudinal studies of cumulative ACE exposure have been conducted, but many have only followed participants through mid-adolescence, and focused on very limited outcomes (e.g., Flaherty et al., 2013; Schilling, Aseltine, & Gore, 2007; Thompson et al., 2014). The aforementioned studies by Mersky et al., (2013), and Giovanelli et al (2016) are notable exceptions, and there is also much to be learned by

looking to more general studies of Life Stress like Danese et al., (2008) and the previously discussed KLS (Werner, 1993). Danese and colleagues utilized the well-known longitudinal Dunedin Multidisciplinary Health and Development Study participants to investigate the effects of a limited number of ACEs (maltreatment, socioeconomic disadvantage as measured by parental occupational prestige, and social isolation) on physiological measures of health at age 32. It is important to note, however, that the sample was primarily white and middle or high SES (80.3%), and did not utilize a cumulative ACE score analogous to those in the Kaiser study, limiting generalizability and comparison. Giovanelli et al. (2016) used a prospective longitudinal design to investigate the relationship between ACEs and mental health, educational attainment, occupational prestige, crime, and substance use in young adults in the Chicago Longitudinal Study. Importantly, while several ACEs from 0-18 were reported retrospectively, precluding causal inference, the measures of child maltreatment were from official court and family service records. Participants were therefore not required to self-report maltreatment (though ideally both self-report and administrative records would be used), reducing the likelihood of underreporting due to stigma or social desirability that may not be at play for less stigmatized events like parental divorce or witnessing a violent crime outside the home (Turner & Lloyd, 2004). In some cases, (Burke, Hellman, Scott, Weems, & Carrion 2011) researchers have found that assessment of ACEs in underserved populations using administrative records reveals higher levels of ACEs than in ACE studies in more advantaged samples. However, official records have also been found to underestimate maltreatment rates, at times quite dramatically (Flaherty, 2008; Swahn et al., 2006), and therefore a combination of self-report and

official records is ideal. While prospective longitudinal studies can be time-consuming and expensive, they are necessary to strengthen inference, answer questions about timing, and illuminate mechanisms.

Other reliability and validity issues identified in questionnaires about adverse experiences include psychological or physical health interference with response validity and reliability, as well as response bias. While some evidence indicates that mood at the time of report can influence memory (McFarland & Buehler, 1998; Matt, Vazquez, & Campbell, 1992), research suggests that this effect may not be as large a problem as one might think (Hardt & Rutter, 2004). For example, Turner and Lloyd (2004) investigated whether the associations between psychiatric disorder and ACE score were explained by this type of mood bias, and found that participants currently experiencing a disorder were not significantly more likely to report adverse experiences than individuals who had previously met criteria for a disorder. Pinto, Correia, & Maia (2014) reported similar findings when investigating the reliability of adolescents' retrospective reports of ACEs. They assessed the degree to which psychopathological or physical symptomology at the time of the evaluation interfered with reporting. Their results suggested that concurrent mental and physical health status was not related to the reliability of self-report responses, which is imperative, as these variables are quite often investigated as outcomes.

However, Øverlien, Thoresen, & Dyb, (2013) did find response bias when assessing factors that may affect the validity of mothers' responses when reporting on their child's adverse experiences. They found that individuals take into account several factors when responding, including whether or not the experience(s) in question fit with

the events in the questionnaire (i.e., making subjective assessments taking frequency and severity into account), their feelings about their child's subjective experience of the event as upsetting, and social desirability bias regarding questions about abuse and neglect.

Protective factors and resilience. Another under-researched issue is that of protective and resilience-promoting factors ACEs in childhood. As mentioned above, early childhood education programs have been shown to have compensatory effects for children in impoverished environments, and the idea that these programs may also have compensatory effects for children experiencing high ACEs early in life is a natural extension of this work. Additionally, it will be important to determine the mechanisms of protective effects (e.g., active ingredients and explanatory factors) to better tailor and more strategically fund programs.

In sum, while the ACEs framework has resonated with the public and policymakers and is an excellent example of translational research, there are substantial gaps. Generalization has begun to be addressed through use of more socioeconomically, racially, and educationally diverse samples, but prospective longitudinal research in such diverse samples has not consistently been done in the ACE framework. Further, given the strong connections between physical and mental health and socioeconomic well-being, investigations into broader ecological outcomes is warranted. Finally, while generalization is warranted, the question of whether ACEs are harmful is clear. The next step is to determine potential avenues for protective effects and promotion of resilience. Developmental psychology is uniquely positioned to leverage the receptivity of the lay community to the ACE framework while working to improve ecological validity and nuance.

The Present Study

This study seeks to better understand the socioeconomic and physiological consequences of ACEs in a high-risk population, to identify how and for whom early childhood education attendance may reduce ACEs, and to expand our understanding of ACEs to more fully encompass the context of early risk. The aims of the current study were to asses (1) if there are dose-response relationships between conventional and expanded measures of ACEs from birth to 18 and crime, educational attainment, income, weight, health behaviors, and self-reported mental and physical health in an urban African-American cohort approaching middle age; (2) how qualitative differences in experiences of ACEs (e.g., type and timing) relate to the aforementioned measures of well-being; (3) if the effects of ACEs are moderated by childhood education program attendance and that hypothesized moderation effects are stronger with increased dosage; and (4) if effects of early childhood education programming on outcomes differ by sex or risk.

Preliminary data analysis. Previous analyses on ACEs in the CLS sample indicate that ACEs consistently predicted a diverse set of outcomes at age 26. Mersky, Topitzes, & Reynolds (2013) found that ACEs were strongly associated with poor outcomes in early adulthood. Higher levels of adversity were largely commensurate with cumulative effects; that is, CLS participants with several ACEs were much more likely to have several poor outcomes than participants with no ACEs. A 2016 article in *Pediatrics* (Giovanelli, Reynolds, Mondi, & Ou), investigated the association between ACEs and nine measures of well-being through age 26, most of which had not been previously assessed. A more comprehensive measure of ACEs (and a closer approximation to the

measure used in the Kaiser/CDC study) than used in Mersky et al. was utilized to predict outcomes such as educational attainment, occupational prestige, mental health, and crime. Nearly two-thirds of the study sample experienced one or more ACEs by age 18, similar to the rates reported in the Kaiser/CDC study. Even after controlling for demographic factors and early intervention status, individuals reporting ACEs were significantly more likely to exhibit poor outcomes than those with no ACEs. Those with four or more ACEs had significantly reduced likelihood of high school graduation (OR = .37; $p < .001$), increased risk for depression (OR = 3.9; $p < .001$), health compromising behaviors (OR = 4.5; $p < .001$), juvenile arrest (OR = 3.1; $p < .001$) and felony charges (OR = 2.8; $p < .001$). They were also less likely to hold skilled jobs (OR = .50; $p = .001$) and to go further in school even for adversity measured by age 5. A forthcoming article (Giovanelli, Reynolds, Mondi, & Ou, in preparation) investigated mechanisms of ACE effects in these associations. This dissertation study builds on these results with an updated data set by 1) examining educational attainment, socioeconomic well-being, obesity, and crime outcomes for participants and subgroups of participants at age 35-37, 2) investigating subgroup differences in the effects of early childhood intervention on ACE-related outcomes, 3) using an updated ACEs measure that takes into account broader contextual factors.

Hypotheses. Consistent with the first aim, I hypothesized that ACEs from birth to 18 would be related to completion of an Associate's or Bachelor's degree, total years of education, felony arrest, incarceration, smoking history, depressive symptoms, and perceived health status in this population. While prospective longitudinal studies of the relationships between educational and criminal outcomes have limited precedent in ACE

research (see Giovanelli, Reynolds, Mondi, & Ou, 2016; Topitzes, Pate, Berman, & Medina-Kirchner, 2016), and no precedent in the large-scale Kaiser/CDC studies, these hypotheses were based on empirical evidence linking poor educational attainment and high crime rates to psychosocial stressors in childhood (Gilbert et al., 2009; Williams & Jackson, 2005). The hypothesized health and health behavior effects would be consistent with the extensive extant literature (Felitti et al., 1998; Dong et al., 2004).

Relating to the second aim, I proposed several hypotheses relating to type and timing of ACEs. First, I hypothesized that the ACE scales would contain an underlying factor structure that would allow for investigation of "subtypes." To date, several researchers have investigated the factor structure of the ACEs questionnaire. One investigation (Ford et al., 2014), used data from the CDC's Behavioral Risk Factor Surveillance System's ACE module, which is identical to the early Kaiser ACE surveys, and suggests that ACE questionnaire consists of three distinct factors: physical/emotional abuse, sexual abuse, and household dysfunction. The current investigation has only one binary indicator for each abuse and neglect question, and therefore each question cannot be its own component in this scale. As such, I hypothesized that child abuse and neglect (CAN) items would together comprise one component, and that, consistent with Ford et al., conventional measures of household dysfunction would comprise another.

The present study adds ACEs indicative of a "high-risk context" (Expanded ACEs) to the questionnaire: witnessing or victimization by violence outside of the home; frequent family conflict; family financial problems; arrest of a family member; out of home placement; death of a parent; death of a sibling; and death of a close friend or relative, and I expected that Expanded ACEs, with the exception out of home placement,

would comprise a distinct third factor with unique predictive power. Out of home placement was expected to fall with abuse and neglect, as foster care and other out of home placement is by and large preceded by reports of CAN. The hypotheses relating to the factor structure of the ACE scales will be referred to as hypothesis 2a.

Second, I hypothesized that effects would differ by the subtypes of ACE revealed by the investigation of the factor structure. In light of the overwhelming evidence of the far-reaching and diverse effects of extreme adversity in particular, I expected that the CAN factor would have stronger effects on later well-being than household dysfunction or Expanded ACEs (hypothesis 2b).

For the third hypothesis relating to the second aim, based on previous investigations of the effects of stress in general (Flaherty et al., 2013; Gunnar & Quevedo, 2007; Finkelhor et al., 2013), I expected that strength of relationships would vary based on the timing of ACEs. Specifically, I hypothesized that ACEs experienced in early childhood, before protective competencies are developed and when the brain is most vulnerable to environmental stress, would have the largest impact. Adolescence, as another sensitive period, was also hypothesized as a period in which ACEs would be more strongly related to outcomes. I will refer to this as hypothesis 2c for clarity.

Consistent with the third aim, based on previous literature documenting the positive effects of CPC attendance on both proximal (e.g., maltreatment rates) (Reynolds & Robertson, 2003) and distal (e.g., educational attainment) (Reynolds et al., 2011) outcomes, I hypothesized that participation in the CPC intervention would moderate the associations between both conventional and expanded ACEs experienced from birth to

age 5 and outcomes, and that increased dosage (i.e., longer CPC participation) would show stronger effects.

Finally, regarding the fourth aim, in light of research indicating that those at the most disadvantage may benefit disproportionately from enrichment programs (Reynolds et al., 2007; Reynolds, Temple, Ou, White, & Robertson, 2011), I hypothesized that participants at the highest demographic risk prior to entering school would benefit most from the intervention, and that this benefit would increase with dosage. That is, the extended participation group, attending CPC for 4-6 years, would benefit more than the group that just attended CPC preschool. Finally, previous research has also indicated that males benefit more than females do from the CPC intervention (Reynolds, Temple, Robertson, & Mann, 2001) and therefore I expected that males would benefit more from intervention. Research such as this is a crucial step towards informing policy and practice targeted toward reducing the occurrence and meliorating the effects of ACEs in high-risk populations.

Chapter 2

Method

Sample & Design

To date, this is the largest ACE study to assess health and socioeconomic outcomes in a primarily African American sample. The current sample comprises a subsample of 1,352 of the 1,539 original participants from the Chicago Longitudinal Study (CLS), a prospective longitudinal investigation of the effects of early education and life experiences on the development of low-income, minority children who grew up in inner-city Chicago and attended early childhood programs in Chicago Public Schools (CPS) (Reynolds et al., 2011). This subsample was created by using administrative data and self-report information on ACEs from surveys administered at age 22-24 and 35-37.

The original sample was evenly split by sex and was representative of the local context's racial and ethnic composition (93% African American, 7% Hispanic) (See Table 1). Intervention group members (N = 989) attended the Child-Parent Center (CPC) preschool program at age three and/or four years. The CPC program provided a comprehensive array of evidence-based educational and family support services at 20 sites from pre-school to 3rd grade. Members of the control group (N = 550) were from five randomly selected schools, and attended the usual full-day kindergarten programs available to low-income CPS students. Prior research on this sample has demonstrated that these groups are comparable on child, family, and school characteristics, and are representative of children living in urban poverty (Reynolds, Temple, Robertson, & Mann, 2001; see Table 1). For the purposes of investigating differential effects of preschool attendance, participants have been further divided into four groups: 1) CPC

preschool intervention alone, hereafter referred to as "CPC attendance" 2) CPC preschool intervention *plus* continued attendance at CPC into elementary school, hereafter referred to as "Extended Participation," and 3) no CPC attendance from prek-3rd grade, hereafter referred to as the "Comparison Group." In addition to reduced rates of maltreatment, long-term effects of CPC attendance have been found on remedial education, delinquency, educational attainment, and economic status (Reynolds et al., 2011). Cost-benefit analyses of the program when participants were 26 years old indicated that the CPC preschool program provided a total return of $10.83 per dollar invested ($83,708 per participant) (Reynolds et al., 2011).

Procedure

The Institutional Review Boards of the University of Minnesota and the University of Wisconsin, Madison have periodically approved all procedures for this study since data collection began. Participant surveys were conducted each year from 3rd-6th grade, on two separate occasions in high school, and on three separate occasions in adulthood (age 20-21, 22-24, and age 35-37). When participants were minors, parents consented to their participation in the study with each survey, and when they reached adulthood, consent was obtained from the participants themselves.

Data collection for the age 22-24 and age 35-37 survey data utilized in the present study comprised an hour and a half phone interview in which participants were asked about their educational, occupational, family, and personal experiences.

Court and Department of Child and Family Services administrative records of abuse and neglect were prospectively collected in collaboration with Chapin Hall at the University of Chicago. Periodically, as participants approached adulthood, the CLS team

conducted updates of administrative records, and validation and analysis of existing records from earnings, college attendance completion, justice system records (criminal arrests and incarceration), and public aid.

Predictors

Adverse Childhood Experiences. To answer questions about "type" of ACE, several different ACE measures were created: Conventional and Expanded ACEs, Conventional ACEs only, Child Abuse and Neglect only, Household Dysfunction only, and Expanded ACEs only. For each of these types, ACE counts by time period were also created (0-5, 6-10, and 11-15).

For the full sample size of 1,352, responses from the 1142 participants who responded to the survey at age 22-24 were used as the baseline measures, as ACE questions by definition pertain to the time period prior to age 18. Three additional ACE questions, which were asked at 35 but not at 24, were added to the ACE score at 24. Of the participants who had ACE scores at 22-24, 256 (22.4%) did not have scores for these additional questions, and this was controlled for in analyses. Results were unchanged.

For the 210 participants who did not respond to the survey at age 22-24 but did respond to the survey at age 35, an ACE score was created based on responses to the questions at age 35. Overall, 85% of the ACE scores were derived from the age 22-24 survey, and 15% were derived from the age 35-37 survey.

Conventional Adverse Childhood Experiences (ACEs-C). In the age 22-24 survey, participants were asked seventeen questions about major "Life Events," and indicated whether or not these events had occurred. If a participant indicated Yes, they were then asked to indicate specific time periods: 0-5, 6-10, 11-15, 16-25, and 26-present.

As ACEs are defined as occurring prior to age 18, only the first three time periods were included in the present study's analyses, and were collapsed for the overall "birth to 18" ACE analyses, such that even experiences that participants indicated happened in multiple time periods were only counted once.

Consistent with the convention set with the Kaiser/CDC ACE questionnaire (Appendix B), three indicators from the seventeen items were used as "Conventional ACEs": (1) One of your parents had problems with alcohol or drugs, (2) The prolonged absence of a parent or caregiver, and (3) The divorce of your parents. Participants reporting both parental absence and parental divorce during a given time period ranged from 14% to 20%. To minimize duplicate reporting, parental absence and parental divorce were collapsed into one dichotomized indicator.

In the age 35-37 survey, participants were asked the same seventeen questions, along with four additional questions approximating other indicators from the Kaiser/CDC questionnaire: (1) Mental illness of a parent or caregiver (2) Witness to domestic abuse of mother or caregiver (3) One of your parents was arrested by the police during your lifetime and (4) You were a victim of child abuse or neglect. These four indicators were combined with the three indicators from the age 22-24 survey to create the self-report portion of the Conventional ACE scale.

Finally, to complete the Conventional ACE scale, dichotomized indicators of physical abuse, sexual abuse, and neglect from administrative records were added to the scale. The final Conventional ACE scale comprised the following nine items:

1. Physical Abuse from 4-18
2. Sexual Abuse from 4-18

3. Neglect from 4-18
4. Child welfare case from 0-3
5. One of your parents had problems with alcohol or drugs
6. The prolonged absence of a parent or caregiver or divorce of parents
7. Mental illness of a parent or caregiver
8. Witness to domestic abuse of mother or caregiver
9. One of your parents was arrested by the police during your lifetime

Additionally, to attempt to mitigate underreporting of CAN, if administrative records indicated no substantiated reports of child abuse and neglect, but a participant responded affirmatively to the item "You were a victim of child abuse or neglect," a point was added to their ACE score. Only participants who had information on questions from both age 24 and age 35 surveys and administrative records were included (N = 886-890). This variable was also cut at 0, 1, 2, 3, and ≥4, and dummy coded indicators were created.

Finally, as all information pertained to experiences prior to age 18, for the 210 participants who did not respond to the survey at 24 but did respond at age 35, the corresponding self-report information from age 35 was used. This variable was cut at 0, 1, 2, 3, and ≥4, and dummy coded indicators were created. However, due to author oversight the analyses for ACEs-C with the augmented sample were not conducted until after this manuscript was completed, and therefore, all analyses with ACEs-C use the sample of 888 participants who had responses at both timepoints. Analyses with the augmented sample can be found in Appendix K, and results were relatively consistent.

Expanded Adverse Childhood Experiences (ACEs-CE). An additional eight items from the original seventeen were selected as "Expanded ACEs." Items were

selected based on the research base on stressful or traumatic childhood experiences, with the aim of capturing a more complete picture of high-risk participants' early experiences from an ecological systems perspective. The "Expanded ACEs" count variable included the nine ACEs listed above along with the following additional items:

1. Frequent family conflict
2. Victim of a violent crime
3. Witness to a shooting or stabbing
4. Foster care or out of home placement from 0-18
5. Death of a parent
6. Death of a sibling
7. Death of a close friend or relative

Prospectively collected items regarding subjective neighborhood safety and food, clothing, or medical expense insecurity were considered for incorporation as additional expanded ACEs, but ultimately these items were dropped as variance was restricted and these items had limited predictive utility.

As all information pertained to experiences prior to age 18, for the 210 participants who did not respond to the survey at 24 but did respond at age 35, the corresponding self-report information from age 35 was used. This variable was cut at 0, 1, 2, 3, and ≥4, and dummy coded indicators were created.

Additionally, 252 participants had administrative CAN data and ACE information at age 24 but not at 35, and were therefore missing responses to parental mental illness, parent arrest, and witnessing of domestic violence. These participants' scores were still utilized, as information on 15 out of the 18 possible ACEs was present. A dichotomous

variable indicating whether or not a participant fell in this category was created and entered as a control variable for robustness testing. Results were unchanged.

Household dysfunction (HD). This count variable was composed of the conventional household dysfunction variables only:

1. Parent absence or divorce
2. Parental substance abuse
3. Witnessing domestic violence
4. Mental illness of a parent
5. Arrest of a parent.

As less than 2% of the sample had 4 or more HD indicators from 0-18, this variable was cut at 0, 1, 2, and ≥3, and dummy coded indicators were created.

Child abuse and neglect (CAN). This count variable was composed of the conventional abuse and neglect indicators from administrative records:

1. Sexual abuse from 4-18
2. Physical abuse from 4-18
3. Neglect from 4-18
4. Child welfare involvement from 0-3.

As less than 1% of the sample had 3 or more CAN indicators from 0-18, this variable was cut at 0, 1, and ≥2, and dummy coded indicators were created. To mitigate the effects of under-reporting, an alternate version of this variable was created in which participants who responded affirmatively to the item "You were a victim of child abuse or neglect," but did not have administrative records indicating CAN had a point added to their CAN score.

Expanded ACEs only (ACEs-E). This count variable comprised all of the indicators added to the ACE count that were indicative of a higher-risk community context:

1. Witnessing a violent crime
2. Victim of a violent crime
3. Frequent family conflict
4. Family financial problems
5. Death of a parent
6. Death of a close friend or relative
7. Death of a sibling

This variable was also cut at 0, 1, 2, 3, and ≥4, and dummy coded indicators were created.

Moderators

Intervention group status. The CPC program provides educational and family support services to children ages three to nine years (preschool to third grade) within a comprehensive model similar to Head Start. Major program elements include low student-to-staff ratios throughout preschool (17:2) and early elementary school (25:2); a literacy-focused curriculum that employs a variety of teacher- and child-directed techniques; a comprehensive parent involvement and education program; home visits; and health services. Preschool participants attend the program for three hours each weekday. See previous publications for an in-depth description (Reynolds, 1999; Reynolds, Temple, Robertson, & Mann, 2001). See Table 1 for descriptive statistics of the subgroups in the full sample and the subsample for the current investigation.

CPC preschool participation. Students who attended a CPC in preschool were coded as preschool participants. CPC participants comprised 64.5% of the original sample and 65.6% of the subsample used in the current study.

Extended participation. Students who attended a CPC in preschool and continued into 2nd or 3rd grade (4-6 years of participation total) were coded as extended participants. Extended participation attendees comprised 32.7% of the original sample and 34.4% of the subsample in the current study. As these participants all necessarily attended CPC preschool as well, it should be noted that of the 989 original CPC preschool attendees, 51% of those went on to attend extended participation. In the subsample, of the 887 CPC preschool attendees, a similar proportion (52.4%) went on to attend Extended participation.

Comparison group. Students who did not attend a CPC at any point in preschool through 3rd grade were coded as comparison group participants (35.5% of the original sample; 34.4% of the subsample used in the current study). These participants were matched on child, family, and school characteristics in the total sample. Descriptive statistics show that the participants in the subsample used in the current study are also comparable on key demographic characteristics (Table 1).

Sex. Sex is a dichotomous variable. Participants were coded 1 if female (50.3% of the original sample; 52.6% of the current sample) and 0 if male (49.7% of the original sample; 47.4% of the current sample).

Demographic risk. The risk index is composed of eight dichotomous indicators measured from birth to age 3: (a) single parent household; (b) mother under age 18 at child's birth; (c) four or more children in the household; (d) mother a high school

dropout; (e) family income below 185% of the federal poverty level; (f) mother unemployed; (g) welfare receipt; (h) and residence in a high-poverty neighborhood. Analyses were also run with indicators entered individually to ensure that the index does not alter results. The average risk index score in this sample was 4.5 (1.7), which is identical to the average risk index for the full sample. This index was dichotomized to 4 or more vs. less than 4 when creating interaction terms for moderation analyses.

Covariates

Participant sex, race (African American or not), and risk index score, and preschool attendance status were controlled in probit and logistic regressions examining the effects of ACE counts on outcomes. When examining the effects of subtypes of ACEs on outcomes, the other types of adversity were also entered as covariates. As information from two different timepoints was used, descriptive statistics for demographics at age 24, age 35, combined data, and the original full sample are provided in Table 2, and by sex in Tables 3 and 4.

Outcomes

Outcomes were determined from both administrative records and self-report. None were imputed, with the exception of income. See full descriptive statistics for outcomes in Table 5.

Educational attainment. Two measures were gathered from administrative records from school districts, higher education and employers, and self-reports.

Years of education. Years of education is a continuous variable indicating the number of years of education ranging from seven to 22, with 12 denoting high school graduation or a General Education Development (GED) credential by June 2015. The

average number of grades completed for this sample was 12.7 (2.15). On average, females, t (1294) = 7.22, p <.001; participants who attended CPC preschool, t (1204)= 4.61, p <.001; and participants in extended participation went further in school, t (1160) = 3.76, p <.001.

Completion of Associate (AA) or Bachelor's (BA/BS) degree. Completion of AA or BA/BS is a dichotomous variable indicating completion of a higher education course of study by June 2015. In this sample, females, X^2 (2, N = 1297) = 31.09, p <.001; CPC attendees, X^2 (2, N = 1297) = 7.77, p <.01; and extended participation attendees, X^2 (2, N = 1162) = 5.63, p <.05, all completed an AA or BA at higher frequencies than males, non-CPC attendees, and people who did not attend extended participation.

Income. The income variable was computed based on administrative records of income from 2010-2014. For individuals who were not in the administrative file, self-report information was used. Missing values were imputed using other administrative information on education and crime. A dichotomized variable was created indicating whether a participant made more or less than the average entry wage of all occupations in the state of Illinois for 2014, which was $20,415 per year. CPC preschool participants and extended participation attendees had higher frequencies of income above the average entry wage, X^2 (2, N = 1227) = 7.52, p <.01 and X^2 (2, N = 1091) = 8.56, p <.01, respectively.

Criminal justice system involvement. Two measures were gathered from federal prison records and documented histories in state, county, and circuit courts.

Incarceration or jail. A participant is coded 1 for this variable if they have ever been in federal prison or in jail by 2016. Males, X^2 (2, N = 1352) = 227.31, p <.001, and

comparison group participants, X^2 (2, N = 1352) = 9.49, p <.01, had higher rates of lifetime incarceration. Participants who were not in the extended participation group had marginally higher rates of lifetime incarceration as well, X^2 (2, N = 1194) = 3.31, p <.10.

Felony arrest. A participant is coded 1 for this variable if they have had one or more felony arrests by 2016. Males had higher rates of felony arrest than females, X^2 (2, N = 1352) = 169.29, p <.001.

Obesity. In the age 35 survey, participants were asked to report their current height and weight. This information was used to calculate BMI in mmHg, and consistent with CDC guidelines, participants with a BMI ≥30 were coded as "obese."

Perceived health status. In the age 35 survey, participants are asked, "in general, how would you describe your health?" on a 5-point Likert scale ranging from poor to excellent. If participants respond "fair" or "poor," they are coded 1 for this variable. Higher rates of females rated their health as "fair or poor" than did males, X^2 (2, N = 1102) = 9.18, p <.01

Depression. In the age 35 survey, participants completed a modified version of the Brief Symptom Inventory (BSI; Derogatis, 1975). Participants indicated on a six-point Likert scale how often they had felt depressed, hopeless, lonely, [that] life is not worth living, or very sad in the preceding month. The scale ranged from 0 (Not at all) to 5 (almost every day). In the present study, this scale demonstrated excellent internal consistency (α = .90). Participants were coded as currently (at the time of the age 35 survey) depressed or not based on a coding strategy previously validated in this sample (Mondi, Reynolds, & Ou, 2017; Reynolds et al., 2007). Participants were coded as "1" on the dichotomized variable if they reported feeling depressed, lonely, or very sad almost

daily, if they reported feeling hopeless a few times a week or more, or if they reported feeling that life was not worth living a few times a month or more. While the BSI is not a diagnostic tool and is therefore not used to diagnose clinical depression or Major Depressive Disorder, previous research has shown that the BSI scores do correlate with diagnoses of major depressive disorder, as well as other measures of overall psychological well-being (Mondi et al., 2107). As such, a score of 1 on this variable indicated that this participant was likely experiencing impaired functioning, subclinical, or clinical levels of depressed mood. As described in Mondi et al., 2017, "The use of a dichotomous variable is consistent with previous BSI research, and is intended to prevent case over-identification (e.g., Derogatis & Lynn, 2000; Shrout & Yager, 1989)." Males endorsed significant depressive symptoms at higher rates than did females, X^2 (2, N = 1102) = 7.16, p <.01.

Smoking status. Consistent with convention in cardiovascular disease screening in the medical field (Wallace, Ricco, & Barrett, 2014), participants were asked if they had smoked more than 100 cigarettes in their lifetime. Participants who indicated "yes" were coded 1 on this variable. Males endorsed lifetime smoking at higher rates than females, X^2 (2, N = 1102) = 42.1, p <.001. Participants in the comparison group, X^2 (2, N = 1102) = 3.62, p <.10, and participants who did not attend extended participation, X^2 (2, N = 964) = 3.33, p <.10, endorsed lifetime smoking at marginally higher rates than those who attended CPC preschool or were in the extended participation group.

Data Analytic Plan

Regression analyses. Probit, linear, and binary logistic regression analyses were conducted in Stata (StataCorp, College Station, TX), resulting in adjusted odds ratios,

standardized regression coefficients, and confidence intervals. Marginal effects are the change in the outcome unit (percentage points for all outcomes except educational attainment) associated with each ACE conditional on the covariates. The basic model for ACEs from birth to age 18 included 4 dichotomous ACE frequency variables (1, 2, 3, and ≥4). The reference group was 0-ACEs. Sex, race, CPC preschool participation, CPC school-age participation, and the aforementioned index of family ecology of risk (maternal education at child's birth, public assistance use, employment status of mother, whether or not the mother was younger than age 18 at childbirth; an ordinal scale from 0-7) were entered as covariates.

Principal Components Analyses. The determination of how to group ACEs by "type" first required exploration of the underlying structure of the current ACE measure. Internal consistency reliability analyses (Cronbach's alpha) were also conducted to confirm that the ACEs in this sample did not "hang together" measuring one common factor. Subsequently, exploratory and confirmatory Principal Components Analysis was conducted in SPSS (IBM SPSS Statistics, IBM Corporation, Armonk, NY) separately for ACEs-CE and ACEs-C. The overall pattern of factor loadings was examined to identify potential categories of ACEs that cluster together in this sample, creating "sub-types" of ACE scores that could be run separately to parse differential effects by type of ACE.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was first examined to determine if the data was suitable for FA. The extraction method used was Principal Components Analysis, and an oblique extraction method (Direct Oblimin) was used as data were not expected to be orthogonal. However, Varimax, an orthogonal extraction

method, was also conducted and did not meaningfully change results. Bartlett's Test of Sphericity was utilized to determine normality of the distribution.

For the PCA, four general criteria, based on convention, were used to determine factor loadings: 1) Factors had to have an Eigenvalue of at least one 2) each additional factor had to significantly contribute (10% or more) to an increase in cumulative variance explained, 3) A factor had to have > 3 unique factor loadings to be considered a factor, and 4) Confirming the factors by determining where the "elbow" of the scree plot indicated a leveling off point of the slope curve. A threshold of .3 was loosely defined as a threshold for including an item as a factor; however, no items were ultimately dropped as some that did not load >.3 (e.g., child welfare involvement from birth to age 3) are strongly supported by extensive prior research as ACEs, and loadings may have been affected by small sample size.

Guided by this process, the different types of ACE scores were subsequently created and entered into the analyses with the same covariates mentioned above. The primary types of ACE scores used were the Conventional ACE score (ACEs-C), the Conventional and Expanded ACE score (ACEs-CE), and based on the PCA, subscores for Abuse and Neglect only (CAN), and for Household Dysfunction only (HD). These analyses were repeated separated by timing of ACEs as well (0-5, 6-10, and 11-15).

Moderation models. To test for moderation of effects of ACEs by CPC participation, a variable measuring any ACE exposure from birth to age 5 was interacted with CPC preschool participation and added to the model as a group. This ACE variable indicated "any ACEs from birth to age 5 versus none" to maximize statistical power. Coefficients are again reported as adjusted odds ratios and marginal effects; 95%

confidence intervals were used for all significance tests. Standardized mean differences are also reported.

A similar approach was used to determine whether the effects of CPC vary by subgroups. Separate interaction terms between intervention category (CPC and extended participation) and sex were created. To test interactions between level of risk intervention dosage, interaction terms were created between dosage and psychosocial risk as measured by the dichotomized risk index ("high" = ≥4 out of 8).

Robustness of findings. As mentioned above, sensitivity and robustness were investigated for all questions through 1) the use of alternate covariate specifications to determine if coefficients are stable and consistent (e.g., investigating different combinations of ACEs, investigating variables as continuous, dichotomous, and threshold), 2) accounting for missing data (e.g., controlling for participants with ACEs-CE scores who are missing age 35 data), 3) varying report sources (e.g., self-report of maltreatment combined with administrative records to address underreporting vs. administrative records alone), 4) testing generalizability by investigating effects of type and timing of ACEs, 5) examining inconsistencies between age 24 and age 35 reporting, and 6) testing alternative model specifications, including running 0-18 analyses for subscales with no adjustment for other concurrent forms of adversity (Appendix J).

Chapter 3

Results

Descriptive Characteristics of the Sample

Within this sample of 1,352 adults in their late 30s, 93.8% are African-American. The rest of the sample (6.2%) is Hispanic. Approximately two-thirds (65.6%) had attended the CPC preschool program, and more than one-third of the total sample (39%) had participated in extended participation (i.e., attended a CPC in preschool and continued into 2nd or 3rd grade, for 4-6 years of participation total). Of the two-thirds who attended CPC, about half of those (53%) went on to participate in extended participation. The mean risk index score, on a scale of 0-8, was 4.5 (SD = 1.7). All risk index components were measured for birth to age three. These demographic characteristics are comparable to those of the original sample (see Table 1).

Regarding the individual components of the risk index, in this sample, 75% of participants were in single parent households; 16% were born before their mother was 18 years old; 17% were in a household with 4 or more children; 62% were participating in Temporary Assistance for Needy Families (TANF), a federal assistance program, at the earliest data collection; and 84% were eligible for free lunch. Additionally, 46% of participants had mothers who had completed high school, and 34% had mothers who were employed full or part-time. Finally, 76% of the sample attended schools in neighborhoods with 60% or more residents lived below the poverty line.

Prevalence of Adverse Childhood Experiences from Birth to 18

Individual indicators (Table 6). The ACE indicator most often reported was parent absence or divorce (32%), followed by parent arrest (23%), witnessing domestic

violence (20%), and death of a close friend or relative (20%). Parent mental illness (5%), death of a brother or sister (5%), victim of a violent crime (6%), and death of a parent (9%) had the lowest prevalence of the self-report items. For the administrative records, sexual abuse (2%) and physical abuse (3%) were least prevalent. Frequencies for the self-report questions asked again at age 35 can be found in the Appendix Table E1.

Subgroup differences. In examining administrative records, females were more likely to have records indicating they had been sexually abused, X^2 (2, N = 1352) = 8.46, p <.01. The comparison group and the non-extended participation groups were more likely to have a record indicating they had been neglected, X^2 (2, N = 1352) = 14.58, p <.001 and X^2 (2, N = 1194) = 5.78, p <.05. These groups were also more likely to have any child abuse or neglect history overall, X^2 (2, N = 1352) = 10.10, p <.01 and X^2 (2, N = 1194) = 7.72, p <.01. Comparison group participants had higher rates of out of home placement X^2 (2, N = 1253) = 4.63, p <.05. Males had higher rates of self-report of several individual ACEs, including family financial problems, parent absence or divorce, witness to a violent crime, victim of a violent crime, and death of a close friend or relative. These differences by sex were seen at age 35 as well, with the exception of family financial problems. See Table 6 for more specific frequencies.

ACEs-C. For Conventional ACEs 56% (N = 494 out of 886) of the sample had at least 1 ACE-C prior to age 18. In 28% of the sample, 1 ACE was reported; 15% reported 2; 8% reported 3; and 4% reported 4 or more. Rates of ≥4 ACEs-C in this sample were lower than in the original Kaiser/CDC ACE study (4% in the current sample compared 12.5% in the Kaiser/CDC sample); however, it should be noted that our ACEs-C score

does not measure emotional abuse or emotional neglect, and therefore the number of ACEs assessed is lower overall.

Subgroup differences. Males were marginally more likely to have 3 ACEs-C, X^2 (2, N = 886) = 2.91, p <.10, while extended participation attendees were significantly more likely to have 3 ACEs-C, X^2 (2, N = 803) = 4.68, p <.05.

ACEs-CE. Overall ACE prevalence rates in this sample (N = 1352) are presented in Table 7. In 69% of the sample (N = 939 out of 1352), at least 1 ACE-CE was reported prior to age 18. In 22% of the sample, 1 ACE-CE was reported; 16% reported 2; 10% reported 3; and 21% reported 4 or more.

Subgroup differences. Chi-square analyses were conducted to identify subgroup differences in overall ACE counts (Table 7). Males were more likely to have ≥4 ACEs-CE, X^2 (2, N = 1352) = 12.41, p <.01. The comparison group was also marginally more likely to have ≥4 ACEs-CE, X^2 (2, N = 1352) = 3.00, p <.10.

Household dysfunction. In this sample, 47% had at least one HD indicator, 28% had 1 HD indicator, 12.5% had 2 HD indicators, and 7% had ≥3 HD indicators. There were no significant differences in frequencies based on sex or intervention status.

CAN. 10% of the sample had 1 CAN indicator, and 3% of the sample had ≥2. An alternate abuse and neglect variable was also created wherein any participant who had 0 CAN administrative records but who had responded yes to the self-report question "Were you a victim of child abuse or neglect?" was coded as a 1. This increased the number of participants with a score of 1 on this measure to 15%.

Subgroup differences. The comparison group was significantly more likely to have ≥2 CAN indicators prior to age 18, X^2 (2, N = 1352) = 8.24, p <.01. Participants in

the comparison group had higher frequencies of ≥2 on both the standard and augmented versions of this variable than participants in the CPC preschool group, X^2 (2, N = 1352) = 8.24, p <.01. Participants in the comparison group also had marginally higher frequencies of a count of 1 on the augmented variable than the CPC preschool group, X^2 (2, N = 1352) = 3.65, p <.10.

Expanded ACEs only. In this sample, 25% had 1 Expanded ACE, 14% had 2 Expanded ACEs, 8% had 3 Expanded ACEs, and 5% had ≥4 Expanded ACEs. About 13% of the sample had experienced *only* expanded ACEs. That is, their Conventional ACE score was 0, but their Expanded ACE score was 1 or more. This is consistent with Cronholm (2015) findings in which they found that about 14% of their sample had experienced only Expanded ACEs. See Table 8 and Figure 1 for details on frequencies by type of ACE.

Subgroup differences. Males were significantly more likely to have 3 and ≥4 ACEs, X^2 (2, N = 1352) = 23.15, p <.001 and X^2 (2, N = 1352) = 11.53, p <.01, respectively.

Correlations. Independent ACE variables were assessed for collinearity, and bivariate correlations among ACEs are presented in Table 9. None were found to be prohibitively highly intercorrelated (r ≥0.7). Individual ACEs generally showed small to medium but significant associations with each other, as would be expected. Neglect and out of home placement were the most highly correlated of the individual ACE variables (r = .63 p <.001). Witnessing and being the victim of a violent crime (r = .35; p <.001) were correlated moderately. Other significant correlations between ACEs generally ranged from .06 to .30.

Partial correlations between individual ACEs and outcomes and between high ACE counts and outcomes, controlling for covariates, are presented in Tables 10 and 11. Individual ACEs generally showed small but significant correlations with adult outcomes. For example, witnessing domestic violence was significantly associated with depression (r = .17; p =<.001), and neglect was significantly associated with educational attainment (r = -.10; p <.001). High ACEs-CE and ACEs-C counts were modestly associated with outcomes when controlling for covariates. High (≥4) ACEs CE was significantly associated with incarceration (r = .15, p <.001), felony (r = .06, p <.05), annual income (r = -.06, p <.05), smoking history (r = .18, p <.001), and depressive symptoms (r = .16, p <.001). High ACEs-C was also significantly, but more modestly, associated with incarceration, felony, smoking history, and depression, which may partly be due to lower frequencies in this group. High (≥2) CAN was significantly associated with incarceration (r = .07, p <.01) and Bachelor's or Associate's Degree completion (r =-.06, p <.05). Finally, high (≥3) HD was significantly associated with incarceration (r = .07, p <.05), smoking history (r = .12, p <.001), and depression (r = .06, p <.05).

Bivariate correlations among outcomes are presented in Appendix Table E2. Many outcomes were significantly intercorrelated, in expected directions.

Inconsistency analyses. While the self-report responses at age 24 served as the basis for the main ACEs-CE counts, broader questions about the validity of self-report of ACEs in general warrants examination of consistency for the 886 participants who had ACE scores at both timepoints. For this purpose, a difference score was created for each of the nine self-report ACEs asked at both timepoints. Participants received a difference score of 1 if they answered "yes" to the question at age 24 and "no" at age 35, or vice

versa. Overall, 75% of the sample answered consistently to seven or more items out of the nine (see Appendix Tables E2 and E3). That is, 26% were consistent on all items, 27% were consistent on eight out of the nine, and 22% were consistent on seven out of the nine. About 11% of the sample answered inconsistently on four or more items. A dichotomized variable indicating these participants was created and entered into regression analyses to control for inconsistency in the analyses which used information from both timepoints. Results were unchanged.

Regarding inconsistency on individual items, participants were particularly inconsistent on the following items: Family financial problems, Parent substance abuse, and Witness to a violent crime. On all of these items, frequencies were higher at 35 than at 24.

Effects of ACEs from Birth to 18 on Adult Outcomes

Overall, consistent with hypothesis 1, ACEs-C and ACEs-CE significantly impacted several adult outcomes in a graded fashion. They were primarily associated with incarceration history, lifetime smoking, and depressive symptoms outcomes at age 35, as shown in Figures 2-4. Based on standardized mean difference measures of effect size, ACEs-C tended to be more strongly associated with these outcomes on the whole, suggesting that the addition of the expanded/contextual ACE items does not provide substantial information on these outcomes above and beyond the core ACE questionnaire. Contrary to the original hypothesis, associations between overall ACEs and felony arrest, income, educational attainment, weight, and self-rated health were weaker and less consistent. See Appendix F for linear regression results of the continuous income,

obesity, smoking, depression, and self-rated health variables. Results were similar to somewhat weaker.

Conventional ACEs (ACEs-C) from birth to 18. Table 12 shows the relations between ACES-C from birth to 18 and outcome measures. Log odds ratios, marginal effects, p-values, confidence intervals, and standardized mean differences are shown.

Criminal justice system involvement. There was a somewhat graded association between ACE groups and incarceration history, with the 2 ACE group and the ≥4 ACE group significantly more likely to have been incarcerated or in jail (OR = 1.94; p = .037; marginal effect = .088 and OR = 3.71; p = .034; marginal effect = .193, respectively), and the 3 ACE group trending towards significance (OR = 1.82; p = .074; marginal effect = .094). The standardized mean difference of the marginal effect for the ≥4 group was .63 standard deviations greater than the comparison group. In looking at felony arrest, results were similar but somewhat weaker, with a significant association between the 2 ACE group and felony arrest (OR = 1.78; p = .018; marginal effect = .124). For the ≥4 ACE group, there was a trending relation between ACEs and felony arrest (OR = 2.08; p = .081; marginal effect = .162).

Educational attainment and income. Educational attainment and income were not significantly associated with any of the ACEs-C groups.

Weight. Obesity at age 35 was not significantly associated with ACEs-C scores.

Smoking. There as a graded association between ACE score and lifetime history of smoking more than 100 cigarettes. Participants in the 1 ACE group about as likely to endorse this question as those in the 0 ACE group (OR = 1.06; *ns*; marginal effect = .012), whereas participants in the 2-4 ACE groups were significantly more likely to be

lifetime smokers. The 2-ACE group had increased odds of 1.78 ($p < .01$), the 3-ACE group had increased odds of 2.24 ($p < .01$) and the ≥4-ACE group had increased odds of 3.40 (P < .01), with a standardized mean difference of .78 SDs. For the latter group, the corresponding marginal effect showed an increase of 29.5 points.

Depression. Similar to smoking, the associations between ACE group membership and depression were graded. The 1 ACE group was not more likely to endorse significant depressive symptoms than the 0 ACE group (OR = 1.59; *ns*; marginal effect = .043), whereas the 2-4 ACE groups were at significantly increased risk for endorsement of depressive symptoms. The 2-ACE group had increased odds of 1.91 ($p < .05$), the 3-ACE group had increased odds of 2.54 ($p < .01$) and the ≥4-ACE group had increased odds of 3.10 ($p < .05$), with a standardized mean difference of .83 SDs.

Self-rated physical health. None of the ACE groups had significantly increased likelihood of rating their own health as fair or poor.

Conventional and Expanded ACEs (ACEs-CE) by age 18. Table 13 shows the relations between ACES-CE from birth to 18 and outcome measures, and Figures 2-4 show effects of ACEs-CE vs. ACEs-C on key outcomes. Log Odds Ratios, marginal effects, p-values, confidence intervals, and standardized mean differences are shown.

Criminal justice system involvement. Relative to the 0-ACEs-CE group, participants with ≥4 ACEs-CE by age 18 were significantly more likely to have been incarcerated by age 36 (OR = 2.47; $p = .000$; marginal effect = .129), with a standardized mean difference of .46 SDs. The relations between ACEs-CE and felony arrest were weaker, though there was a trending association (OR = 1.38; $p = .087$; marginal effect = .067).

Educational attainment and income. Participants in the ≥4 ACEs-CE group were just three quarters as likely to have an annual income of $20,415 or higher as the 0 ACEs-CE group (OR = .737; *p* = .076; marginal effect = -.069), though this effect was trending towards significance. Neither of the educational attainment measures were significantly associated with ACEs-CE scores.

Weight. Obesity at age 35 was not significantly associated with ACEs-CE scores.

Smoking. Individuals with multiple ACEs-CE were significantly more likely to endorse having smoked >100 cigarettes over the course of their lifetime, and this effect was somewhat graded. The 3 ACEs-CE group was trending towards a significantly increased risk for smoking (OR = 1.50; *p* = .070; marginal effect = .099), whereas participants in the ≥4 ACEs-CE group nearly three times as likely to have a lifetime history of smoking (OR = 2.70; *p* = .000; marginal effect = .241) than the 0 ACEs-CE group. The standardized mean difference for the ≥4 group was .62 SDs.

Depression. The association between ACEs-CE and depression was graded, with the 1 ACEs-CE group showing the smallest increase in odds over the 0 ACE group (OR = 1.30; ns), and the ≥4 ACEs-CE group showing a nearly four-fold increase in odds (OR = 3.74; *p* = .000; marginal effect = .164) and a standardized mean difference of .77 SDs. The 3 ACEs-CE group was also significantly more likely to endorse depressive symptoms (OR = 2.60; *p* = .019; marginal effect = .114).

Self-rated physical health. Only the ≥4 ACE group had higher odds of rating their own health as “fair or poor,” and this association was trending (OR = 1.50; *p* = .067; marginal effect = .072).

The Latent Structure of the ACEs Scales

Prior to running the PCA on the ACEs-C and ACEs-CE scales to investigate hypothesis 2a, internal consistency reliability statistics were obtained. Cronbach's alpha for the entire ACEs-CE scale was .66, which is slightly below the "acceptable" range of .7-.8 and indicates that while the items are related, there are likely latent subgroups. Cronbach's alpha for the ACEs-C scale was lower ($\alpha = .518$).

PCA on ACEs-C. The KMO sampling adequacy for the Conventional ACE scale was .66, which is well above the recommended minimum value of .5 (Kaisen, 1970). Bartlett's Test of Sphericity was significant, with $\chi^2(36) = 442.84$, $p < .001$. Despite the fact that, in practice, ACEs are generally separated into Abuse/Neglect and Household Dysfunction, there is limited precedent for analysis of the underlying structure of ACE questionnaires (see Ford et al., 2014; Mersky, Janczewski, & Topitzes, 2017). As such, an exploratory PCA was conducted with the nine "Conventional ACE" items. Pairwise deletion was selected to maximize available data.

Consistent with hypothesis 2a, the ACEs-C scale appeared to have two principal components, CAN and Household Dysfunction. Examination of results based on the first and second criteria stated above indicated that there were three latent factors with Eigenvalues >1, which each accounted for >10% of the variance (see Table 14), and 47% of the variance total. However, criterion 3 specifies that three or more items must uniquely load to create a factor, and child welfare case history from birth to age 3 and parental mental illness were the only items uniquely loading on Factor 3. Additionally, for criterion 4, examination of the Scree plot suggested a clear elbow leveling off point at two factors, illustrating that a two-factor model better described the data (see Figure 5). As such, the third factor was not considered a unique factor.

Altogether, Factors 1 and 2 accounted for 35% of the variance. Factor 1, accounting for 22% of the variance, comprised the hypothesized "Household Dysfunction" subscale in the Conventional ACE scale: Parent Arrest, Witnessing Domestic Violence, Parent Absence or Divorce, and Parent Substance Abuse. Parent Mental Illness, while it loaded most strongly on the excluded third factor, also loaded >.3 on this factor and was therefore included in Factor 1. Factor 2 accounted for 13% of the variance, and comprised the "Abuse and Neglect" variables on the Conventional ACE scale: Physical Abuse, Sexual Abuse, and Neglect.

Given the results of the exploratory PCA, a confirmatory analysis was conducted specifying two factors. Items loaded >.4 on the hypothesized factors (see Table 14) with the exception of the child welfare case history from birth to three indicator, which did not load >.3 on either factor. However, it loaded more strongly on the abuse and neglect factor (.272), and was included with the other abuse and neglect indicators consistent with theory. Factors determined here were used in part to address the portion of question 2 relating to "type" of ACE.

PCA on ACEs-CE. The KMO sampling adequacy was .76, which is again well above the recommended minimum value of .5 (Kaisen, 1970). Bartlett's Test of Sphericity was significant, with $\chi2(153) = 2036.35$, $p < .001$. As such, the PCA was conducted with the 9 "Conventional ACE" and an additional 8 "Expanded" ACE items, along with the self-report of Child Abuse and Neglect. Examination of output based on the four criteria indicated that there were two or three latent factors (Table 16). While six factors demonstrated Eigenvalues >1 (criterion 1), only factors 1 & 2 contributed >10% in variance explained (criterion 2). However, visual examination of the scree plot

indicates that the “elbow” levels off at factor 3 (criterion 3; Figure 6), and more than three items uniquely loaded onto this third factor (criterion 4). The first factor accounted for 18% of the variance. The second factor accounted for slightly more than 10% of the additional variance. The potential third factor accounted for just 7% of the variance.

Despite the third factor’s relatively weak contribution to the total variance, there was some ambiguity between the two and three factor solution. Given the high loadings of four items on Factor 3, the elbow of the scree plot indicating three potential factors, and more than three items falling on the third factor, two separate confirmatory PCAs were conducted.

Confirmatory PCA on ACEs-CE, two factors. The confirmatory PCA specifying two factors showed that Factor 1 again comprised the “household dysfunction” variables, and the expanded ACE variables tended to cluster with these (Table 17). Parent substance abuse, parent arrest, prolonged absence or divorce of parents, witnessing domestic violence, frequent family conflict, witness to a shooting or stabbing, victim of a violent crime, family financial problems, and death of a friend or relative loaded onto Factor 1. Parental mental illness, death of a parent, and death of a sibling also loaded most strongly onto Factor 1, but the loading was <.3. Abuse and neglect again comprised Factor 2, including physical abuse, neglect, and child welfare involvement 0-3. Out of home placement, an expanded ACE, also clustered with abuse and neglect. Although sexual abuse loaded most strongly on this factor, the loading was <.3.

Confirmatory PCA on ACEs-CE, three factors. The confirmatory PCA specifying three factors showed that all items fell on one of the three factors at or above .3, with the exception of death of a parent (.112) (Table 18). The first factor appeared to

capture some elements of a high-risk/impoverished home and community, and was composed of parental absence or divorce, parent substance abuse, witnessing a violent crime, victim of a violent crime, death of a close friend or relative, frequent family conflict, and family financial problems. The second factor was composed of the abuse, neglect, and out of home placement variables. The third factor could be conceptualized as a factor indicating a harsh home environment, and encompassed parent mental illness, witnessing domestic violence, parent arrest, death of a sibling, and self-report of child abuse and neglect. However, arguments could be made for items on the "High Risk/Impoverished Context" and items on the "Harsh Home Environment" factors being interchangeable. As such, while these results are interesting from a theoretical perspective and warrant further investigation, the low variance accounted for and the lack of clarity around what exactly each factor is measuring suggests that contrary to hypothesis 2a, a two factor solution (CAN and Household Dysfunction/Expanded ACEs) has the most practical application at this time.

Associations between ACEs and Outcomes by Type and Timing of ACE

The PCA on the ACEs-C scale generally revealed two factors, Child Abuse and Neglect and Household Dysfunction. When Expanded ACEs were added to the models, out of home placement generally fell on the CAN factor, while the Expanded ACEs fell on the HD factor. As such, three main subtypes of ACEs were investigated: CAN; HD; and HD/Expanded ACEs. These composite variables were used in logistic and linear regression to differentially analyze the long-term impacts of subtypes of ACEs on health outcomes. While Expanded ACEs did not fall on its own unique factor, given that nearly

a quarter of the sample with ACEs had Expanded ACEs only, effects of expanded ACEs were also investigated (see Appendix G).

Furthermore, to determine how differences timing of ACEs relate to the aforementioned measures of well-being, the probit and logistic regressions for the ACEs-C and ACEs-CE scales were investigated based on three time periods: 0-5, 6-10, and 11-18, corresponding with the developmental periods of early childhood, middle childhood, and adolescence.

First, results of CAN from birth-18, HD from birth-15, and HD/E from birth to 15 are presented. See Figures 7-15 for associations between different types of ACEs from birth to 18 and outcomes. Then, results are presented for ACEs-C and ACEs-CE by time period: early childhood, middle childhood, and adolescence. Relations between CAN and HD within these time periods were also investigated, and are presented in Appendix H.

Child Abuse and Neglect (CAN) 0-18 (Table 19). Administrative records of documented child abuse and neglect (CAN) or child welfare involvement from birth to age 18 were summed and separated into 0 and ≥1 CAN groups due to low frequencies of participants with ≥2 CAN reports. Six of the nine focal outcomes were significantly associated with a documented CAN history. These associations were generally weaker than with the overall ACE counts, and the highest standardized mean difference was .44 SDs.

Criminal Justice System Involvement. Participants with in the ≥ CAN group had two-fold increased odds of lifetime incarceration (OR = 2.16; p <.01; marginal effect = .101) and of felony arrest (OR = 2.13; p <.001; marginal effect = .174).

Education and Income. The ≥1 CAN group was about half as likely to earn the average entry wage as the 0 CAN group (OR = .52 p < .001; marginal effect = -.137). For

educational attainment, the ≥1 CAN group did not get as far in school as the 0 CAN group (β= .-.570; *p* <.001). The ≥1 CAN group also had similarly reduced odds of attaining a Bachelor's or Associate's Degree (OR = .51; *p* < .01).

Weight. The ≥1 CAN group was significantly less likely to be obese than the 0 CAN group (OR= .63; marginal effect = -0.111; *p* <.05).

Other outcomes. CAN was not significantly related to smoking behaviors, depressive symptoms, or self-rated physical health in this sample. However, when self-report of CAN was added to the score for the 70 participants who self-reported CAN but did not have administrative records, associations between CAN and depressive symptoms and self-rated physical health became marginally significant, and obesity was no longer significant (see Appendix I). Other results were unchanged.

Household Dysfunction (HD), 0-18 (Table 20). Household dysfunction variables were separated out from the overall ACE count and participants were grouped by number of conventional household dysfunction experiences (0, 1, 2, and ≥3) they had by age 18.

Criminal Justice System Involvement. There was no association between incarceration history and household dysfunction.

Education and Income. There was not a significant association between HD and annual income in this sample. However, there was a somewhat graded association between HD and educational attainment, with the 2 and ≥3 HD groups going further in school (β= .476; *p* < .05 and β= .658; *p* <.05). Relations between HD and attainment of a Bachelor's or Associate's degree was somewhat graded, with, contrary to expectation, increasing likelihood of attainment of a BA or AA with 2 HD (OR = 1.82; *p* < .05; marginal effect = .097) and with ≥3 HD (OR = 2.11; *p* <.05; marginal effect = .126).

Weight. There was no association between household dysfunction and weight in this sample.

Smoking. There was a graded association between lifetime smoking and household dysfunction, with the 2 (OR = 1.56; marginal effect = .108; p <.05) and ≥3 HD (OR = 2.29; marginal effect = .199; p < .01) groups significantly more likely to have smoked ≥100 cigarettes.

Depression. Participants in 2 HD group had increased odds of reporting depressive symptoms of 2.27 (p<.05).

Self-rated physical health. There was no association between household dysfunction and self-rated physical health in this sample.

Household Dysfunction and Expanded ACEs, 0-18 (Table 21). Household dysfunction and expanded ACES were separated out from the CAN indicators and participants were grouped by number of household dysfunction and expanded ACE experiences (0, 1, 2, 3, and ≥4) they had by age 18.

Criminal Justice System Involvement. Participants in the ≥4 HD/E group were twice as likely to have been incarcerated (OR = 2.05; p <.01; marginal effect = 103) as the group with no HD/E.

Education and Income. There was not a significant association between HD/E and annual income in this sample. Similar to results for HD alone, participants with 2 and ≥4 HD/E had modestly increased odds of attaining a BA or AA. The 2 HD/E group had increased odds of 1.69 (p <.05), while the ≥4 HD/E group had increased odds of 1.71 (p <.05).

Weight. There was no association between HD/E and weight in this sample.

Smoking. There was a graded association between lifetime smoking and HD/E, with the 3 (OR = 1.69; marginal effect = .128; $p < .05$) and ≥4 HD (OR = 3.19; marginal effect = .279; $p < .001$) groups significantly more likely to have smoked ≥100 cigarettes. The standardized mean difference for the ≥4 HD/E group on smoking was nearly as high as that for the ≥4 ACEs group.

Depression. The relation between HD/E and depression was also graded, with participants in the 2, 3, and ≥4 HD/E groups at significantly increased odds of endorsing depressive symptoms. The 2 HD/E group had nearly twofold increased odds (OR = 1.81; $p < .10$; marginal effect = .065), while the 3 HD/E group had increased odds of 2.63 ($p < .05$). The group with 4 or more HD/E had quadruple the odds of endorsing depressive symptoms compared to the the 0 HD/E group (OR = 4.04; $p < .001$; marginal effect = .180), with a standardized mean difference of .84, which is higher than for the ≥4 group on the overall ACE measures.

Self-rated physical health. There was no association between HD/E and self-rated physical health in this sample.

Adversity in early childhood.

ACEs-C in early childhood (Table 22). ACEs-C from birth to 5 were dummy coded into three groups: 0 ACEs-C, 1 ACE-C- and ≥2 ACEs-C. Overall, like the ACEs-C from birth to 18, ACEs-C in early childhood were generally associated with incarceration history, smoking, and depressive symptoms.

Criminal justice system involvement. Individuals in the ≥2 ACEs-C group were significantly more likely than those in the 0 ACE group to have been incarcerated by age

36 (OR = 2.23; p = .040; marginal effect = .127), with a standardized mean difference of .44, whereas there was no association between ACEs prior to age 5 and felony arrest.

Educational attainment and income. There was no association between ACEs-C from 0-5 and educational attainment or income.

Weight. The ≥2 ACEs-C group was, interestingly, significantly less likely to be obese at age 35 (OR = .52; p <.05; marginal effect = -.153).

Smoking. Participants in the ≥2 ACEs-C group had increased odds of endorsing smoking >100 cigarettes over the course of their lifetime (OR = 3.46; p <.001). The corresponding marginal effect showed an increase of 29.7%. The standardized mean difference for the group with high ACEs in early childhood was .75 SDs, approximately as large an effect as that of high ACEs across childhood and adolescence combined.

Depression. The ≥2 ACEs-C group was at significantly increased risk for endorsing significant depressive symptoms (OR = 2.56; p <.05; marginal effect = .126), with a standardized mean difference of .51.

Self-rated physical health. There were no significant associations between ACEs-C group from 0-5 and self- assessment of health as "fair or poor."

ACEs-CE in early childhood (Table 23). ACEs-CE were also dummy coded into three groups: 0 ACEs-CE, 1 ACE-CE, and ≥2 ACEs-CE. Overall, these results followed the same pattern as ACEs-C, wherein results were similar to the birth to 18 scale, primarily showing associations with incarceration, smoking, and depressive symptoms. The effect size for incarceration was the same, but those for smoking and depression were somewhat smaller.

Criminal Justice System Involvement. Participants in the ≥2 ACEs-CE birth to 5 group were significantly more likely to have been incarcerated (OR = 2.27; $p < .001$; marginal effect = .128). The standardized mean difference was .44 SDs.

Education and income. No relation was observed between ACEs-CE from birth to 5 and educational attainment or income.

Weight. No relation was observed between ACEs-CE from birth to 5 and obesity.

Smoking. There was a graded association between ACEs-CE from 05 and smoking, with the 1 ACEs-CE group marginally more likely to have a lifetime smoking history (OR = 1.32; $p <.10$; marginal effect = .067), and the ≥2 ACEs-CE group significantly more likely (OR = 2.22; $p <.001$; marginal effect = .195), with a standardized mean difference of .48 SDs.

Depressive symptoms. Experiencing either 1 or ≥2 ACEs-CE prior to age 5 significantly increased the likelihood that a participant would endorse depressive symptoms (OR = 2.07; $p <.01$; marginal effect = .084 and OR = 3.22; $p <.001$; marginal effect = .156, respectively). The standardized mean difference for the ≥2 ACE group was .66.

Self-rated health. There was no relation between ACEs-CE from 0-5 and self-rated health.

Adversity in middle childhood.

ACEs-C in middle childhood. (Table 24). ACEs-C from ages 6-10 was separated into three groups: 0, 1, and ≥2.

Criminal justice system involvement. Participants in the ≥2 ACE-C group were significantly more likely to have been incarcerated (OR = .157; $p < .01$; OR = 2.90), with a standardized mean difference of .54 SDs.

Education and Income. There were no significant associations between ACEs-C and education or income.

Weight. Participants in the ≥2 ACE-C group were less likely to be obese at age 35 (OR = 0.55; $p < 01$; marginal effect = -.142).

Smoking. There was a graded association between ACEs-C and lifetime smoking. The 1 ACE-C group had increased odds of 1.59 ($p < .01$) of reporting having smoked at least 100 cigarettes, while the ≥2 ACE-C group had increased odds of 2.48 ($p <.001$), with a standardized mean difference of .57 SDs.

Depression. There was a significant association between the 1 ACE-C group and depressive symptoms (OR = 2.31; $p < .01$; marginal effect = .093).

Self-Rated Health. There were no significant associations between ACEs-C and self-rated health.

ACEs-CE in middle childhood (Table 25). ACEs-C from 6-10 was separated into four groups: 0, 1, 2, and ≥3. The additional group was added due to high frequencies of 2 and ≥3 ACEs-CE in this age group.

Criminal justice system involvement. There was a graded relation between ACEs-CE between the ages of 6-10 and lifetime incarceration, with the 2 and ≥3 ACEs-CE group significantly more likely to have been incarcerated (OR = 1.84; $p <.05$; marginal effect = .087 and OR = 2.24; $p <.01$; marginal effect =.118, respectively). The standardized mean difference for the ≥3 ACEs group was .38 SDs.

Education and income. There was a trending association between membership in the ≥3 ACEs-CE group and making less than the median entry-wage income in Chicago (OR =0.72; p <.10; marginal effect=-.072). There were few significant relations between ACEs-CE from 6-10 and educational attainment.

Weight. Consistent with other results in this sample, participants in the ≥3 ACEs-CE group were significantly less likely to be obese than their counterparts with 0 ACEs-CE (OR = 0.68; p <.05; marginal effect = -.092).

Smoking. There was a clear graded relation between ACEs-CE and smoking in this sample, with a trending relation between the 1 ACEs-CE group and smoking and significant associations between the 2 and ≥3 ACEs groups and smoking. The 1 ACEs-CE group had increased odds of lifetime smoking of 1.34 (p <.10), the 2 ACEs-CE group had increased odds of 1.60 (p < .05) and the ≥3 ACEs-CE group had increased odds of 2.76 (p < .001; standardized mean difference = .64 SDs).

Depressive Symptoms. A graded association also emerged between ACEs-CE and depressive symptoms. The 1 ACEs-CE group had 75% greater odds of reporting depressive symptoms at age 35 (OR = 1.75; p <.05); the 2 ACEs-CE group had almost twice the odds (OR = 1.94, p <.10), although it should be noted that this association was trending. The ≥3 ACEs-CE group had increased odds of 3.39 (p <.001) over the 0 ACEs-CE group, with a standardized mean difference of .70.

Self-rated health. Only the ≥3 ACEs-CE group was at a significantly increased likelihood of rating their health as fair or poor (OR = 1.68; p <.5; marginal effect = .096).

Adversity in adolescence.

ACEs-C in adolescence (Table 26). ACEs-C from ages 11-18 were separated into three groups: 0 ACEs-C, 1 ACE-C, and 2 ACEs-C.

Criminal justice system involvement. There were no significant associations between ACEs experienced from 11-15 and incarceration or felony arrest.

Education and income. There were no significant associations between ACEs-C experienced from 11-15 and income. However, the group with ≥2 ACEs-C completed slightly more years of education, on average (β= .413; $p < .05$). Both the 1 and 2 ACE groups were slightly more likely to obtain a Bachelor's or Associate's degree, as well (OR = 1.65; $p < .05$ and OR = 1.73; $p < .05$).

Weight. ACEs-C were not significantly associated with obesity at age 35.

Smoking. The ≥2 ACE group was at significantly increased odds of smoking (OR = 1.75; $p <.01$), with a standardized mean difference of .36.

Depression. ACEs-C were not associated with reporting of depressive symptoms.

Self-rated health. ACEs-C were not associated with self-rated health.

ACEs-CE in adolescence (Table 27). ACEs-CE from 11-18 were separated into four groups: 0 ACEs-CE, 1 ACE-CE, 2 ACEs-CE, and ≥3 ACEs-CE due to higher frequencies of 2 and ≥3 ACEs.

Criminal justice system involvement. The ≥3 ACEs-CE group was significantly more likely to have been incarcerated (OR = 2.27; $p <.001$; marginal effect = .115; standardized mean difference .44), and the 1 and ≥3 ACEs-CE groups both had nearly 1.5 increased odds of felony arrest (OR = 1.43; $p <.05$; marginal effect =.075 and OR = 1.42; $p <.10$; marginal effect = .074), although the association for the ≥3 ACEs-CE group was trending.

Education and income. There were no significant associations between ACEs-CE and education or income.

Weight. There were no significant associations between ACEs-CE and weight.

Smoking. The association between ACEs-CE and smoking was graded, with the 2 and ≥3 ACE groups significantly more likely to endorse lifetime smoking. The 2 ACE group was about 50% more likely than the 0 ACE group to have smoked >100 cigarettes (OR = 1.49; p <.05; marginal effect = .097), and the ≥3 ACE group was about twice as likely (OR = 2.10; p <.01; marginal effect = .181).

Depression. Associations between depressive symptoms and ACEs-CE were less clear. The 1 ACEs-CE group showed a trending relation between ACEs-CE and depressive symptoms (OR = 1.73; p <.10; marginal effect = .059), and the ≥3 ACEs-CE group was significantly more likely to report depressive symptoms (OR = 2.79; p <.001; marginal effect = .126; standardized mean difference of .57).

Self-rated health. ACEs-CE from 11 to 15 were not associated with self-rated health.

Early Intervention as a Moderator of ACE Effects

To test for moderation of effects of ACEs-C and ACEs-CE by CPC and Extended program participation, an indicator of the presence or absence of ACEs prior to age 5 was interacted with intervention status and added to the model. Coefficients are reported as adjusted odds ratios with 95% confidence intervals. Effect sizes are also reported.

Interactions between ACEs-C and preschool participation. Analyses were also conducted to test the hypothesis that preschool participation would have a compensatory effect for participants with one or more Conventional ACEs (ACES-C) prior to age 5

(Table 28). The two education outcomes showed trending effects for the interaction between ACEs-C and CPC preschool attendance. The interaction between CPC preschool attendance and ACEs-C on number of grades completed was marginally significant (β = .057; *p* <.10; CI = -0.87 to .233; ES = .27) (Figure 16). Among the group that had experienced at least 1 ACE-C prior to age 5, those who attended CPC preschool completed on average, 1 full year of education more than the comparison group (13.4 vs. 12.4). Among the group without ACEs-C prior to age 5, CPC preschool attendees went about half a grade farther in school (13.1 years vs. 12.7 years) than the comparison group.

Similar results were seen for the interaction between ACEs-C preschool attendance on Bachelor's or Associate's Degree attainment (OR = 2.52; *p* .055; CI = 0.98 to 6.51; ES = .49) (Figure 17). Participants with ACEs-C prior to age 5 and who attended CPC preschool were somewhat more likely to attain a BA or AA than any of the other three groups. Among the ACEs-C group, 27.5% of CPC preschool attendees attained a BA or AA, compared to 11.7% in the comparison group with ACEs-C, a 15.8% difference. For those with no ACEs-C, only 22.8% of CPC preschool attendees attained a BA or AA, compared with 19.7% of the comparison group, a 3.1% difference.

Interactions between ACEs-C and extended program participation. There were no significant interactions between ACEs-C and Extended program participation status (Table 29).

Interactions between ACEs-CE and CPC preschool participation (Table 30). There was a significant interaction between ACEs-CE and CPC preschool attendance with respect to number of grades completed (β = 0.59; *p* .021; CI = .090 to 1.09; ES = .27). The group who had experienced ACEs-CE prior to age 5 and attended preschool

completed 13.03 years of education on average, compared 12.15 for the group who had experienced ACEs but had not attended CPC, for a difference of 0.88, nearly 1 full grade. Among the no ACEs-CE group, those who had attended CPC completed an average of 12.80 grades, versus 12.51 for those who had not attended CPC and did not have ACES (a difference of 0.29).

For BA/AA attainment, among the ACEs-CE group, 22.9% of those who had attended CPC preschool had a BA or AA by age 35, compared to 11% for the comparison group, a difference of 11.9 points. Among the no ACEs-CE group, 18% of CPC participants attained a BA/AA compared to 15.9% of the comparison group, for a difference of just 2.1 points. The difference in difference overall between ACEs-CE and no ACEs-CE groups is 9.8 points, indicating that preschool attendance had a compensatory effect for the group who experienced ACEs prior to age 5 (OR 2.17; p .042; CI 1.03-4.59; ES = .42).

Interactions between ACEs-CE and extended participation (Table 31). There were no significant interactions between ACEs-CE and Extended program participation status (Table 31).

Sex as a Moderator of Early Intervention

To determine if effects of early childhood education programming differ by sex, interaction terms were created between sex and intervention status and added to logistic regressions. As in Question 3, effect sizes were also calculated for interpretability.

Interactions between sex and CPC preschool attendance (Table 32). A marginally significant interaction was found between sex and preschool attendance on incarceration outcomes (OR 0.44, p <.10; CI 0.19 to 1.02; ES = .33). Comparison group

males had an incarceration rate of 42.0%, while males who attended CPC preschool had a rate of 33.4%, a difference of -8.6%. Comparison group females evinced a rate of 7.4% versus females who attended CPC preschool (2.4%), a difference of -5%.

CPC preschool attendance also appeared to have a compensatory effect for obesity in female participants (OR .50; *p* .012; CI 0.30 to 0.86; ES = .45). For males in the intervention group, 39.9% were obese at age 35, compared to 34.8% of males in the comparison group, a difference of -5.1%. For females in the intervention group, 47.2% were obese for females in comparison, 58.8%, a difference of -11.6%. The overall difference in difference between the groups was 6.5%.

Interactions between sex and extended participation (Table 33). There were no significant interactions between sex and Extended program participation status.

Early Intervention as a Moderator of Risk

To determine if effects of early childhood education programming differ by risk and dosage, interaction terms were created between risk and intervention status and added to logistic regressions. As in Question 3, effect sizes were also calculated for interpretability.

Interactions between risk and CPC preschool attendance (Table 34). There were no significant interactions between risk and CPC preschool attendance.

Interactions between risk and Extended Participation (Table 35). The interaction between risk and extended participation on income was marginally significant (OR 1.72; *p* .060; CI 0.98 to 3.01; ES = .30), see Figure 22. 40% of the high-risk extended participation group had an income above the median entry-level wage, whereas the high risk comparison group had a rate of 27.7%, for a difference of +12.3%. The low-

risk extended participation group had a rate of 47.8%, compared to the low risk comparison group's rate of 47.3%, for a difference of +0.5.

General Results

Overall, results for Aim 1 showed graded associations between ACEs and smoking, depression, and incarceration history. However, contrary to expectation, the addition of expanded ACEs to the ACE scale did not substantially increase predictive power, and effect sizes for the ACEs-C measure tended to be stronger.

Investigation of Aim 2 indicated that the underlying structure of the ACEs scale was consistent with convention, in that CAN and HD comprise two different factors. However, Expanded ACEs did not comprise a unique third factor; rather, they tended to cluster with HD. It should be noted that HD and Expanded ACE items warrant further exploration due to complex PCA results. Further investigation of Aim 2 indicated that different types of ACEs are differentially associated with outcomes. CAN is indeed strongly associated with most outcomes, underscoring assumptions that maltreatment is uniquely disruptive to development and independently contributes to impairment long after the initial insult. However, effect sizes for the significant associations between CAN and outcomes were generally smaller than those for the overall ACE score, suggesting that CAN is arguably a necessary but not sufficient measure of early adversity. Interestingly, CAN was not associated with smoking or depression outcomes, while HD and HD/Expanded ACEs were. This suggests that HD and Expanded ACEs may be driving the overall associations between aggregate ACE scores with these outcomes.

Strong differences in patterns of effects were not observed for ACEs occurring at different times during development; rather, patterns and magnitudes of effects during the

different periods of development were generally similar to effects across the entire period from birth to 18. Overall, results from Aims 1 and 2 suggest that measuring conventional ACEs from birth to 18 provides information similar to that garnered from measurement of ACEs at more granular time periods and measurement of additional types of ACEs.

Analyses for Aim 3 revealed that effects of ACEs were indeed moderated by CPC attendance. Specifically, participants with early ACEs who attended CPC preschool completed more school and obtained a post-secondary degree at higher frequencies than participants who did not have early ACEs, regardless of whether or not those participants attended preschool. Finally, for Aim 4, contrary to hypotheses, females were the group that tended to benefit somewhat more from CPC participation, specifically regarding incarceration and obesity. Extended participation, or attendance of 4-6 years of CPC preschool, did not appear to have an increased compensatory role for ACE affected participants, by sex, or by risk. As such, in the present study, dosage did not appear to impact the effects of intervention on outcomes.

Chapter 4

Discussion

The present study examined the effects of ACEs on well-being in adulthood, as well as the potential protective role of early childhood intervention in high risk groups. The purpose was to address several gaps in the ACE literature, including the examination of a wider array of ACE outcomes, differential effects by type and timing of ACEs, and possible mechanisms of resilience. Additionally, there is a need for increased ecological validity in both the measurement of ACEs, particularly for individuals in poverty, and in the measurement of outcomes (i.e., beyond simple self-report). From a transactional ecological framework, this study anticipated that ACEs would exert impacts on broad well-being in a high-risk sample; the ACE scale would exhibit several types of distinct underlying factors, and that these underlying factors would have differential impacts; and that intervention participation would have compensatory effects for high risk groups.

General Prevalence and Associations of ACEs Across Childhood and Adolescence with Broad Outcomes

Overall, when examining the ACEs-C scale, an approximate replication of the Kaiser/CDC ACE questionnaire, this sample endorsed relatively low rates of ACEs compared to the national sample (CDC, 2013). For example, in the original ACE study, 12.5% of the sample endorsed having experienced ≥4 ACEs, compared to just 4.2% in the current study. Comparable rates endorsed having experienced 1, 2, and 3 ACEs, but the rate of participants endorsing 0 ACEs was higher in this sample (44.2% vs 36.1% in the original survey). This may be partially due to several key differences that should be noted: First, our survey relied on administrative records of abuse and neglect. This is, in

some ways, a strength of this study, as it addresses concerns about the reliability of self-report. However, it is also well documented that abuse and neglect are often severely under-reported (Flaherty, 2008; Swahn, 2006). This assertion is evident in the 5% of our participants in the current sample who self-reported a CAN history but had no official child welfare history, especially when considering that this number is 35% of the total participants with CAN from any source. Including self-report of CAN for those who did not have administrative records of abuse and neglect but did endorse experiencing CAN did increase the percentage of participants with ≥4 ACEs-C (to 9.7%) but the percentage with 0 ACEs remained largely the same. Relatedly, we did not have administrative data on psychological abuse or emotional neglect, and as such, our conventional ACE scale measured fewer ACEs overall. All of these factors may have contributed to the lower rate of conventional ACEs reported in this sample.

Rates of ACEs-CE were higher, with 21% of the sample reporting ≥4. However, nearly twice as many ACEs were measured in the ACEs-CE scale, and as such, comparisons to the frequencies of the original ACE questionnaire are of limited utility. The discrepancy in frequencies may also indicate that, as suggested by prior research (Finkelhor et al., 2013), participants in this sample may have experienced qualitatively different types of ACEs than in the national sample. It is worth noting that of the participants who experienced any ACEs at all, nearly a quarter endorsed experiencing *only* expanded ACEs. This suggests that conventional measures of ACEs may fail to gather information on the full spectrum of adverse experiences, particularly in high poverty populations.

The first aim of the present study was to establish whether conventional and expanded ACEs were associated with adult well-being in this sample. The hypothesis was partially supported, as both the ACEs-C and ACEs-CE scales in this sample were consistently associated with increased risk for incarceration, smoking, and depressive symptoms. The associations between ACEs and both health habits and mental health outcomes replicates previous findings in conventional ACE studies in both homogeneous (Edwards et al., 2007; Felitti et al., 1998) and diverse (Mouton et al., 2016, smoking only) samples, but this is the first ACE study to investigate the association between ACEs and incarceration, despite extensive evidence that trauma and life stress increase likelihood of criminal behavior (Malinowsky, Rummell & Hanson, 1993; Murray & Farrington 2005, 2008a, 2008b; Widom & Ames, 1994). Relations between ACEs and educational attainment and income, obesity, and self-rated health were weaker and less consistent. The absence of effects on education and income was surprising, considering what is known about the associations between physical health and criminal behavior and education/socioeconomic status. However, it may be that a more complex mechanism is at play than was able to be revealed by the statistical methods used in the current study. Importantly, ACES-C, despite relatively low frequencies in the 3 and ≥4 ACEs groups, were generally equally or more strongly associated with outcomes than ACEs-CE, suggesting that contextual adversity and expanded ACEs may not contribute substantially to predictive power for the focal outcomes in mid-life. On the other hand, HD and Expanded ACEs were associated with depression while CAN was not. As such, it is possible that a broader measure of ACEs may be more impactful associated with outcomes not investigated in this study, like other indicators of mental health.

Type and Timing of ACEs

The factor structure of the ACE questionnaires. The second aim of the present study was, in part, to investigate the factor structure of the ACEs-C and ACEs-CE scales. Results of the PCA suggested that the ACEs-C scale contains two latent factors, CAN and Household Dysfunction, providing support for Hypothesis 2a and the field's standard practice of delineation of ACEs into these two categories. The PCA on the ACEs-CE scale was less clear, but ultimately results suggested that Expanded ACEs tended to cluster with HD, whereas out of home placement fell on the CAN factor. This was contrary to Hypothesis 2a, which postulated that Expanded ACEs would comprise its own factor separate from CAN and HD. It is perhaps not surprising that the Expanded ACEs shared a component with HD, as "Expanded" items like frequent family conflict, witnessing a violent crime, and family financial problems correlated with conventional HD items like parent substance abuse, parent mental illness, and parent arrest. Conceptually, while HD does not explicitly measure poverty, many of these items are more common in high-poverty households. In this sample HD had significant overlap with expanded ACEs; for example, of the participants who endorsed Expanded ACEs, 62% of them also endorsed at least 1 HD ACE.

Several important issues arose when examining Expanded ACEs in this sample. First, Expanded ACEs were operationalized in the present study as any ACE that was not measured in the original Conventional ACE scale. However, a more precise definition of the construct of Expanded ACEs may help to clarify the issue. For example, Expanded ACEs could be defined as ACEs that are experienced as a result or related to a high crime environmental context outside of the home. Indeed, when a confirmatory factor analysis

was run on the ACEs-CE items with three factors, it appeared that the ACEs designated Expanded and HD split into two different factors roughly indicating High Risk Context vs. a Harsh Home Environment. Some have criticized the use of dichotomous variables for factor analysis, as information is more likely to be lost or vulnerable to distortion as the binary data provides less information (Carroll, 1945). To wit, one potential direction, after clarifying the construct of Expanded ACEs, may be to utilize more precise statistical approaches. Specifically, estimating the model using polychoric correlations, which do not require variables to be continuous or normally distributed, and running analyses as true factor analysis in Lisrel or MPlus, would alleviate concern about misspecifications of the model based on assumptions of normality of non-normal data. However, it should be noted that many have argued that nominal and ordinal scales "can be used to measure correlation and provide a sound, albeit attenuated, basis for factor analysis" (Atkinson, 1988), and as such, results from the PCA conducted in the present study are likely a reasonably accurate approximation of the true factor structure of the ACE scales.

Additionally, the indicators measuring death of parents and death of siblings appeared to differ from the other Expanded ACEs added to the scale. These are, from a developmental standpoint, potentially adverse events, however, they are not necessarily conceptually similar to "Expanded" ACEs, and details on the level of closeness or living situations of the family members in question were not collected. They did not meaningfully contribute to the two factor solution in the ACEs-CE PCA, indicating that further investigation is warranted before including them in future measures of Expanded ACEs. Death of a close friend or relative, on the other hand, was higher among males in this sample, correlated with both witnessing and being victimized by a violent crime, and

loaded with other measures indicative of a high risk context in the PCA. While information on gang involvement was not investigated in the current study, many members of the CLS have reported gang activity in their neighborhoods as well as their own involvement, and therefore is more conceptually consistent with the theoretical underpinnings of "Expanded ACEs."

ACEs by type. Also relating to the second aim, hypothesis 2b stated that CAN history, controlling for other adversity, demographic risk, and intervention status, would be strongly associated with outcomes. Looking across the 0-18 period, presence of any CAN was indeed significantly associated with all outcomes with the exception of depression, smoking, and self-rated health. When self-report data of CAN was utilized, trending associations emerged between CAN and depressive symptoms and self-rated health as well. This is consistent with expectation, as abuse and neglect are generally considered more severe forms of early adversity, and have been found to result in alterations of neurobiology and psychosocial functioning in ways that other types of less severe adversity may not. As such, results suggest that CAN alone, even absent the "piling on" of other ACEs that research and theory suggest often occurs in the presence of CAN, has serious detrimental effects on later functioning. However, it should be noted that effects of CAN were generally smaller than effects of overall ACEs, suggesting that HD and Expanded ACEs may provide valuable information that CAN does not. It should also be noted that CAN was significantly negatively associated with obesity, such that participants with higher CAN scores were less likely to be obese, which is inconsistent with prior research (Felitti et al., 1998). However, our weight information was derived from self-report data and may therefore be less reliable.

Conversely, household dysfunction alone did not show nearly as robust associations with poor outcomes. High HD from 0-18 was, oddly, associated with higher educational attainment. It may be that participants with higher rates of household dysfunction were more motivated to strive for mobility out of their home and neighborhood situations. Future analyses should investigate subgroup differences potentially driving this effect in the CLS sample.

Despite the evidence that CAN is more strongly associated with well-being in adulthood than HD and Expanded ACEs, there were two outcomes for which Household Dysfunction and Expanded ACEs were predictive but CAN was not. While CAN was not associated with smoking, the higher HD groups and Expanded ACEs groups were significantly more likely to smoke. Additionally, when HD and Expanded ACEs were combined, there was a graded association with both smoking and depression. As HD and Expanded ACEs directly measure dysfunctional family and neighborhood environments, including family substance use and mental illness, it is possible that participants with high HD/E scores had environmental and hereditary priming for these outcomes.

ACEs by timing. Hypothesis 2c stated that, given extensive research on early childhood and adolescence as periods of rapid growth and development, ACEs in these periods would be particularly impactful. However, across developmental periods, results were similar to the analyses of ACEs from birth to 18. Generally, having high ACEs-C and ACEs-CE in early childhood, middle childhood, and adolescence was associated with incarceration, smoking, and depression at similar magnitudes (that is, two-to-nearly four-fold increases in odds) as was having high ACEs-C or ACEs-CE across childhood and adolescence.

Importantly, results in adolescence deviated from this pattern for ACEs-C, and were less clear. There were no effects of high ACEs-C seen on incarceration or depression, and although associations with smoking remained significant, they were attenuated. There were associations, however, between ACEs-C and educational attainment similar to those seen between HD from birth to 18 and educational attainment, in that the participants with high ACEs-C actually tended to go farther in school and be more likely to attain a BA or AA, although it is unclear why this might be. It should be noted that self-report ACE information (household dysfunction and expanded ACEs) was only available until age 15; as such, it is possible that ACE information experienced between 16 and 18 might have changed this picture.

In aggregate, hypothesis 2c was partially supported. The odds of poor outcomes were similar for when examining ACEs separately by developmental period as for ACEs across childhood and adolescence, suggesting that measuring ACEs across the birth to 18 period may be both parsimonious and as informative. However, the measure of abuse and neglect prior to age 5 was a single indicator of child welfare involvement, and therefore associations would likely be stronger with a more granular measure of early abuse and neglect, and further research is warranted.

The Impacts of Early Intervention

Consistent with hypotheses, CPC attendance demonstrated a protective effect for participants with ACEs. However, contrary to hypotheses, benefits conferred by CPC attendance did not increase with dosage. This is consistent with some earlier investigations on this sample finding that length of preschool attendance was not significantly associated with adult well-being (Reynolds et al., 2011), and underscores the

potential for using early ACE data to inform prevention efforts through evidence-based programming. This suggests that attending an enrichment program in the early childhood period may confer significant benefits that may be retained regardless of school age intervention matriculation. However, given findings that extended participation has been found to have positive effects on more proximal well-being in this sample (Reynolds, 1995; Reynolds, Temple, & Ou, 2003), it is also possible that increased dosage confers benefits through complex mechanistic pathways not measured in this study. Alternatively, as the present study used just two moderator variables ("any CPC preschool attendance" and "Extended prek-3rd grade participation") to examine the effects of dosage, a more nuanced and granular examination of dosage effects by different periods of attendance or by subgroup may reveal additional effects.

Intervention and early risk. Generally, intervention participants evinced lower frequencies of maladaptive outcomes and higher frequencies of adaptive outcomes; however, the hypothesis that intervention status would have a compensatory effect on ACE-affected participants was supported for educational attainment outcomes alone. Specifically, participants who experienced ACEs prior to age 5 and who also attended CPC preschool went farther in school than other participants, including those who attended CPC but did not have ACES. They were also more likely to attain at BA or AA degree. These findings also resonate with and build on prior research on the CPC program, which has indicated both that preschool participants tend to evince higher educational attainment (Reynolds et al., 2011)**,** and that higher risk participants benefit disproportionately from early intervention programs (Datta, 1979; Karoly et al., 2006; Reynolds et al., 2011). Importantly, however, in the aforementioned studies, risk was

defined as demographic risk, as opposed to early adversity, and this study is the first to our knowledge to examine compensatory effects of preschool participation for participants with high levels of ACEs specifically.

Interactions between intervention and demographic risk were also examined. With the exception of a trending effect on income, interaction effects were not significant. It should be noted that this sample also measures outcomes more distal to CPC preschool attendance than those investigations did. It may be that in the longer term, individuals with certain types of risk such as early adversity as measured by ACEs may truly benefit more than those with high demographic risk alone, but further research is warranted.

Intervention and sex. Contrary to previous findings in this sample (Karoly et al., 2006; Reynolds et al., 2011; Zigler, Gilliam, & Jones, 2006), the hypothesis that intervention would benefit male participants more than females was not supported. While both males and females who attended CPC had lower rates of lifetime incarceration, CPC appeared to have a significant compensatory effect for females only. However, low frequencies of this outcome for females indicate that this should be interpreted with caution. Females who attended CPC also had lower frequencies of obesity compared to females who did not, whereas males who attended CPC had slightly higher frequencies. However, self-report of weight is notoriously unreliable (Gorber, Tremblay, Moher, & Gorber, 2007), and future studies, such as the ongoing collection of biomarkers including weight and body composition in a subsample of these participants, will further illuminate these associations.

Strengths and Limitations

This study had several strengths, including a wide array of prospectively collected longitudinal data from a variety of sources. It is one of the first larger-scale ACE studies to use a primarily African-American, low-income sample, and also one of the first to investigate the associations between ACEs and broad well-being beyond health outcomes. Several limitations, however, were evident. Many of the ACE items and outcome variables were self-report, and inconsistencies in reporting across time periods and by source were small to moderate. The survey for self-report of ACEs was structured such that time periods did not align with birth to 18, but rather only extended to age 15, with the subsequent time period "16-24." As such, it was impossible to parse which experiences reported from 16-24 occurred between 16 and 18, and therefore some information on ACEs in the adolescent period was lost. Additionally, while results contribute to the research base on ACEs by replicating findings in dissimilar samples, the homogeneously African-American sample limits generalizability of these findings specifically. Finally, while the measurement of abuse and neglect in this sample was prospective and verified by administrative records, it is highly likely that CAN is being underreported.

Future Directions

Several future research directions are indicated. First, replication must continue to be conducted with large, diverse, prospectively studied samples to contribute to further generalization of the associations between adversity and outcomes. Second, while such generalization of associations between adversity and outcomes is important, enough evidence exists to begin tracing developmental pathways leading from ACEs to adult outcomes. That is, while it is important to investigate the associations between

intervention, ACEs, and adverse outcomes longitudinally, attention to the ways these processes work and for whom is integral to prevention practice. It seems that investigations illustrating graded associations between ACE counts and outcomes are published continuously, but few go so far as to investigate mechanisms to specifically illuminate the ways cumulative ACEs operate on adult outcomes through a developmental lens, although a study investigating CPC participation and mechanisms of transmission of ACE effects in this sample is currently in progress. It is time. This is the first step in determining how to both reduce incidences of ACEs and mitigate their effects. Caveats regarding generalizability and context notwithstanding, the impacts of ACEs have been well documented and the field must also strive to study mechanisms and points for intervention. In this endeavor, the ACE field has much to learn from the field of developmental psychology and the forefathers of life stress research. In other words, as Emmy Werner (1993) so eloquently stated:

"Rutter (1987) reminds us that if we want to help vulnerable youngsters, we need to focus especially on the protective processes that bring about changes in life trajectories from risk to adaptation. He included among them (a) those that reduce the risk impact, (b) those that reduce the likelihood of negative chain reactions, (c) those that promote self-esteem and self-efficacy, and (d) those that open up opportunities."

While this study has investigated moderators and established that CPC attendance may have compensatory effects for children at higher risk due to ACEs, further research is warranted to explain this type of differential impacts for various subgroups of children, including further investigation into the effects of dosage, with the ultimate goal of strengthening and tailoring programs to maximize benefits. For example, given the

present study's finding that CPC participation can buffer against the effects of ACEs, and earlier findings that CPC may be more beneficial for males and for higher risk participants, a logical next step would be investigating whether males with ACEs or higher risk participants *with ACEs* receive more benefits from intervention participation than females or lower risk participants with ACEs.

It will also be valuable to assess the relations between ACEs and physiological indicators of biological processes and health outcomes (e.g., cortisol, lipid panels). While large-scale educational, social, and behavioral interventions currently hold the greatest promise for promoting healthy development among ACE-affected individuals, from a developmental psychopathology perspective, ACE researchers should endeavor to develop multiple-levels-of-analysis programs of research, as these will likely yield the greatest insights into ACE prevention and intervention.

In this vein, in my dissertation prospectus, I proposed conducting more in-depth ACEs and mental health evaluations and assessments of physical health via biomarkers (e.g., cholesterol, blood glucose, blood pressure, body composition, telomeres) in a subsample of the CLS participants. While this project is underway through a partnership with Northwestern University's Department of Preventive Medicine, it became unfeasible to include this data in my dissertation. However, exploration of ACE effects on the physiological level remains a gap in the field. Given what is known about the effects of stress on physical functioning and what is known about the effects of cumulative ACEs, marrying these two types of findings is a logical next step. In keeping with the developmental principle of analyzing variables on multiple levels, the logical next step in the field is to link the health findings to physiological data. This is especially important

given the null findings between ACEs and self-reported health in the current study and the murky associations between ACEs and self-reported weight. Investigation of participants' self-report responses to questions about their health and their weight, and comparison of these responses to directly measured biological processes and health indicators (e.g., body fat, cortisol, cholesterol, blood sugar, telomere length), will provide insight into the reliability and validity of self-report of this type of information. It should be noted that Johnson et al., (2017) investigated the association between maltreatment and biomarkers of cardiometabolic risk in a small longitudinal sample followed from birth to middle age, and found that neglect was associated with the biomarkers and with self-rated health, but physical and sexual abuse were not. Rigorously validated, directly measured health information will also allow researchers to create useful indices of well-being, using mental and physical health information as well as potentially incorporating information on occupational and socioeconomic well-being, to investigate the associations between ACE counts and a dimensional measure of adaptive functioning.

Furthermore, while expanded ACEs were partially evaluated in the current study, quite a few ACEs that are more common to underserved community contexts, poverty, and disadvantage were not comprehensively addressed. This likely led to an underestimation of participants with high levels of childhood adversity (i.e., it is likely that more than the 21% of the sample reported had ≥4 adverse experiences prior to age 18). Future ACE research would be strengthened by including more measures of population-specific ACEs (e.g., ACEs related to urban poverty); however, it is important to ensure clarity of the ACE construct as opposed to simple demographic risk. To this point, the field would benefit from moving beyond binary (yes/no) retrospective self-

report measures of ACEs, collecting richer and more nuanced data about experiences via collection methods such as interviews and a view of ACEs through a more narrative, holistic lens. In this same vein, the effects of ACEs may also partially depend on the individual's conceptualization and response around the event or situation, and it would be useful to investigate if levels of concurrent or retrospective distress mediate the relation between ACEs and outcomes. This data is also being collected in the collaboration with Northwestern University.

Implications and Conclusions

Practical implications for the study can be drawn from the evidence for moderation of ACE effects by CPC preschool attendance. The findings that CPC has compensatory effects for participants who experienced ACEs early in life, particularly relating to educational attainment, suggests that there is an unexplored role for the translation of ACE research within prevention and intervention research.

There is a critical need for primary prevention initiatives aimed at reducing the incidence of ACEs. Relatedly, there is a need for tools that can effectively identify children affected by ACEs and promote healthy subsequent development, particularly given observed effects of ACEs experienced from birth to age five on life-course outcomes. This, along with evidence that underserved populations may experience ACEs at higher rates (albeit, different ACEs from the conventionally measured ACEs), suggests that implementing ECE programs in high-poverty neighborhoods may be an effective strategy for promoting resilience and wellbeing at large scales among these populations. Preventive interventions beginning in the first few years of life have demonstrated positive effects on long-term health and well-being by reducing family stress and

adversity and promoting children's school readiness, achievement, and socio-emotional learning. Nationally, about two-fifths of young children are enrolled in publicly-funded preschool programs (US Department of Education). However, fewer are in intensive programs that have been linked to positive long-term effects for vulnerable children and families. Given the public's receptivity to ACE research, new evidence of the impact of CPCs on ACEs specifically could have far-reaching policy implications. Because policymakers have limited resources to invest in intervention, researchers must find methods to maximize their effectiveness. Research such as this can serve to fuel the growing movement toward trauma-responsive and trauma-informed public education systems, amplifying both public receptivity and budgetary support in addition to resonating with teachers who work with ACE-affected children on a daily basis. It is important to leverage receptivity to ACE research in order to develop improved policy and practice that fully addresses the effects of ACEs high-risk populations.

Furthermore, the demonstrated predictive utility of measurement of early ACEs above and beyond demographic risk suggests that the universal use of ACE inventories to identify needs at preschool or kindergarten enrollment or at the pediatrician's office could be a valuable tool for identifying children who may be in need of more intensive intervention and support. Given the expense and limited scalability of interventions such as home visiting, universal ACE inventories in such settings could also be one way to prioritize beneficiaries of such programs. On a smaller scale, findings from this study can be incorporated in current CPC programming to address the needs of children at elevated risk (determined through demographic risk and a family needs assessment) through a broad-based program that would provide a number of ways to enhance outcomes based

on meditational findings. At least one CPC site has begun this process by screening for ACEs upon enrollment. The CLS is an exceptional framework for translational research and evidence-based policy development. By investigating the long-run effects of a sustained, public school program for a large sample on ACEs, this study provides further evidence that scalable interventions during these early years can have a lasting impact on healthy development and reduction of ACEs, as well as inform practice in the CPCs themselves.

Understanding the adverse effects of ACEs is important to obtain funding for prevention and intervention efforts, but obtaining funding is just the beginning: in order to design and implement effective preventive interventions, we must deepen our understanding of both the ways in which incidence of ACEs can be reduced *and* the ways in which individuals can be protected from these adverse effects.

These results contribute to the growing body of evidence of the enduring effects of ACEs using a cross-disciplinary and multi-level analysis approach. By and large, ACEs research to date has been dominated by the fields of public health and medicine, and the present study builds and expands on previous findings through a developmental lens, investigating sensitive periods, different types of ACEs, and broader context.

The evidence that ACEs and subtypes of ACEs, contribute to not only health outcomes, but also to socioeconomic, crime, and educational outcomes has vast implications for policy and practice efforts combatting systemic inequity and marginalization. The study additionally highlights the pattern of effects of ACEs in the context of poverty and minority status, contributing to our knowledge base of the generalizability of ACE research.

Examination of patterns across different types of ACEs suggested that CAN, even when controlling for demographic risk, household dysfunction, and expanded ACEs, is strongly associated with crime, educational attainment, and socioeconomic status in mid-adulthood. This underscores and builds on existing evidence that CAN is a severe insult to a child's development, and can derail individuals from their developmental trajectory in ways that resonate decades later. It also suggests that CAN may be driving many of the associations between ACEs and later outcomes. However, it should be noted that HD and Expanded ACEs were associated with depression and smoking outcomes while overall CAN was not, suggesting that different mechanisms may be at play for the development of these conditions.

The finding that ACEs experienced within early childhood, middle childhood, and adolescence all have impacts nearing the magnitude of ACEs experienced across childhood and adolescence for several outcomes is somewhat in contrast with what we know about the sensitivity of the early period of development in particular. However, more robust measures of CAN in early childhood specifically may reveal stronger associations, and the preponderance of research suggests that this early period is an opportune time for enrichment and intervention.

Overall, these findings suggest that ACEs exert detrimental effects on adult well-being in low-SES children, above and beyond the effects of demographic risk and poverty (Giovanelli et al., in press; Odgers & Jaffee, 2013), and speak to the need to continue to support underserved communities in active ways. Although ameliorating poverty and its negative impacts continue to be high priorities, greater investments in

interventions aimed at reducing the incidence and counteracting the effects of ACEs are also warranted.

Table 1. *Overall Demographics of Original Sample and Current Sample*

Study Category	Female %	Male %	CPC %	Extended %	Comparison %	Total sample
Participants' Characteristics at Start of Study						
Original Sample	770 (50.3)	761 (49.7)	988 (64.5)	504 (37.9)	543 (35.5)	1,531
African American	93.6	92.2	92.7	92.9	93.4	92.9
Hispanic	6.4	7.8	7.3	7.1	6.6	7.1
Child-Parent Center preschool participation	66.5	62.5	--	100.0	--	64.5
Child-Parent Center extended participation	39.7	36.1	51.0	--	--	37.9
Overall risk index (mean)	4.6(1.7)	4.5(1.7)	4.5 (1.7)	4.5 (1.6)	4.5 (1.7)	4.5 (1.7)
Current Maximized Sample Participation Status						
Have ACE score	711 (52.6)	641 (47.4)	887 (65.6)	469 (39.3)	465 (34.4)	1,352
African American	94.1	93.5	93.6	93.5	94.2	93.8
Hispanic	5.9	6.5	6.4	6.5	5.8	6.20
Child-Parent Center preschool participation	67.8	63.1	--	100.0	--	65.6
Child-Parent Center extended participation	41.0	37.5	52.9	--	--	39.3
Overall risk index (mean)	4.6(1.7)	4.4(1.7)	4.5 (1.7)	4.5 (1.6)	4.5 (1.7)	4.5 (1.7)

Note. Of the original sample of 1,539, 8 individuals were excluded due to lack of identifying information. Participants have been followed prospectively from ages 3-5 to 37.

Child-Parent Center preschool participation: Participants who attended the Child Parent Center (CPC) preschool program at three and/or four years of age

Child-Parent Center extended participation: CPC preschool intervention plus continued attendance at CPC into 2nd or 3rd grade, for 4-6 years of intervention total

Risk index: Composed of eight dichotomous indicators measured from birth to age 3, summed for each participant: (a) single parent household; (b) mother under age 18 at child's birth; (c) four or more children in the household; (d) mother a high school dropout; (e) family income below 185% of the federal poverty level; (f) mother unemployed; (g) welfare receipt; (h) and residence in a high-poverty neighborhood.

Table 2. *Demographics Comparing Age 24, Age 35, Maximized Sample, and Original Sample*

Study Category		Age 24 %	Age 35 %	Maximized Sample %	Original sample %	Missing ACE score %
Current Sample Participation Status					N = 1531	N = 179
Have ACE score		1142 (74.6)	1102 (72.0)	1,352 (88.3)	--	--
Black (African American)		94.1	93.7	93.8	92.9	86.6
Hispanic		5.9	6.3	6.20	7.1	13.4
Child-Parent Center preschool participation		65.8	65.8	65.6	64.5	56.4
Child-Parent Center extended participation		39.4	39.6	39.4	37.9	25.7
Overall risk index (mean)		4.5(1.7)	4.5 (1.7)	4.5 (1.7)	4.5 (1.7)	4.7(1.7)
One or more outcomes						
	Crime	1142	1096	1352	1531	179
	Education and Income	1117-1032	1051-1063	1227-1297	1317-1398	90-101
	Health	834-892	1018-1096	1024-1102	1103- 1025	1-2

Note:
Child-Parent Center preschool participation: Participants who attended the Child Parent Center (CPC) preschool program at three and/or four years of age
Child-Parent Center extended participation: CPC preschool intervention plus continued attendance at CPC into 2nd or 3rd grade, for 4-6 years of intervention total
Risk index: Composed of eight dichotomous indicators measured from birth to age 3, summed for each participant: (a) single parent household; (b) mother under age 18 at child's birth; (c) four or more children in the household; (d) mother a high school dropout; (e) family income below 185% of the federal poverty level; (f) mother unemployed; (g) welfare receipt; (h) and residence in a high-poverty neighborhood.
Maximized sample*:* ACEs reported at age 24, plus new, previously unasked ACEs reported at age 35 for participants who responded to survey at both timepoints. If missing age 24 score, replaced entire score with age 35 score, calculated with same variables as above but all self-report collected at 35.

Table 3. *Demographics Comparing Age 24, Age 35, Maximized Sample, and Original Sample, Males Only*

Study Category	Age 24 %	Age 35 %	Maximized Sample %	Original Sample %
Current Sample Participation Status				N = 761 (100)
Have ACE score	521 (68.5)	501 (65.8)	641 (84.2)	
Black (African American)	93.9	93.4	93.5	92.3
Hispanic	6.1	6.6	6.5	7.8
Child-Parent Center preschool participation	62.8	62.7	63.1	62.6
Child-Parent Center extended participation	36.8	37.0	37.5	36.1
Overall risk index (mean)	4.5(1.7)	4.3 (1.7)	4.4 (1.7)	4.5 (1.7)

Table 4. *Demographics Comparing Age 24, Age 35, Maximized Sample, and Original Sample, Females Only*

Study Category	Age 24 %	Age 35 %	Maximized Sample %	Original sample %
Current Sample Participation Status				N = 770 (100)
Have ACE score	621 (80.1)	601 (78.1)	711 (92.3)	
Black (African American)	94.4	93.8	94.1	93.6
Hispanic	5.6	6.2	5.9	6.4
Child-Parent Center preschool participation	68.1	68.22	67.8	66.5
Child-Parent Center extended participation	41.6	41.6	41.0	39.7
Overall risk index (mean)	4.5 (1.7)	4.6 (1.7)	4.6 (1.7)	4.6 (1.7)

Table 5. *Frequencies and Group Differences for Outcome Variables, with X^2 and T-test*

Outcome	N	Overall prevalence %	Males %	Females %	CPC Preschool %	Comparison %	Extended Participation %	No Extended Participation %
Incarceration	1352	19.30	36.35***	3.94	16.91	23.87**	16.20	20.41†
Felony arrest	1352	34.54	52.26***	18.57	33.15	37.20	33.90	35.31
Income	1227	36.67	34.96	38.19	39.38**	31.41	41.86**	33.13
Obesity	1024	44.73	38.07	50.74***	43.87	46.40	45.83	44.34
Highest grade completed (mean)	1296	12.71 (2.15)	12.26 (2.04)	13.11*** (2.17)	12.91 (2.17)***	12.33(2.06)	13.01(2.28)***	12.52(2.09)
Bachelor's or Associate's Degree	1297	17.89	11.55	23.44***	20.02**	13.77	21.32*	15.84
Smoking	1102	43.01	53.59***	34.17	40.97	46.95^{t}	38.32	44.25^{t}
Depressive symptoms	1102	12.43	15.34**	10.00	12.97	11.41	11.29	12.86
Self-rated health	1102	22.23	18.09	25.71**	21.76	23.14	20.47	22.64

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 6. *Prevalence of Individual ACEs*

Outcome	N	Overall prevalence %	Males %	Females %	CPC Preschool %	Comparison %	Extended Participation %	No Extended Participation %
Child welfare involvement from birth to 3	1352	3.40	3.28	3.52	3.04	4.09	2.99	3.72
Physical abuse	1352	2.88	3.12	2.67	2.48	3.66	2.77	3.17
Sexual abuse	1352	1.70	0.62	2.67**	1.47	2.15	1.07	2.34
Neglect	1352	7.25	6.55	7.88	5.30	10.97***	5.54	9.38*
Out of home placement	1253	7.42	7.77	7.11	6.28	9.65*	6.41	8.13
CAN, self-report	1094	10.24						
CAN, administrative records	1352	12.28	11.08	13.36	10.37	15.91**	10.23	14.90*
CAN self-report and administrative records	1352	17.60	17.00	18.14	15.22	22.15**	13.86	20.14**
Age 24								
Family financial problems	1123	16.92	20.74**	13.73	16.89	16.97	16.34	17.34
Frequent family conflict	1142	15.76	17.27	14.49	14.80	17.60	15.89	14.97
Parent absence or divorce	1142	32.05	38.77***	26.41	31.60	32.91	33.74	29.30
Parent substance abuse	1142	10.86	11.13	10.63	12.13†	8.42	10.76	10.35
Witness to a violent crime	1142	13.49	22.26***	6.12	13.33	13.78	13.94	12.58
Victim of a violent crime	1142	5.95	9.02***	3.38	5.87	6.12	6.36	5.57
Death of a parent	1142	8.67	8.06	9.18	8.93	8.16	7.33	9.55
Death of a brother or sister	1142	5.25	5.76	4.83	5.33	5.10	5.62	5.10
Death of a friend or relative	1142	19.70	23.22**	16.75	20.40	18.37	17.85	20.06
Age 35								
Parent arrest	1091	22.64	23.74	21.72	22.04	22.95	20.83	24.27
Witness domestic violence	1091	20.26	19.35	21.01	23.06†	18.80	21.01†	16.36
Family member with mental Illness	1096	4.65	4.02	5.18	4.27	4.85	4.31	5.00

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 7. *Prevalence of ACE Scores*

	N	Overall prevalence %	Males %	Females %	CPC Preschool %	Comparison %	Extended %	No Extended %
ACEs-CE	1352							
0 ACEs-CE	413	30.55	28.86	32.07	31.68	28.39	33.05*	29.93
1 ACE-CE	301	22.26	20.75	23.63	20.97	24.73	18.76	23.59*
2 ACEs-CE	214	15.83	14.35	17.16	16.80	13.98	18.55	15.03
3 ACEs-CE	140	10.36	10.92	9.85	10.94	9.25	10.23	10.07
≥4 ACEs-CE	284	21.01	25.12***	17.30	19.62	23.66†	19.40	21.38
ACEs-C	886							
0 ACEs-C	392	44.24	42.06	45.87	43.84	45.03	44.38	45.13
1 ACEs-C	254	28.67	27.51	29.53	29.97	26.16	28.12	28.57
2 ACEs-C	128	14.45	15.87	13.39	13.53	16.23	13.12	15.73
3 ACEs-C	75	8.47	10.32†	7.09	8.56	8.28	10.94*	6.63
≥4 ACEs-C	37	4.18	4.23	4.13	4.11	4.30	3.44	3.93
HD								
0 HD	715	52.88	51.33	54.29	53.55	51.61	53.30	53.93
1 HD	379	28.03	28.24	27.85	26.83	30.32	26.23	28.69
2 HD	169	12.50	13.88	11.25	12.97	11.61	12.79	11.86
≥3 HD	89	6.58	6.55	6.61	6.65	6.45	7.68	5.52
CAN								
0 CAN	1186	87.72	88.92	86.64	89.63	84.09	89.77	85.10
1 CAN	131	9.69	9.05	10.27	8.68	11.61	8.32†	11.72
≥2 CAN	35	2.59	2.03	3.09	1.69	4.30**	1.92	3.17
CAN with self-report								
0 CAN Aug	1116	82.54	83.15	82.00	84.78	78.28	86.14	80.14
1 CAN Aug	201	14.87	14.82	14.91	13.53	17.42†	11.94	16.69*
≥2 CAN Aug	35	2.59	2.03	3.09	1.69	4.30**	1.92	3.17
Expanded								
0 Expanded	650	48.08	43.99	51.76	48.93	46.45	5011	47.45
1 Expanded	342	25.30	23.56	26.86	24.80	26.24	23.45	26.62
2 Expanded	184	13.61	13.57	13.64	13.87	13.12	14.71	12.28
3 Expanded	106	7.84	11.54***	4.50	7.78	7.96	6.61	8.28
≥4 Expanded	70	5.18	7.33**	3.23	4.62	6.24	5.12	5.38

Note: If missing age 24 score, replaced score with age 35 score, calculated with same variables as above but all self-report collected at 35; $^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 8. *Breakdown by Type of ACE*

ACE Type	Overall %	Only, % out of total sample	Only, % out of total with ACEs at all
Current Sample Participation Status			
Overall ACEs-CE	69.45	--	--
Overall ACEs-C	55.76	--	--
CAN	12.28/17.46†	1.55/2.1†	2.24/2.98†
HD	47.12	12.87	18.53
Expanded	51.92	16.23	24.2

†Including self-report

Table 9. *Bivariate Correlations Among ACEs*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Physical abuse																	
2. Sexual abuse	.08**																
3. Neglect	.26***	.16***															
4. Child welfare involvement birth-3	.01	.07*	.12***														
5. Out of home placement	.34***	.14***	.63***	.32***													
6. Parent absence or divorce	.05†	.04	.08*	.04	.11***												
7. Family conflict	.03	.09**	.09**	.03	.06*	.25***											
8. Family financial problems	.06†	.07*	.08**	.01	.03	.19***	.31***										
9. Parent substance abuse	.07**	.09**	.21***	.01	.13***	.25***	.28***	.26***									
10. Witness to a violent crime	.07*	.02	.03	.01	-.01	.21***	.18***	.23***	.19***								
11. Victim of a violent crime	.47	.08**	.02	.03	.02	.21***	.20***	.28***	.19***	.35***							
12. Death of a parent	-.03	.01	-.03	-.04	-.04	.10***	.03	.02	-.04	.03	.03						
13. Death of a sibling	-.02	.00	.02	.04	.05	.09***	.12***	.06*	.03	.03	.04	.08**					
14. Death of a close friend or relative	.05†	.07*	.08**	-.01	.05	.23***	.19***	.20***	.17***	.26***	.24***	.05†	.05†				
15. Mental illness of a parent	-.01	.06*	.06*	.10***	.11***	.12***	.08*	.08*	.08*	.06	.14***	-.01	.02	.10**			
16. Witnessing domestic violence	.06†	.06*	.09**	.00	.06*	.16***	.21***	.14***	.22***	.10**	.20***	.01	.09*	.11**	.17***		
17. Parent arrest	.09**	.03	.19***	.06*	.17***	.15***	.14***	.13***	.14***	.12***	.14***	-.01	.09**	.15***	.20***	.29***	

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 10. *Correlations between ACEs and Outcomes, Controlling for Covariates*

	Incarceration	Felony	Annual Income	Obesity	Highest grade completed	BA/AA	Smoking History	Depression	Self-rated Health
Physical Abuse	.08**	.07*	-.03	-.02	-.02	-.02	-.02	.02	.03
Sexual Abuse	-.02	.02	-.02	-.01	-.02	-.02	.04	-.03	.04
Neglect	.11***	.08**	-.12***	-.07*	-.10***	-.06*	.02	-.01	.00
Child Welfare Involvement	.05	.06*	-.05†	-.02	-.10***	-.09**	.04	.06*	.03
Out of home placement	.11***	.07**	-.09**	-.07*	-.11***	-.10***	.01	.03	.02
Parent Absence or Divorce	.13***	.09*	-.03	-.05	-.03	.00	.14***	.07*	-.03
Family Conflict	.05	.03	-.02	-.05	-.01	.03	.12***	.06†	.01
Family Financial Problems	.14***	.08**	-.06†	-.03	-.02	.04	.12***	.07*	-.02
Parent Substance Abuse	.08**	.03	.01	-.06	.01	.08**	.09**	.02	-.06†
Witness to a violent crime	.17***	.11***	-.01	.02	-.04	.00	.13***	.09**	-.02
Victim of a violent crime	.14***	.12***	-.03	.00	-.01	-.02	.11**	.08**	.01
Death of a parent	.02	.01	-.02	-.02	.01	.01	.08*	.07*	.03
Death of a sibling	.08*	.01	-.03	.01	-.03	-.03	.05	.05	.01
Death of a close friend or relative	.10***	.08**	-.04	.02	-.05	-.01	.10**	.09*	.06$^{\iota}$
Mental illness of a parent	.05	.02	.00	-.04	-.03	-.04	.10**	.10***	.03
Witnessing domestic violence	.03	-.04	.00	.03	.04	.02	.10***	.17***	.08**
Parent arrest	.09**	.07*	-.01	-.01	-.03	.00	.07*	.10**	.07*

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 11. *Correlations between High Adversity Counts and Outcomes, Controlling for Covariates*

	Incarceration	Felony	Annual Income	Obesity	Highest grade completed	BA/AA	Smoking History	Depression	Self-rated Health
≥4 ACEs-CE	.15***	.06*	-.06*	-.03	-.05†	.01	.18***	.16***	.05
≥4 ACEs-C	.09**	.06†	-.02	-.04	-.02	.02	10**	.06^{t}	.02
≥2 CAN	.07**	.05†	-.03	-.02	-.04	-.06*	.04	.01	.01
≥3 HD	.07*	.01	.01	-.03	.05	.04	.12***	.06*	.01

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table 12. *Odds Ratios and Marginal Effects of ACEs-C 0-18 on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	886	--	--	--	--	--
No ACE (reference group)	392	--	--	--	--	--
1 ACE	254	.910	-.015	-.069 to .039	.593	--
2 ACE	128	1.94*	.088*	.005 to .171	.037	--
3 ACE	75	1.82ᵗ	.094ᵗ	-.009 to .196	.074	--
4 or more ACE	37	3.71*	.193*	.014 to .372	.034	.63
Felony Arrest	886	--	--	--	--	--
No ACE (reference group)	392	--	--	--	--	--
1 ACE	254	.990	-.004	-.081 to .072	.912	--
2 ACE	128	1.78*	.124*	.021 to .227	.018	--
3 ACE	75	1.05	.008	-.111 to .127	.896	--
4 or more ACE	37	2.08ᵗ	.162ᵗ	-.020 to .344	.081	.42
Income	856	--	--	--	--	--
No ACE (reference group)	382	--	--	--	--	--
1 ACE	246	1.31	.064	-.016 to .145	.112	--
2 ACE	122	1.18	.037	-.067 to .141	.457	--
3 ACE	71	0.93	-.015	-.141 to .111	.796	--
4 or more ACE	35	0.82	-.041	-.212 to .130	.623	-.11
Highest Grade Completed	883	--	--	--	--	--
No ACE (reference group)	391	--	--	--	--	--
1 ACE	253	--	.116	-.212 to .443	.489	--
2 ACE	127	--	.363ᵗ	-.052 to .779	.086	--
3 ACE	75	--	.128	-.385 to .641	.623	--
4 or more ACE	37	--	-.072	-.770 to .625	.838	.03
Bachelor's or AA Degree	884	--	--	--	--	--
No ACE (reference group)	391	--	--	--	--	--
1 ACE	253	1.37	.050	-.019 to .119	.154	--

2 ACE	128	1.56	.077	-.016 to .169	.104	--
3 ACE	75	1.20	.039	-.074 to .151	.499	--
4 or more ACE	37	1.46	.064	-.098 to .226	.437	.23
Obesity	828	--	--	--	--	--
No ACE (reference group)	368	--	--	--	--	--
1 ACE	235	0.81	-.052	-.133 to .030	.216	--
2 ACE	121	0.97	-.007	-.110 to .146	.898	--
3 ACE	72	0.80	-.055	-.179 to .070	.391	--
4 or more ACE	32	0.58	-.132	-.304 to .040	.133	-.36
Smoking	886	--	--	--	--	--
No ACE (reference group)	392	--	--	--	--	--
1 ACE	254	1.06	.012	-.069 to .092	.773	--
2 ACE	128	1.78**	.139**	.037 to .241	.007	--
3 ACE	75	2.24**	.195**	.071 to .318	.002	--
4 or more ACE	37	3.40***	.295***	.136 to .454	.000	.78
Depression	886	--	--	--	--	--
No ACE (reference group)	392	--	--	--	--	--
1 ACE	254	1.59	.043	-.013 to .099	.129	--
2 ACE	128	1.91	.069†	-.009 to .148	.081	--
3 ACE	75	2.54	.112*	.007 to .217	.036	--
4 or more ACE	37	3.10	.151*	-.001 to .303	.049	.83
Self-rated Health	884	--	--	--	--	--
No ACE (reference group)	391	--	--	--	--	--
1 ACE	253	1.17	.027	-.041 to .096	.435	--
2 ACE	128	1.33	.051	-.039 to .141	.267	--
3 ACE	75	1.28	.046	-.066 to .158	.418	--
4 or more ACE	37	1.44	.065	-.092 to .222	.416	.20

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 13 *Odds Ratios and Marginal Effects of ACEs-CE 0-18 on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	1352	--	--	--	--	--
No ACE (reference group)	413	--	--	--	--	--
1 ACE	301	.750	-.039	0.088 to .010	.117	--
2 ACE	214	1.27	.028	-.036 to .091	.392	--
3 ACE	140	1.50	.054	-.024 to .131	.176	--
4 or more ACE	284	2.47***	.129***	.062 to .195	.000	.46
Felony Arrest	1352	--	--	--	--	--
No ACE (reference group)	413	--	--	--	--	--
1 ACE	301	.950	-.015	-.088 to .058	.681	--
2 ACE	214	1.07	.012	-.070 to .093	.777	--
3 ACE	140	1.11	.021	-.074 to .116	.663	--
4 or more ACE	284	1.38t	.067t	-.010 to .145	.087	.19
Annual Income	1227	--	--	--	--	--
No ACE (reference group)	382	--	--	--	--	--
1 ACE	274	.917	-.021	-.096 to .054	.581	--
2 ACE	186	1.19	.040	-.046 to .126	.361	--
3 ACE	131	1.03	.005	-.092 to .102	924	--
4 or more ACE	254	0.74t	-.069t	-.144 to. 007	.076	-.19
Highest Grade Completed	1296	--	--	--	--	--
No ACE (reference group)	398	--	--	--	--	--
1 ACE	285	--	.020	-.291 to .331	.901	--
2 ACE	208	--	.065	-.278 to .408	.709	--
3 ACE	136	--	.081	-.317 to .479	.690	--
4 or more ACE	269	--	-.207	-.528 to .113	.205	-.10
Bachelor's or AA Degree	1297	--	--	--	--	--
No ACE (reference group)	398	--	--	--	--	--
1 ACE	285	1.17	.021	-.039 to .081	.490	--

2 ACE	208	1.65*	.086*	.005 to .147	.036	--
3 ACE	136	1.12	.013	-.064 to .090	.738	--
4 or more ACE	270	1.25	.035	-.029 to .100	.280	.14
Obesity	1024	--	--	--	--	--
No ACE (reference group)	299	--	--	--	--	--
1 ACE	218	1.00	-.010	-.097 to .078	.826	--
2 ACE	164	1.20	.045	-.051 to .141	.355	--
3 ACE	116	1.00	-.001	-.109 to .106	.974	--
4 or more ACE	227	0.87	-.034	-.121 to .053	.446	-.07
Smoking	1102	--	--	--	--	--
No ACE (reference group)	321	--	--	--	--	--
1 ACE	237	1.10	.022	-.064 to .109	.610	--
2 ACE	175	1.13	.029	-.066 to .124	.545	--
3 ACE	122	1.50ᵗ	.099ᵗ	-.008 to .205	.070	--
4 or more ACE	247	2.70***	.241***	.158 to .324	.000	.62
Depression	1102	--	--	--	--	--
No ACE (reference group)	321	--	--	--	--	--
1 ACE	237	1.30	.024	-.041 to .088	.473	--
2 ACE	175	1.65	.052	-.023 to .127	.173	--
3 ACE	122	2.60*	.114*	.019 to .209	.019	--
4 or more ACE	247	3.74***	.164***	.087 to .241	.000	.77
Self-rated Health	1102	--	--	--	--	--
No ACE (reference group)	320	--	--	--	--	--
1 ACE	237	1.23	.036	-.038 to .110	.342	--
2 ACE	175	1.14	.018	-.063 to .098	.668	--
3 ACE	122	1.43	.066	-.031 to .162	.181	--
4 or more ACE	248	1.50ᵗ	.072ᵗ	-.004 to .148	.067	.24

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 14. *Factor Loadings of ACEs-C Items, Exploratory*

	Structure Matrix			Pattern Matrix		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Physical abuse 4-18	.085	.695	-.155		**.702**	
Sexual abuse 4-18	.033	.472	.270		**.465**	
Neglect 4-18	.237	.739	.133		**.718**	
Child welfare 0-3	-.081	.220	.744			**.748**
Parent absence or divorce 0-15	.578	.079	-.046	**.583**		
Parent substance abuse 0-15	.600	.285	-.174	**.592**		
Parent mental illness 0-15	.413	-.118	.596	**.389**		**.575**
Witness domestic violence 0-15	.679	.017	.103	**.682**		
Parent arrest 0-15	.588	.126	.304	**.562**		

Note: Factor loadings presented are results post rotation (Direct Oblimin).
Factor 1 and 2 are correlated at r=.114; Factor 2 and 3 are correlated at r = .045; Factor 1 and 3 are correlated at r = .080
Only potential factors with Eigenvalues >1 are presented

Table 15. *Factor Loadings of ACEs-C Items, Confirmatory, Two Factors*

	Structure Matrix		Pattern Matrix	
	Household Dysfunction	Abuse & Neglect	Household Dysfunction	Abuse & Neglect
Physical abuse 4-18	.019	.671		**.694**
Sexual abuse 4-18	.081	.490		**.494**
Neglect 4-18	.233	.755		**.737**
Child welfare 0-3	.095	.280		**.272***
Parent absence or divorce 0-15	.538	.123	**.534**	
Parent substance abuse 0-15	.520	.312	**.477**	
Parent mental illness 0-15	.543	-.022	**.569**	
Witness domestic violence 0-15	.673	.085	**.683**	
Parent arrest 0-15	.630	.203	**.614**	

Note: Factor loadings presented are results post rotation (direct Oblimin).
Factor1 and 2 are correlated at r=.198
*Child welfare case history from 0-3 did not meet criteria as a unique factor loading but was retained due to strong conceptual evidence for this construct as an ACE.

Table 16. *Factor Loadings of ACEs-CE Items, Exploratory*

	Structure Matrix			Pattern Matrix		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Physical abuse 4-18	.157	.698	.042		**.726**	
Sexual abuse 4-18	.109	.192	-.025		**.127**	
Neglect 4-18	-.001	.790	.180		**.757**	
Child welfare 0-3	-.011	.099	.092			**.028**
Parent absence or divorce 0-15	.420	.119	.202	**.322**		
Parent substance abuse 0-15	.223	.220	.208		**.128**	
Parent mental illness 0-15	.199	-.073	.605			**.611**
Witness domestic violence 0-15	.092	.063	.688			**.678**
Parent arrest 0-15	.143	.212	.679			**.672**
Out of home placement 0-18	-.015	.787	.187		**.748**	
Witness violent crime 0-15	.723	.056	.088	**.721**		
Victim of violent crime 0-15	.677	-.009	.288	**.636**		
Death of a parent 0-15	.197	-.012	-.071	**.227**		
Death of a sibling 0-15	-.130	-.040	.170			**.119**
Death of a close friend or relative 0-15	.617	.114	.165	**.590**		
Frequent family conflict	.213	.024	.205			**.061**
Family financial problems	.401	.043	.107	**.276**		
CAN Self Report	.312	.242	.606			**.523**

Note: Factor loadings presented are results post rotation (Direct Oblimin).
Factor 1 and 2 are correlated at r=.114; Factor 2 and 3 are correlated at r = .045; Factor 1 and 3 are correlated at r = .080
Only potential factors with Eigenvalues >1 and >10% of variance are presented

Table 17. *Factor Loadings of ACEs-CE Items, Confirmatory, Two Factors*

	Structure Matrix		Pattern Matrix	
	Household dysfunction	Abuse and neglect	Household dysfunction	Abuse and Neglect
Physical abuse 4-18	.100	.499		**.494**
Sexual abuse 4-18	.158	.278		**.261***
Neglect 4-18	.178	.784		**.774**
Child welfare 0-3	.031	.419		**.423**
Parent absence or divorce 0-15	.530	.073	**.530**	
Parent substance abuse 0-15	.524	.182	**.508**	
Parent mental illness 0-15	.312	.179	**.293***	
Witness domestic violence 0-15	.489	.147	**.478**	
Parent arrest 0-15	.415	.297	**.382**	
Out of home placement 0-18	.120	.865		**.864**
Witness violent crime 0-15	.532	-.084	**.554**	
Victim of violent crime 0-15	.602	.031	**.618**	
Death of a parent 0-15	.098	-.140	**.119***	
Death of a sibling 0-15	.195	.033	**.194***	
Death of a close friend or relative 0-15	.515	.008	**.523**	
Frequent family conflict	.571	.050	**.575**	
Family financial problems	.559	-.004	**.570**	
CAN Self-Report	.564	.353	**.526**	

Note: Factor loadings presented are results post rotation (direct Oblimin).
Factors 1 and 2 are correlated at r=.137
* Sexual abuse, child welfare case history from 0-3, death of a parent, and death of a sibling did not meet criteria as a unique factor loading but was retained due to strong conceptual evidence for these constructs as ACEs.

Table 18. *Factor Loadings of ACEs-CE Items, Confirmatory, Three Factors*

	Structure Matrix			Pattern Matrix		
	Factor 1	Factor 2	Factor 3	High Risk Context	Abuse and Neglect	Harsh Home Environment
Physical abuse 4-18	.142	.572	-.082		**.585**	
Sexual abuse 4-18	.158	.304	.048		**.298**	
Neglect 4-18	.117	.803	.164		**.793**	
Child welfare 0-3	-.014	.351	.288		**.327**	
Parent absence or divorce 0-15	.519	.081	.245	**.487**		
Parent substance abuse 0-15	.543	.221	.167	**.527**		
Parent mental illness 0-15	.084	.026	.632			**.652**
Witness domestic violence 0-15	.303	.028	.613			**.579**
Parent arrest 0-15	.213	.176	.610			**.581**
Out of home placement 0-18	.018	.858	.226		**.845**	
Witness violent crime 0-15	.617	-.017	.042	**.643**		
Victim of violent crime 0-15	.600	-.023	.263	**.572**		
Death of a parent 0-15	.108	-.142	.028	**.112***		
Death of a sibling 0-15	.090	-.039	.314			**.318**
Death of a close friend or relative 0-15	.548	.044	.144	**.543**		
Frequent family conflict	.563	.059	.256	**.532**		
Family financial problems	.616	.050	.109	**.624**		
CAN Self Report	.392	.262	.602			**.519**

Note: Factor loadings presented are results post rotation (Direct Oblimin).
Factor 1 and 2 are correlated at r=.055; Factor 2 and 3 are correlated at r = .116; Factor 1 and 3 are correlated at r = .231.
* Death of a parent did not meet criteria as a unique factor loading but was retained due to strong conceptual evidence for this construct as an ACE.

Table 19. *Odds Ratios and Marginal Effects of CAN 0-18 on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	1354	--	--	--	--	--
No CAN (reference group)	1188	--	--	--	--	--
1 or more CAN	166	2.16	.101**	.027 to .175	.007	.31
Felony Arrest	1354	--	--	--	--	--
No CAN (reference group)	1188	--	--	--	--	--
1 or more CAN	166	2.13	.174***	.086 to .262	.000	.44
Income	1228	--	--	--	--	--
No CAN (reference group)	1078	--	--	--	--	--
1 or more CAN	150	0.52	-.137**	-.217 to -.057	.001	-.39
Highest Grade Completed	1298	--	--	--	--	--
No CAN (reference group)	1136	--	--	--	--	--
1 or more CAN	162	--	-.570**	-.919 to -.221	.001	-.27
Bachelor's or AA Degree	1299	--	--	--	--	--
No CAN (reference group)	1137	--	--	--	--	--
1 or more CAN	162	0.51	-.071**	-.124 to -.018	.009	-.29
Obesity	1025	--	--	--	--	--
No CAN (reference group)	905	--	--	--	--	--
1 or more CAN	120	0.63	-.111*	-.206 to -.016	.022	-.29
Smoking	1104	--	--	--	--	--
No CAN (reference group)	974	--	--	--	--	--
1 or more CAN	130	0.84	-.042	-.137 to .054	.393	-.13
Depression	1104	--	--	--	--	--
No CAN (reference group)	974	--	--	--	--	--
1 or more CAN	130	0.79	-.019	-.071 to .033	.464	-.11
Self-rated Health	1103	--	--	--	--	--
No CAN (reference group)	973	--	--	--	--	--
1 or more CAN	130	1.10	.016	.063 to .096	.690	.07

Table 20. *Odds Ratios and Marginal Effects of HD 0-18 on Adult Well-Being*

Outcome		Log odds Ratio	Marginal	95% CI	*P*-value	Stand. mean
Incarceration	1354	--	--	--	--	--
No HD (reference group)	717	--	--	--	--	--
1 HD	379	0.84	-.021	-.067 to .026	.379	--
2 or more HD	258	1.36	.044	-.018 to .106	.165	.18
Felony Arrest	1354	--	--	--	--	--
No HD (reference group)	717	--	--	--	--	--
1 HD	379	0.97	-.009	-.077 to .058	.788	--
2 or more HD	258	1.07	.012	-.071 to .095	.774	.03
Income	1228	--	--	--	--	--
No HD (reference group)	655	--	--	--	--	--
1 HD	337	1.33	.067^{t}	-.006 to .140	.073	--
2 or more HD	236	1.35	.072	-.018 to .163	.116	.18
Highest Grade Completed	1298	--	--	--	--	--
No HD (reference group)	685	--	--	--	--	--
1 HD	362	--	.239^{t}	-.042 to .521	.096	--
2 or more HD	251	--	.537*	.194 to .880	.002	.25
Bachelor's or AA Degree	1299	--	--	--	--	--
No HD (reference group)	685	--	--	--	--	--
1 HD	362	1.46	.055^{t}	-.002 to .112	.059	--
2 or more HD	252	1.90	.103**	.027 to .179	.008	.35
Obesity	1025	--	--	--	--	--
No ACE (reference group)	523	--	--	--	--	--
1 HD	281	0.92	-.022	-.103 to .060	.604	--
2 or more HD	221	0.97	-.006	-.100 to .088	.900	-.03
Smoking	1104	--	--	--	--	--
No HD (reference group)	565	--	--	--	--	--
1 HD	304	0.98	-.005	-.085 to .074	.900	--
2 or more HD	235	1.79	.141**	.048 to .233	.003	.36

Depression	1104	--	--	--	--	--
No ACE (reference group)	565	--	--	--	--	--
1 HD	304	1.61	.046†	-.009 to .101	.099	--
2 or more HD	235	2.19	.086*	.018 to .153	.013	.46
Self-rated Health	1103	--	--	--	--	--
No ACE (reference group)	562	--	--	--	--	--
1 HD	305	1.03	.004	-.061 to .071	.890	--
2 or more HD	236	1.16	.026	-.052 to .105	.509	.07

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 21. *Odds Ratios and Marginal Effects of HD/Expanded ACEs 0-18 on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	1352	--	--	--	--	--
No HD/E (reference group)	452	--	--	--	--	--
1 HD/E	311	-.68	-.048[t]	-.093 to -.003	.038	--
2 HD/E	206	1.06	.010	-.050 to .069	.746	--
3 HD/E	138	1.09	.010	-.056 to .076	.764	--
4 or more HD/E	245	2.04	.103[**]	.038 to .168	.002	.38
Felony Arrest	1352	--	--	--	--	--
No HD/E (reference group)	452	--	--	--	--	--
1 HD/E	311	0.88	-.030	-.100 to .040	.401	--
2 HD/E	206	0.86	-.034	-.113 to .045	.396	--
3 HD/E	138	0.85	-.036	-.126 to .053	.426	--
4 or more HD/E	245	1.14	.025	-.053 to .103	.533	.08
Income	1227	--	--	--	--	--
No HD/E (reference group)	414	--	--	--	--	--
1 HD/E	283	1.01	.002	-.072 to .076	.960	--
2 HD/E	181	1.26	.051	-.036 to .138	.247	--
3 HD/E	129	1.16	.035	-.064 to .133	.492	--
4 or more HD/E	220	0.94	-.014	-.095 to .069	.747	-.03
Highest Grade Completed	1296	--	--	--	--	--
No HD/E (reference group)	435	--	--	--	--	--
1 HD/E	297	--	.181	-.120 to .482	.238	--
2 HD/E	200	--	.211	-.130 to .553	.224	--
3 HD/E	134	--	.204	-.191 to .600	.311	--
4 or more HD/E	230	--	.012	-.321 to .345	.944	.01
Bachelor's or AA Degree	1297	--	--	--	--	--
No HD/E (reference group)	435	--	--	--	--	--
1 HD/E	297	1.26	.032	-.027 to .091	.292	--

2 HD/E	200	1.69	.077*	.005 to .149	.035	--
3 HD/E	134	1.27	.033	-.048 to .113	.430	--
4 or more HD/E	231	1.71	.079*	.007 to .152	.032	.28
Obesity	1024	--	--	--	--	--
No ACE (reference group)	322	--	--	--	--	--
1 HD/E	229	0.96	-.009	-.094 to .076	.839	--
2 HD/E	159	1.31	.067	-.028 to .163	.168	--
3 HD/E	115	0.95	-.011	-.118 to .096	.840	--
4 or more HD/E	199	0.99	-.033	-.094 to .088	.946	.10
Smoking	1102	--	--	--	--	--
No HD/E (reference group)	346	--	--	--	--	--
1 HD/E	248	1.14	.030	-.054 to .114	.484	--
2 ACE	171	1.15	.033	-.061 to .128	.484	--
3 HD/E	120	1.69	.128*	.022 to .234	.018	--
4 or more HD/E	217	3.19	.279***	.195 to .363	.000	.72
Depression	1102	--	--	--	--	--
No HD/E (reference group)	346	--	--	--	--	--
1 HD/E	248	1.30	.025	-.038 to .087	.437	--
2 HD/E	171	1.81	.065†	-.012 to .140	.098	--
3 HD/E	120	2.63	.116*	.022 to .211	.016	--
4 or more HD/E	217	4.04	.180***	.099 to .261	.000	.84
Self-rated Health	1102	--	--	--	--	--
No ACE (reference group)	344	--	--	--	--	--
1 HD/E	249	1.14	.023	-.048 to .094	.523	--
2 HD/E	171	1.20	.030	-.051 to .110	.466	--
3 HD/E	120	1.21	.035	-.058 to .128	.460	--
4 or more HD/E	218	1.38	.057	-.021 to .135	.153	.17

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 22. *Odds Ratios and Marginal Effects of ACEs-C in Early Childhood on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	888	--	--	--	--	--
No ACEs-C (reference group)	662	--	--	--	--	--
1 ACE-C	173	1.26	.028	-.033 to .089	.365	--
2 or more ACEs-C	53	2.23*	.127*	.006 to .249	.040	.44
Felony Arrest	888	--	--	--	--	--
No ACE-C (reference group)	662	--	--	--	--	--
1 ACE-C	173	1.21	.039	-.043 to .121	.346	--
2 or more ACEs-C	53	1.47	.083	-.059 to .224	.254	.22
Income	858	--	--	--	--	--
No ACE-C (reference group)	642	--	--	--	--	--
1 ACE-C	167	1.07	.014	-.071 to .099	.743	--
2 or more ACEs-C	49	1.02	.004	-.141 to .149	.956	.03
Highest Grade Completed	885	--	--	--	--	--
No ACE-C (reference group)	660	--	--	--	--	--
1 ACE-C	172	--	.138	-.209 to .484	.435	--
2 or more ACEs-C	53	--	-.143	-.722 to .437	.630	-.07
Bachelor's or AA Degree	886	--	--	--	--	--
No ACE-C (reference group)	660	--	--	--	--	--
1 ACE-C	170	1.08	.012	-.058 to .082	.739	--
2 or more ACEs-C	53	0.94	-.008	-.124 to .107	.886	-.01
Obesity	830	--	--	--	--	--
No ACE-C (reference group)	622	--	--	--	--	--
1 ACE-C	160	0.94	-.015	-.102 to .072	.736	--
2 or more ACEs-C	48	0.52*	-.153*	-.292 to -.013	.032	.40
Smoking	888	--	--	--	--	--

No ACE-C (reference group)	662	--	--	--	--	--
1 ACE-C	173	1.22	.046	-.039 to .131	.287	--
2 or more ACEs-C	53	3.46***	.297***	.163 to .431	.000	.75
Depression	888	--	--	--	--	--
No ACE-C (reference group)	662	--	--	--	--	--
1 ACE-C	173	1.46	.040	-.018 to .097	.174	--
2 or more ACEs-C	53	2.56**	.126*	.010 to .242	.033	.51
Self-rated Health	886	--	--	--	--	--
No ACE-C (reference group)	660	--	--	--	--	--
1 ACE-C	173	1.21	.033	-.039 to .105	.371	--
2 or more ACEs-C	53	1.04	.006	-.115 to .128	.917	.03

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 23 *Odds Ratios and Marginal Effects of ACEs-CE in Early Childhood on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	1352	--	--	--	--	--
No ACE-CE (reference group)	903	--	--	--	--	--
1 ACE-CE	269	1.22	.024	-.026 to .078	.346	--
2 or more ACEs-CE	180	2.27	.128***	.058 to .198	.000	.44
Felony Arrest	1352	--	--	--	--	--
No ACE-CE (reference group)	903	--	--	--	--	--
1 ACE-CE	269	1.19	.022	-.045 to .090	.518	--
2 or more ACEs-CE	180	1.21	.041	-.039 to .121	.313	.11
Income	1227	--	--	--	--	--
No ACE-CE (reference group)	826	--	--	--	--	--
1 ACE-CE	239	1.21	.025	-.046 to .096	.488	--
2 or more ACEs-CE	162	0.96	-.011	-.094 to .071	.786	-.03
Highest Grade Completed	1296	--	--	--	--	--
No ACE-CE (reference group)	867	--	--	--	--	--
1 ACE-CE	261	--	.195	-.088 to .478	.177	--
2 or more ACEs-CE	168	--	-.204	-.543 to .134	.237	-.09
Bachelor's or AA Degree	1297	--	--	--	--	--
No ACE-CE (reference group)	868	--	--	--	--	--
1 ACE-CE	261	1.24	.029	-.025 to .084	.288	--
2 or more ACEs-CE	168	0.97	-.005	-.068 to .059	.885	-.03
Obesity	1024	--	--	--	--	--
No ACE-CE (reference group)	673	--	--	--	--	--
1 ACE-CE	203	1.06	.015	-.064 to .094	.707	--
2 or more ACEs-CE	148	.782	-.059	-.148 to .029	.190	-.15
Smoking	1102	--	--	--	--	--

No ACE-CE (reference group)	723	--	--	--	--	--
1 ACE-CE	218	1.32	.067[†]	-.010 to .144	.090	--
2 or more ACEs-CE	161	2.22	.195[***]	.109 to .281	.000	.48
Depression	1102	--	--	--	--	--
No ACE-CE (reference group)	723	--	--	--	--	--
1 ACE-CE	218	2.07	.084[**]	.025 to .142	.005	--
2 or more ACEs-CE	161	3.22	.156[***]	.230 to .146	.000	.66
Self-rated Health	1102	--	--	--	--	--
No ACE-CE (reference group)	722	--	--	--	--	--
1 ACE-CE	219	1.11	.019	-.045 to .083	.559	--
2 or more ACEs-CE	161	1.24	.038	-.037 to .114	.320	.14

[†]p <.10 [*]*p* <. 05 [**]*p* <.01 [***]*p* <.001

Table 24. *Odds Ratios and Marginal Effects of ACEs-C in Middle Childhood on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	888	--	--	--	--	--
No ACE-C (reference group)	574	--	--	--	--	--
1 ACE-C	205	1.48	.042	-.018 to .102	.169	--
2 or more ACEs-C	109	2.90	.157**	.061 to .253	.001	.54
Felony Arrest	888	--	--	--	--	--
No ACE-C (reference group)	574	--	--	--	--	--
1 ACE-C	205	1.12	.032	-.046 to .110	.422	--
2 or more ACEs-C	109	1.28	.050	-.052 to .152	.335	.16
Income	858	--	--	--	--	--
No ACE-C (reference group)	562	--	--	--	--	--
1 ACE-C	193	1.09	.021	-.060 to .102	.615	--
2 or more ACEs-C	103	0.87	-.031	-.134 to .072	.555	-.08
Highest Grade Completed	885	--	--	--	--	--
No ACE-C (reference group)	571	--	--	--	--	--
1 ACE-C	205	--	.226	-.103 to .555	.178	--
2 or more ACEs-C	109	--	.182	-.242 to .605	.400	.08
Bachelor's or AA Degree	886	--	--	--	--	--
No ACE-C (reference group)	572	--	--	--	--	--
1 ACE-C	205	1.29	.150	-.025 to .113	.213	--
2 or more ACEs-C	109	1.32	.165	-.042 to .140	.291	.48
Obesity	830	--	--	--	--	--
No ACE-C (reference group)	541	--	--	--	--	--
1 ACE-C	190	1.02	.004	-.078 to .089	.908	--
2 or more ACEs-C	99	0.55	-.142***	-.245 to -.040	.006	-.36
Smoking	888	--	--	--	--	--

No ACE-C (reference group)	574	--	--	--	--	--
1 ACE-C	205	1.59	.111**	.030 to .192	.007	--
2 or more ACEs-C	109	2.48	.220***	.118 to .322	.000	.57
Depression	888	--	--	--	--	--
No ACE-C (reference group)	574	--	--	--	--	--
1 ACE-C	205	2.31	.093**	.033 to .152	.002	--
2 or more ACEs-C	109	1.77	.063	-.014 to .139	.107	.33
Self-rated Health	886	--	--	--	--	--
No ACE-C (reference group)	573	--	--	--	--	--
1 ACE-C	204	1.53	.075	.004 to .147	.039*	--
2 or more ACEs-C	109	1.34	.052	-.040 to .145	.267	.20

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 25. *Odds Ratios and Marginal Effects of ACEs-CE in Middle Childhood on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	1352	--	--	--	--	--
No ACE-CE (reference group)	708	--	--	--	--	--
1 ACE-CE	313	1.10	.009	-.040 to .058	.711	--
2 ACEs-CE	149	1.80	.087*	.010 to .164	.026	--
3 ACEs-CE	182	2.24	.118**	.046 to .190	.001	.38
Felony Arrest	1352	--	--	--	--	--
No ACE-CE (reference group)	708	--	--	--	--	--
1 ACE-CE	313	0.98	-.006	-.071 to .059	.859	--
2 ACEs-CE	149	0.94	-.018	-.104 to .068	.676	--
3 ACEs-CE	182	1.08	.015	-.065 to .095	.715	.05
Income	1227	--	--	--	--	--
No ACE-CE (reference group)	647	--	--	--	--	--
1 ACE-CE	286	1.12	.026	-.042 to .094	.453	--
2 ACEs-CE	135	0.98	-.006	-.096 to .085	.904	--
3 ACEs-CE	159	0.72	-.072t	-.154 to .010	.084	-.21
Highest Grade Completed	1296	--	--	--	--	--
No ACE-CE (reference group)	676	--	--	--	--	--
1 ACE-CE	303	--	.219	-.057 to .497	.119	--
2 ACEs-CE	143	--	.018	-.350 to .387	.923	--
3 ACEs-CE	174	--	-.109	-.452 to .234	.533	-.05
Bachelor's or AA Degree	1297	--	--	--	--	--
No ACE-CE (reference group)	677	--	--	--	--	--
1 ACE-CE	303	1.47	.057*	.002 to .111	.041	--
2 ACEs-CE	143	1.08	.011	-.059 to .082	.753	--
3 ACEs-CE	174	1.23	.029	-.040 to .098	.409	.11

Obesity	1024	--	--	--	--	--
No ACE-CE (reference group)	521	--	--	--	--	--
1 ACE-CE	240	0.88	-.032	-.108 to .044	.411	--
2 ACEs-CE	112	1.07	.016	-.086 to .118	.760	--
3 ACEs-CE	151	0.68	-.092*	-.181 to -.003	.043	-.23
Smoking	1102	--	--	--	--	--
No ACE-CE (reference group)	556	--	--	--	--	--
1 ACE-CE	259	1.34	.071†	-.004 to .146	.064	--
2 ACEs-CE	121	1.60	.114*	.014 to .214	.025	--
3 ACEs-CE	166	2.76	.246***	.160 to .331	.000	.64
Depression	1102	--	--	--	--	--
No ACE-CE (reference group)	556	--	--	--	--	--
1 ACE-CE	259	1.75	.060*	.004 to .116	.035	--
2 ACEs-CE	121	1.94	.076†	-.004 to .157	.063	--
3 ACEs-CE	166	3.39	.163***	.086 to .240	.000	.70
Self-rated Health	1102	--	--	--	--	--
No ACE-CE (reference group)	556	--	--	--	--	--
1 ACE-CE	259	1.14	.023	-.041 to .086	.482	--
2 ACEs-CE	121	1.15	.022	-.063 to .108	.612	--
3 ACEs-CE	166	1.68	.096*	.015 to .177	.020	.32

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 26. *Odds Ratios and Marginal Effects of ACEs-C in Adolescence on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	888	--	--	--	--	--
No ACEs-C (reference group)	557	--	--	--	--	--
1 ACE-C	209	1.24	.026	-.031 to .084	.371	--
2 or more ACEs-C	122	1.38	.041	-.032 to .114	.270	.15
Felony Arrest	888	--	--	--	--	--
No ACEs-C (reference group)	557	--	--	--	--	--
1 ACE-C	209	1.23	.039	-.039 to .117	.326	--
2 or more ACEs-C	122	1.07	.010	-.085 to .105	.835	.02
Income	858	--	--	--	--	--
No ACEs-C (reference group)	542	--	--	--	--	--
1 ACE-C	200	1.08	.018	-.063 to .099	.666	--
2 or more ACEs-C	116	1.24	.050	-.052 to .151	.340	.13
Highest Grade Completed	885	--	--	--	--	--
No ACEs-C (reference group)	555	--	--	--	--	--
1 ACE-C	209	--	.076	-.253 to .404	.652	--
2 or more ACEs-C	121	--	.413*	.006 to .820	.047	.19
Bachelor's or AA Degree	886	--	--	--	--	--
No ACEs-C (reference group)	555	--	--	--	--	--
1 ACE-C	209	1.65	.083*	.011 to .154	.023	--
2 or more ACEs-C	122	1.73	.100*	.007 to .194	.035	.32
Obesity	830	--	--	--	--	--
No ACEs-C (reference group)	520	--	--	--	--	--
1 ACE-C	196	0.96	-.011	-.094 to .072	.795	--
2 or more ACEs-C	114	1.04	.010	-.092 to .113	.842	.02
Smoking	888	--	--	--	--	--

No ACEs-C (reference group)	557	--	--	--	--	--
1 ACE-C	209	1.24	.052	-.028 to .133	.205	--
2 or more ACEs-C	122	1.75**	.136**	.036 to .236	.007	.36
Depression	888	--	--	--	--	--
No ACEs-C (reference group)	557	--	--	--	--	--
1 ACE-C	209	1.52	.041	-.013 to .096	.139	--
2 or more ACEs-C	122	1.50	.043	-.025 to .112	.216	.20
Self-rated Health	886	--	--	--	--	--
No ACEs-C (reference group)	555	--	--	--	--	--
1 ACE-C	209	1.04	.007	-.060 to .074	.834	--
2 or more ACEs-C	122	0.95	-.010	-.092 to .072	.808	.03

†p <.10 *p <. 05 **p <.01 ***p <.001

Table 27. *Odds Ratios and Marginal Effects of ACEs-CE in Adolescence on Adult Well-Being*

Outcome	N	Log odds Ratio	Marginal effect	95% CI	*P*-value	Stand. mean diff.
Incarceration	1352	--	--	--	--	--
No ACE-CE (reference group)	585	--	--	--	--	--
1 ACE-CE	312	1.36	.035	-.019 to .088	.208	--
2 ACEs-CE	193	1.37	.047	-.019 to .113	.164	--
3 ACEs-CE	262	2.27	.115***	.052 to .179	.000	.44
Felony Arrest	1352	--	--	--	--	--
No ACE-CE (reference group)	585	--	--	--	--	--
1 ACE-CE	312	1.43	.075*	.006 to .145	.034	--
2 ACEs-CE	193	1.12	.022	-.060 to .104	.596	--
3 ACEs-CE	262	1.42	.074t	-.001 to .148	.054	.19
Income	1227	--	--	--	--	--
No ACE-CE (reference group)	538	--	--	--	--	--
1 ACE-CE	284	0.92	-.020	-.090 to .049	.569	--
2 ACEs-CE	168	1.13	.027	-.058 to .112	.533	--
3 ACEs-CE	237	0.76	-.061	-.134 to .013	.104	-.16
Highest Grade Completed	1296	--	--	--	--	--
No ACE-CE (reference group)	561	--	--	--	--	--
1 ACE-CE	300	--	.108	-.178 to .395	.459	--
2 ACEs-CE	187	--	-.011	-.349 to .328	.950	--
3 ACEs-CE	248	--	-.129	-.438 to .180	.413	.06
Bachelor's or AA Degree	1297	--	--	--	--	--
No ACE-CE (reference group)	561	--	--	--	--	--
1 ACE-CE	300	1.38	.045	-.011 to .101	.115	--
2 ACEs-CE	187	1.13	.016	-.050 to .081	.642	--
3 ACEs-CE	249	1.49	.062t	-.002 to .126	.057	.21

Obesity	1024	--	--	--	--	--
No ACE-CE (reference group)	431	--	--	--	--	--
1 ACE-CE	237	1.33	.071^{t}	-.009 to .150	.082	--
2 ACEs-CE	146	1.00	.000	-.094 to .094	.999	--
3 ACEs-CE	210	1.02	.005	-.079 to .089	.906	.03
Smoking	1102	--	--	--	--	--
No ACE-CE (reference group)	468	--	--	--	--	--
1 ACE-CE	250	1.13	.029	-.049 to .107	.470	--
2 ACEs-CE	157	1.49	.097*	.004 to .189	.040	--
3 ACEs-CE	227	2.10	.181***	.100 to .262	.000	.51
Depression	1102	--	--	--	--	--
No ACE-CE (reference group)	468	--	--	--	--	--
1 ACE-CE	250	1.73	.059^{t}	-.001 to .118	.054	--
2 ACEs-CE	157	1.73	.060	-.012 to .132	.101	--
3 ACEs-CE	227	2.79	.126***	.059 to .193	.000	.57
Self-rated Health	1102	--	--	--	--	--
No ACE-CE (reference group)	466	--	--	--	--	--
1 ACE-CE	251	1.24	.037	-.029 to .104	.271	--
2 ACEs-CE	157	1.22	.036	-.043 to .115	.373	--
3 ACEs-CE	228	1.18	.029	-.041 to .099	.418	.10

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table 28. *Interactions between ACEs-C from 0-5 and CPC Preschool Attendance*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	CPC = 1 ACEs = 1	CPC = 0 ACEs = 1	CPC = 1 ACES = 0	CPC = 0 ACEs = 0	Effect Size
Incarceration	888	0.50	0.21 to 1.19	.117	17.4	30.5	15.8	18.9	-.34
Felony	888	0.76	.367 to 1.56	.450	33.7	39.5	30.9	31.2	-.16
Annual Income	858	1.41	0.69 to 2.89	.342	43.7	31.6	40.0	35.5	.21
Highest Grade Completed	885	0.57^{t}	-.087 to .233	.092	13.4	12.4	13.1	12.7	.27^{t}
Bachelor's or AA Degree	886	2.52^{t}	0.98 to 6.51	.055	27.5	11.7	22.8	19.7	.49^{t}
Obesity	830	0.70	0.36 to 1.40	.317	38.8	49.4	46.0	48.1	-.20
Smoking	888	1.26	0.65 to 2.46	.497	49.3	45.2	37.5	38.9	.13
Depression	888	1.07	0.40 to 2.90	.892	17.2	12.2	10.8	7.9	.04
Self-rated health fair/poor	886	0.63	0.30 to 1.33	.226	21.6	31.1	21.7	22.3	-.27

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table 29. *Interactions between ACEs-C from 0-5 and Extended Program Participation*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	CPC = 1 ACEs = 1	CPC = 0 ACEs = 1	CPC = 1 ACES = 0	CPC = 0 ACEs = 0	Effect size
Incarceration	888	1.02	0.40 to 2.57	.970	17.1	24.4	12.6	19.0	.01
Felony Arrest	888	0.64	0.31 to 1.35	.239	32.1	38.4	32.4	30.0	-.21
Income	858	1.21	0.60 to 2.43	.592	47.5	36.2	42.4	35.7	.15
Highest Grade Completed	885	0.57	-0.11 to 1.25	.100	13.7	12.7	13.2	12.8	.27
Bachelor's or AA Degree	886	1.55	0.69 to 3.52	.284	31.4	17.2	25.9	19.3	.21
Obesity	830	0.66	0.33 to 1.31	.233	36.9	46.8	46.6	46.4	-.27
Smoking	888	1.31	0.67 to 2.59	.434	49.0	45.5	35.8	38.5	.15
Depression	888	1.18	.483 to 3.16	.746	12.3	15.9	7.6	11.5	.06
Self-rated Health	886	0.86	0.40 to 1.88	.713	23.3	26.3	21.0	21.2	-.10

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table 30. *Interactions between ACEs-CE from 0-5 and CPC Preschool Attendance*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	CPC = 1 ACEs = 1	CPC = 0 ACEs = 1	CPC = 1 ACES = 0	CPC = 0 ACEs = 0	Effect size
Incarceration	1352	0.76	0.40 to 1.42	.386	20	29.3	15.5	19.9	-.14
Felony Arrest	1352	0.72	0.43 to 1.23	.233	34.0	41.0	33.4	33.8	-.15
Annual Income	1227	1.23	0.71 to 2.14	.463	40.8	30.7	38.1	32.7	.14
Highest Grade Completed	1296	0.59*	0.09 to 1.09	.021	13.03	12.15	12.80	12.51	.27*
Bachelor's or AA Degree	1297	2.17*	1.03 to 4.59	.042	22.9	11	18	15.9	.42*
Obesity	1024	1.24	0.71 to 2.17	.446	43.7	43.5	43.5	48.6	.12
Smoking	1102	0.92	0.53 to 1.59	.773	49.3	53.2	38.4	40.2	-.05
Depression	1102	0.59	0.26 to 1.31	.192	18.8	20	9.8	6.5	.16
Self-rated Health	1102	0.68	0.36 to 1.27	.230	22.1	27.8	21.8	20.5	-.15

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table 31. *Interactions between ACEs-CE from 0-5 and Extended Participation Attendance*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	CPC = 1 ACEs = 1	CPC = 0 ACEs = 1	CPC = 1 ACES = 0	CPC = 0 ACEs = 0	Effect size
Incarceration	1352	0.94	.472 to 1.88	.865	19	25.9	13.4	18.4	-.03
Felony Arrest	1352	0.68	0.39 to 1.19	.181	33.7	39.2	34.9	32.8	-.21
Annual Income	1227	1.50	0.86 to 2.61	.149	47	31.6	39.8	33.6	.23
Highest Grade Completed	1296	.008	-0.51 to 0.53	.975	13.09	12.51	13.04	12.47	0
Bachelor's or AA Degree	1297	1.22	0.62 to 2.37	.564	24.8	15.5	21.3	15.2	.09
Obesity	1024	1.02	0.58 to 1.82	.936	44.9	43.7	45.8	45.0	-.01
Smoking	1102	0.93	0.53 to 1.66	.829	46.5	50.8	36.6	39.3	-.16
Depression	1102	1.02	0.45 to 2.31	.953	14.3	19.5	7.6	10.9	-.06
Self-rated Health	1102	0.89	0.46 to 1.73	.727	21.2	24.4	20.5	21.5	-.06

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table 32. *Interactions between Sex and CPC Program Attendance*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	Sex = 0 Prek = 1	Sex = 0 Prek = 0	Sex = 1 Prek = 1	Sex = 1 Prek = 0	Effect size
Incarceration	1352	0.44†	0.19 to 1.02	.057	33.4	42.0	2.4	7.4	.33†
Felony Arrest	1352	0.95	0.57 to 1.60	.858	51.3	54.5	17.6	20.3	-.02
Annual Income	1227	0.95	0.57 to 1.60	.865	37.3	30.0	40.6	33.8	.01
Highest Grade Completed	1296	-.145	-.620 to .330	.549	12.45	11.87	13.26	12.82	.07
Bachelor's or AA Degree	1297	1.12	.563 to 2.23	.745	12.4	9.4	26.1	18.7	-.07
Obesity	1024	0.50*	0.30 to 0.86	.012	39.9	34.8	47.2	58.8	.45*
Smoking	1102	0.96	0.58 to 1.61	.884	52.8	55.2	33.1	36.2	.03
Depression	1102	1.17	0.53 to 2.59	.690	16.0	15.1	10.4	8.5	-.01
Self-rated Health	1102	0.66	0.36 to 1.23	.419	19.2	16.5	24.2	28.6	.09

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 33. *Interactions between Sex and Extended Participation*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	Sex = 0 Ext = 1	Sex = 0 Ext = 0	Sex = 1 Ext = 1	Sex = 1 Ext = 0	Effect Size
Incarceration	1352	0.66	0.24 to 1.84	.432	29.8	40.0	2.0	4.7	.14
Felony Arrest	1352	0.90	0.53 to 1.54	.713	52.4	52.7	17.9	19.5	.05
Annual Income	1227	1.04	0.63 to 1.75	.867	39.4	31.1	44.4	34.6	-.02
Highest Grade Completed	1296	0.25	-0.25 to 0.74	.327	12.50	12.07	13.53	12.85	-.12
Bachelor's or AA Degree	1297	1.23	0.63 to 2.39	.539	14.0	10.2	30.0	19.8	-.12
Obesity	1024	0.74	0.43 to 1.28	.286	41.0	36.1	50.0	52.3	.18
Smoking	1102	1.05	0.61 to 1.80	.866	49.9	54.9	30.7	34.0	-.04
Depression	1102	1.17	0.52 to 2.65	.501	11.9	18.0	8.2	11.1	-.07
Self-rated Health	1102	1.03	0.54 to 1.97	.938	17.5	19.5	23.1	25.1	-.02

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 34. *Interactions between Risk and CPC Program Attendance*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	Risk = 1 Prek = 1	Risk = 1 Prek = 0	Risk = 0 Prek = 1	Risk = 0 Prek = 0	Effect size
Incarceration	1352	0.91	0.46 to 1.80	.782	17.5	24.7	15.9	21.3	-.07
Felony Arrest	1352	0.95	0.54 to 1.68	.859	35.0	38.3	29.8	31.7	-.06
Annual Income	1227	1.49	0.86 to 2.58	.159	35.7	26.4	47.7	46.5	.25
Highest Grade Completed	1296	.059	-0.47 to .589	.828	12.65	12.13	13.50	13.04	.03
Bachelor's or AA Degree	1297	1.30	0.66 to .254	.449	16.0	10.3	29.5	24.8	.14
Obesity	1024	0.70	0.39 to 1.26	.237	42.5	48.6	46.9	44.4	-.22
Smoking	1102	1.48	0.83 to 2.62	.184	43.7	44.0	37.8	47.1	.23
Depression	1102	1.30	0.48 to 3.52	.607	15.2	13.0	7.1	7.6	.16
Self-rated Health	1102	0.75	0.37 to 1.51	.419	22.5	25.0	20.5	18.3	-.17

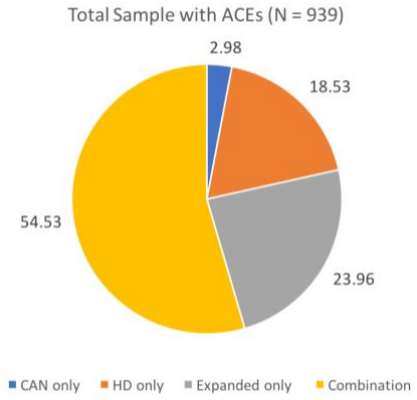
†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table 35. *Interactions between Risk and Extended Participation*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	Risk = 1 Ext = 1	Risk = 1 Ext= 0	Risk = 0 Ext = 1	Risk = 0 Ext = 0	Effect size
Incarceration	1352	0.63	0.30 to 1.35	.234	14.9	22.6	15.8	17.7	-.23
Felony Arrest	1352	1.13	0.61 to 2.07	.687	36.1	36.5	29.0	31.6	.05
Annual Income	1227	1.72^{t}	0.98 to 3.01	.060	40	27.7	47.8	47.3	$.30^{t}$
Highest Grade Completed	1296	0.62	-0.50 to 0.62	.828	12.83	12.25	13.66	13.14	.02
Bachelor's or AA Degree	1297	0.93	0.49 to 1.79	.838	18.3	12.2	34.1	23.5	-.05
Obesity	1024	0.86	0.47 to 1.57	.616	44.5	44.4	48.9	45.1	-.08
Smoking	1102	1.32	0.72 to 2.43	.370	41.2	43.5	34.9	43.5	.16
Depression	1102	1.50	0.47 to 4.77	.501	12.0	16.4	4.1	8.3	.16
Self-rated Health	1102	1.22	0.58 to 2.57	.605	22.2	23.4	16.4	20.4	.12

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Figure 1. Frequencies by Type of ACE



Note: N of 939 is number of participants from sample of 1,352 with any type of ACE (69.5%)

Figure 2. ACEs-CE and ACEs-C 018 and Incarceration

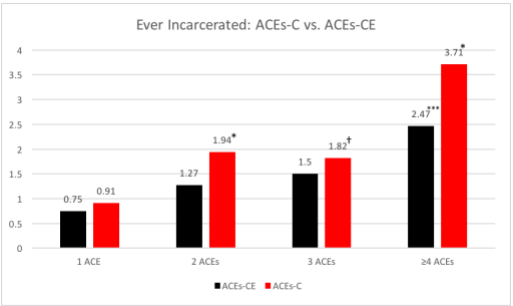


Figure 3 ACEs-CE and ACEs-C 018 and Lifetime Smoking

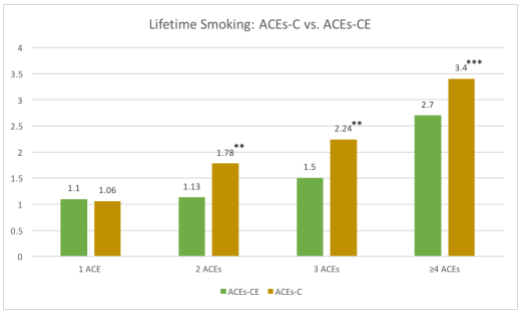


Figure 4. ACEs-CE and ACEs-C 018 and Depressive Symptoms

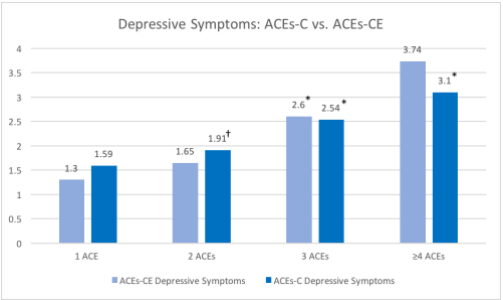


Figure 5. ACEs-C PCA

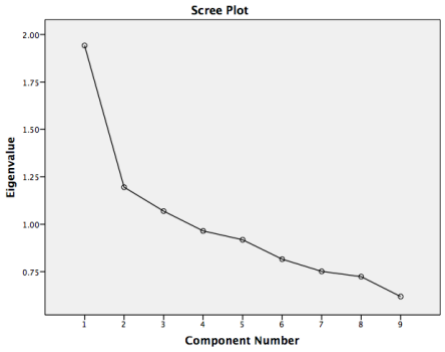


Figure 6. ACEs-CE PCA

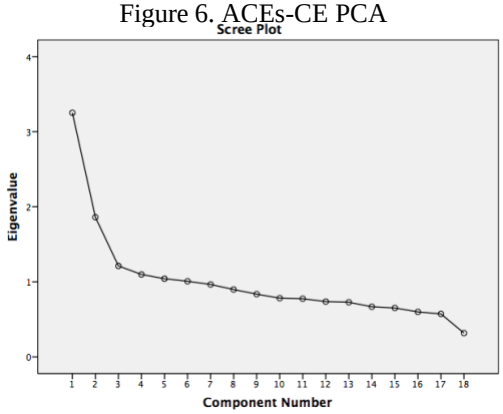


Figure 7. Adversity 0-18 and Incarceration

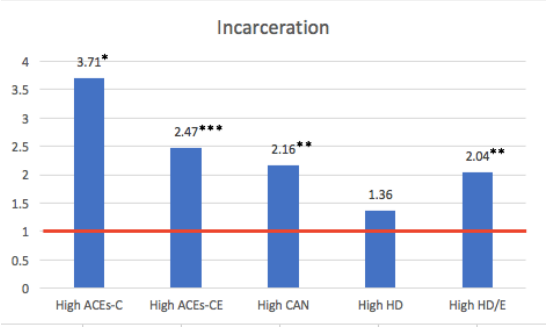


Figure 8. Adversity 0-18 and Felony

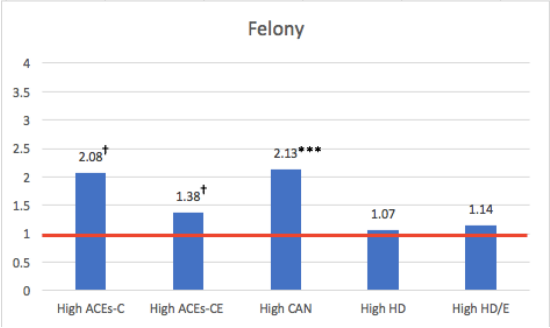


Figure 9. Adversity 0-18 and Income Completed

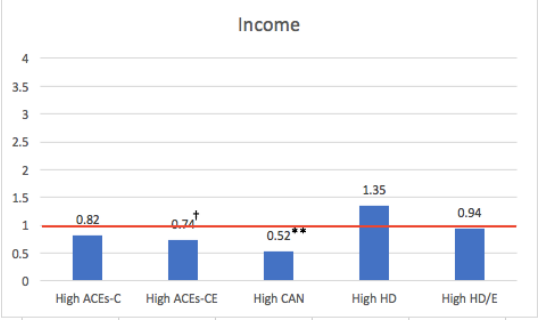


Figure 10. Adversity 0-18 and Highest Grade

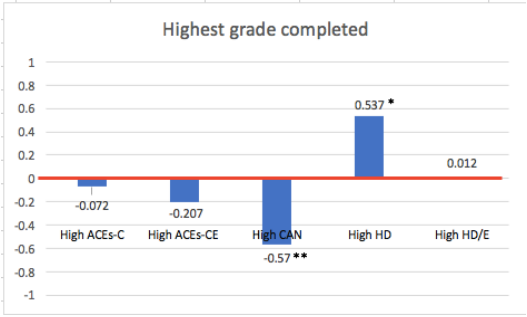


Figure 11. Adversity 0-18 and BA/AA Attainment

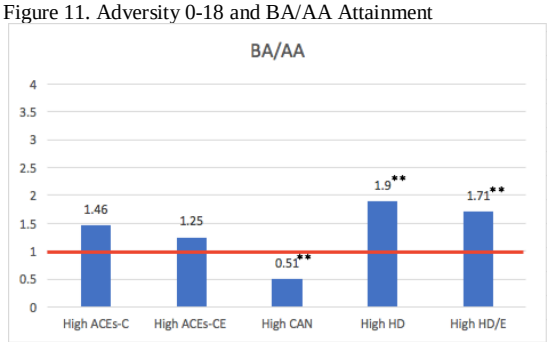


Figure 12. Adversity 0-18 and Smoking

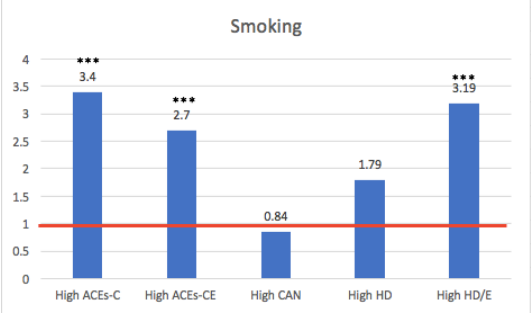


Figure 13. Adversity 0-18 and Depression

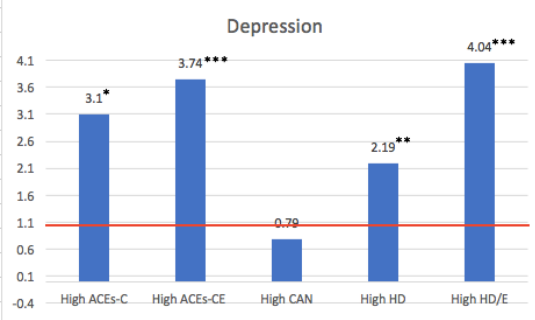


Figure 14. Adversity 0-18 and Self-rated Health

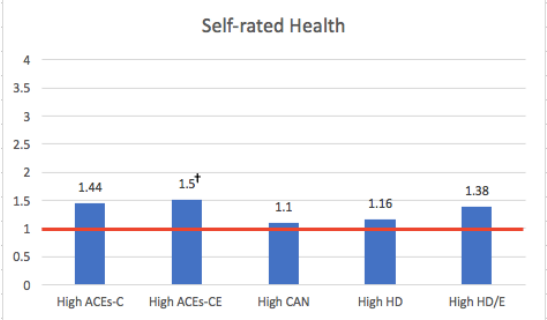


Figure 15. Adversity 0-18 and Obesity

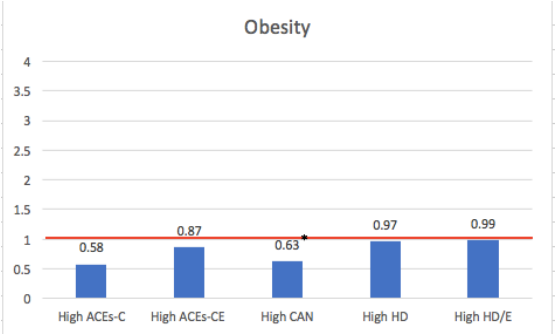


Figure 16.

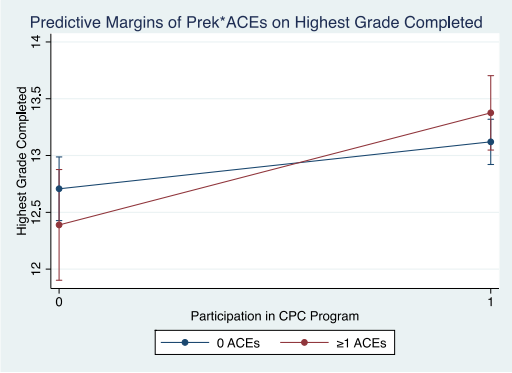


Figure 17.

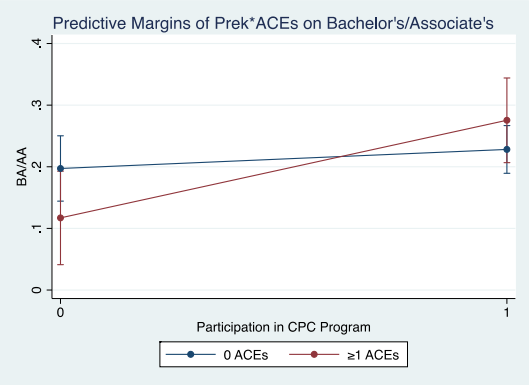


Figure 18.

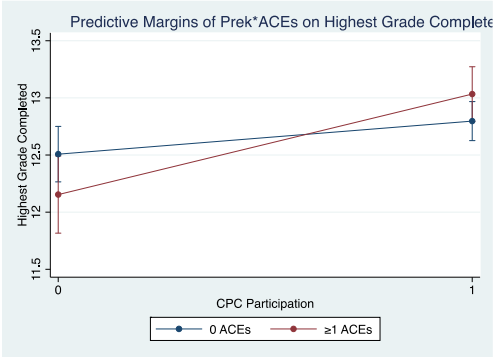
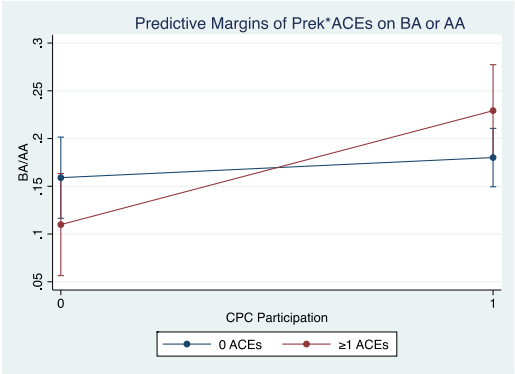


Figure 19.



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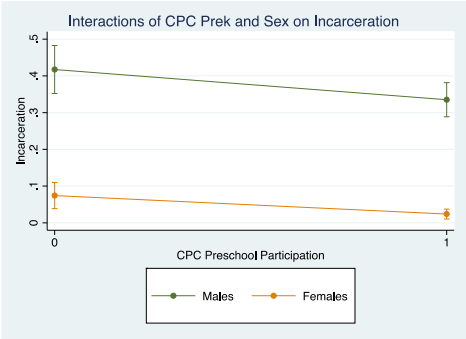


Figure 21.

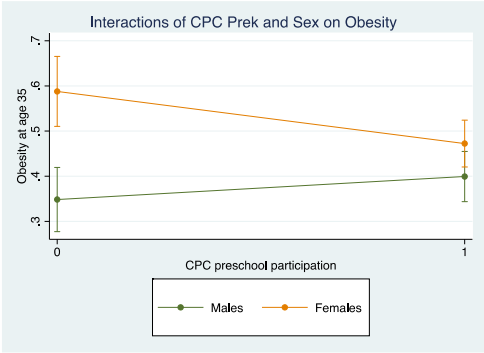
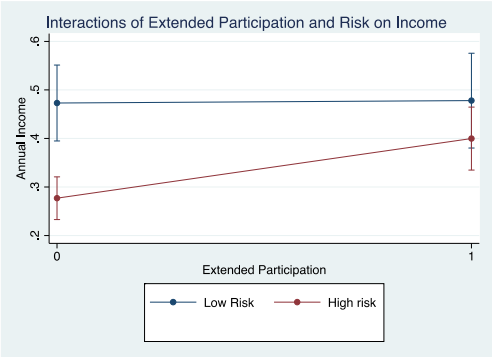


Figure 22.



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Appendix A

Summary of Major ACE Studies

Key studies	Type	Data set/ Population characteristics	ACE Measure	Outcomes measured	Findings	Prevalence rates
Felitti, Anda, Nordenberg, Williamson, Spitz, Edwards, Koss, & Marks, 1998	Retrospective; cross-sectional	Adverse Childhood Experiences Study Wave I N = 8,506 Female: 52.1% Caucasian: 79.4% Education: 75% some college or college graduate Mean age: 56.1	7 ACEs: physical, sexual, emotional abuse, household substance abuse, incarceratio n, mental illness, battered mother	10 of the top risk factors contributing to morbidity and mortality in the US: smoking, depression, obesity, inactivity, suicide attempts, substance abuse, number of sexual partners, and sexually transmitted diseases.	Graded relationship between ACEs and adverse adult outcomes. Individuals with >= 4 ACEs were at significantly increased risk for health risk behavior and disease when compared to those with 0 ACEs. Number of health risk factors in adulthood increased with number of ACEs.	52% had at least 1 ACE, 6.2% had ≥ 4.
Dube, Felitti, Dong, Chapman, Giles, & Anda, 2003	Retrospective; cross-sectional	Adverse Childhood Experiences Study Wave II N = 8,613 Female: 54% Caucasian: 74%	10 ACEs: physical, sexual, emotional abuse, physical and	Illicit drug use	Graded relationship between ACE score and drug initiation, use,	67% had at least one ACE, 16.5% had ≥ 4

		Education: 77% some college or college graduate Mean age: 57 years	emotional neglect, parental divorce, household substance abuse, incarceratio n, mental illness, battered mother		addiction, and parenteral use.	
Turner & Lloyd, 2004	Retrospective; cross-sectional	South Florida community cohort N: 1,784 Female: 58.3 White: 45.2% Black: 43.6% Some college or college graduate: 54.7%	33 ACEs in 4 categories: life traumas, major life events, witnessed violence, and traumatic news.	Depression and anxiety as assessed by the DSM-IV	Lifetime levels of adversity associated with heightened risk for onset of depression and anxiety.	Mean ACE count 7.12 (out of 33)
Anda, Felitti, Bremner, Walker, Whitfield, Perry, Dube, & Giles, 2006	Retrospective; cross-sectional	Adverse Childhood Experiences Study Waves I & II N = 17,337 Female: 54% Caucasian: 75% Education: 75% some college or college graduate Mean age: 57 years	8 ACEs: physical, sexual, emotional abuse, parental divorce, household substance abuse, incarceratio n, mental illness,	18 outcomes, falling in the following domains: affective, somatic, substance abuse, memory, sexual, aggression	Graded relationship between ACE score and all 18 outcomes.	64% had at least one ACE, 12.5% had ≥ 4

			battered mother			
Danese, Moffitt, Harrington, Milne, Polanczyk, Parianti, Poulton, & Caspi, 2009	Prospective; longitudinal	Dunedin Multidisciplinary Health and Development Study N: 1,784 Female: 58.3 White: 45.2% Black: 43.6% Some college or college graduate: 54.7% Age: 32 years at assessment	3 ACEs: Low SES, maternal rejection, harsh discipline, frequent changes in caregiver, physical abuse, sexual abuse, and social isolation	3 outcomes: Depression, inflammation, and metabolic risk markers.	Participants exposed to ACEs at elevated risk for all three outcomes. Effects were "nonredundant, cumulative, and independent of the influence of established developmental and current risk factors."	42.2% had one or more ACEs, 11.9% had two or more.
Nurius, Logan-Greene, & Greene, 2012	Retrospective; cross-sectional	Behavioral Risk Factor Survey (BRFSS) N = 13,593 Female: 60.7% Caucasian: 86.9% Education: 70.9% some college or college graduate Mean age: 57.1	8 ACEs: mental illness, substance abuse (alcoholic or illicit drugs), incarcerated family member, parental divorce, witnessing domestic violence, victim of physical abuse, and	3 outcomes: perceived well-being, psychological distress, and impaired daily activities	Significant associations between ACEs and all three measures of psychological well-being, as well as moderation of effects of ACEs by resilience resources and stress in adulthood.	59.9% had at least 1 ACE, 15.7% had ≥ 4.

			verbal abuse.			
Mersky, Topitzes, & Reynolds, 2013	Prospective; longitudinal	Chicago Longitudinal Study N = 1,129 Female: 54.9% Caucasian: 0% (93% African-American) Education: Not reported Mean age: Outcome data collected between age 22 and 24	8 ACEs: Household Child Protective Service (CPS) record for reported abuse or neglect, personal victim or witness of violent crime, parent substance abuse, prolonged absence of parent, divorce of parents, death of close friend or relative, frequent family conflict, family financial problems.	3 outcomes: Self-rated physical health, mental health, and substance use.	Strong association between ACEs and outcomes; Cumulative adversity predicted cumulative effects.	79.5% had at least 1 ACE, 27.1% had ≥ 4.
Finkelhor, Shattuck,	Retrospective; cross-sectional	National Survey of Children's Exposure to Violence	14 ACEs: emotional, physical, or	Scores on Trauma Symptoms	Original ACE scale items significantly	Frequencies not reported.

Turner, & Hamby, 2013		N: 2,030 Female: 48.8% White: 61.4% Black: 15.1% Latino: 17.8% Mean age: 13.5	sexual abuse; physical or emotional neglect; household mental illness; property victimization (nonsibling); peer victimization (nonsibling); exposure to community violence; socioeconomic status in bottom quartile; someone close had a bad accident or illness; below-average grades; parents always arguing; no good friends (at	Checklist for Children (TSCC) (Anger, depression, anxiety, dissociation, and posttraumatic stress).	accounted for variance in mental health symptoms (R^2=.21), but explanatory power improved after removal of some original ACE scale items and adding expanded items (e.g., peer rejection, peer victimization, community violence exposure, school performance, and socioeconomic status) (R^2=.34)	

			time of interview)			
Flaherty, Thompson, Dubowitz, Harvey, English, Proctor, & Runyan, 2013	Prospective; longitudinal	Longitudinal Studies of Child Abuse and Neglect (LONGSCAN) N: 933 Female: 51.0 White: 24.9 Black: 56.6 Mean age: 14 years old	8 ACEs: psychological maltreatment, physical abuse, sexual abuse, neglect, caregiver substance use, caregiver depressive symptoms, caregiver treated violently, and criminal behavior in household	Caregiver reported poor health, somatic concerns, or illness requiring a doctor.	Graded relationship between ACEs and health problems; recent adversity (previous 2 years) most predictive.	91.2% had one or more ACEs, 57.2% had three or more.
Cronholm , Forke, Wade, Bair-Merritt, Davis, Harkins-Schwarz, Pachter, & Fein, 2015	Retrospective; cross-sectional	Philadelphia ACEs Survey N: 1,784 Female: 58.3 White: 45.2% Black: 43.6% Mean age: Some college or college graduate: 54.7%	9 Conventional ACEs: Physical, emotional, or sexual abuse; substance abuse in household; mental illness in household; witness to	Differing demographic characteristics by ACEs, with the aim of broadening the concept of ACEs (specifically to experiences more likely to occur in less affluent,	Demographic groups at higher risk for Expanded ACEs: Male gender; non-white race; being divorced from one's partner (versus married); working full time (versus part-time	72.9% had one or more conventional ACE; 63.4% had one or more expanded ACE; 49.3% had both conventional and expanded ACEs

			domestic violence; incarcerated household member; emotional or physical neglect 5 Expanded ACEs: Witnessed violence, felt discrimination, unsafe neighborhood, experienced bullying, lived in foster care	nonwhite communities)	employment); and income level <= 150% below the established poverty line Demographic characteristics associated with higher risk for Conventional ACEs: those who reported a race of "other" (versus white); were living with a partner (versus married); and were disabled (versus working full time).	
Giovanelli, Reynolds, Mondi, & Ou, 2016	Prospective and retrospective; longitudinal from 1983 to present	Chicago Longitudinal Study N = 1,142 Female: 54.1% White: 0% Black: 93% Education: Mean years 11.96 Mean age: 25 Outcome data collected between age 22 and 24	9 ACEs: physical abuse; sexual abuse; neglect; prolonged absence of parent or divorce of parents; death of parent, brother, sister, close	8 outcomes: Depression, health compromising behaviors, high school graduation, high school completion, highest grade completed, college attendance, occupational prestige,	Significant associations between ACEs and all outcomes except for college attendance.	62.5% had at least 1 ACE, 13.3% had ≥ 4.

			friend or relative; frequent family conflict; problems of substance abuse of parent; witness to a shooting or stabbing; victim of a violent crime	juvenile arrest, and felony arrest.		
Jimenez, Wade, Lin, Morrow, &Reichman 2016	Prospective and retrospective; longitudinal over 1 year	Fragile Families and Child Wellbeing Study N = 1007 Female: 51% White: 36% Black: 46% Mean age: 5 years Parent's education: Some college or college graduate – 43%	Physical abuse, sexual abuse, psychological abuse, neglect, parent substance use, mental illness, caregiver treated violently, and parent incarceration	Teacher-reported academic outcomes and behavior problems	ACEs in early childhood associated with below-average, teacher-reported academic and literacy skills and behavior problems in kindergarten.	55% had at least 1 ACE from 0-5, 28.3 had ≥2, 4.3 had ≥4.
Mouton, Hargreaves, Liu, Fadeyi, Blot, 2016	Prospective and retrospective; longitudinal	Southern Community Cohort Study N = 22,227	Physical abuse, sexual abuse,	Smoking, alcohol use, BMI, healthcare access	Strong association between ACE score and	58% had at least 1; 17.8% had ≥4

	from 2002-2009	Female: White: 39.2% Black: 55.5% Age: 37% 40-49, 38% 50-59, 25% 60-79 Education >High School: 50%	verbal abuse, physical neglect, emotional neglect, parent separation or divorce, substance use in household, mental illness in household, mother treated violently, and household member in prison	(mammogram, pap smears, PSA screening, colonoscopy, sigmoidoscopy)	smoking, minor to moderate association between ACE score and BMI, moderate association between ACE score and women's health screenings	

Mersky, Janczewski, & Topitzes, 2017*	Retrospective, cross-sectional	Family Foundations Home Visiting Program N = 1,241 All female Mean age: 24.2 White: 33.2 Black: 27.4	Physical abuse, sexual abuse, verbal abuse, physical neglect, emotional neglect, alcohol/drug problem, mental illness in household, domestic violence, incarceration, divorce/separation, financial problems, food insecurity, homelessness, parental absence, peer victimization, violent crime victim	Perceived stress (Perceived Stress Scale), Smoking	Small associations between ACEs and outcomes; more complex associations between individual ACEs and outcomes also investigated. Two-factor solution for Conventional ACE (ACEs-C) scale and four factor solution for Conventional/Expanded ACE (ACEs-CE) scale.	Mean ACEs-C: 3.3 (2.5) Mean ACEs-CE: 5.3 (3.7)

*Not included in the present study due to time constraints

Appendix B

CDC Adverse Childhood Experiences Survey

While you were growing up, during your first 18 years of life:

ABUSE:

1. Did a parent or other adult in the household often or very often…
   Swear at you, insult you, put you down, or humiliate you? OR Act in a way that made you afraid that you might be physically hurt?

2. Did a parent or other adult in the household often or very often…
   Push, grab, slap, or throw something at you? OR Ever hit you so hard that you had marks or were injured?

3. Did an adult or person at least 5 years older than you ever…
   Touch or fondle you or have you touch their body in a sexual way? OR Attempt or actually have oral, anal, or vaginal intercourse with you?

NEGLECT:

4. Did you often or very often feel that …
   No one in your family loved you or thought you were important or special? OR Your family didn't look out for each other, feel close to each other, or support each other?

5. Did you often or very often feel that …
   You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? OR Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?

HOUSEHOLD DYSFUNCTION:

6. Were your parents ever separated or divorced?

7. Was your mother or stepmother:
   Often or very often pushed, grabbed, slapped, or had something thrown at her? OR Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? OR Ever repeatedly hit at least a few minutes or threatened with a gun or knife?

8. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?

9. Was a household member depressed or mentally ill, or did a household member attempt suicide?

10. Did a household member go to prison?

Appendix C

CLS Adverse Childhood Experiences Survey

1. Mental illness of a parent or caregiver*
2. Death of a parent or caregiver
3. Death of a brother or sister
4. Death of a close friend or relative
5. Parental separation (combined into one dichotomized item if either were indicated)
    a. The prolonged absence of a parent or caregiver
    b. The divorce of your parents
6. Frequent family conflict
7. Witness domestic abuse of mother or caregiver*
8. One of your parents had problems with alcohol or drugs
9. One of your parents was arrested by the police during your lifetime*
10. You were the witness to a shooting or stabbing
11. You were a victim of a violent crime including domestic abuse
12. You were a victim of child abuse or neglect*
13. From administrative records:
14. Physical abuse
15. Sexual abuse
16. Neglect
17. Out of home placemet

Appendix D

Research Base on ACEs not Evaluated in the Current Study

Psychological Maltreatment

One less well-known area is psychological maltreatment (emotional abuse and emotional neglect). According to the American Professional Society on the Abuse of Children, "Psychological maltreatment means a repeated pattern of caregiver behavior or extreme incident(s) that convey to children that they are worthless, flawed, unloved, unwanted, endangered, or of value only in meeting another's needs." Emotional abuse and emotional neglect are distinct constructs and are considered such in the ACE studies; however, in the literature, researchers often lump them together as "psychological maltreatment" (e.g., Glaser, 2002; Spertus, Yehuda, Wong, Halligan, & Seremetis, 2003). One distinction is that emotional abuse can be thought of as active and characterized by hostility and rejection, (e.g., a caregiver spurns, terrorizes, exploits, or corrupts a child) (American Professional Society on the Abuse of Children, 1995). Emotional neglect can be conceptualized as more passive, typically characterized by indifference, inattention, and socioemotional stimulus deprivation (Rohner & Rohner, 1980; Brassard, Germain, & Hart, 1987). In light of the problem of a lack of differentiation, the evidence for each of these constructs individually is relatively sparse. Emotional abuse will be addressed first, and emotional neglect will be discussed with physical neglect below.

Emotional (psychological) abuse. In the CDC ACE studies, emotional abuse was measured by the questions "How often did a parent, stepparent, or adult living in your home swear at you, insult you, or put you down?" and "How often did a parent, stepparent, or adult living in your home act in a way that made you afraid that you might be physically hurt?" (Dube et al., 2003).

Behaviorally, emotional abuse has been found to be more predictive of a variety of problems than physical abuse, including hostility, aggression, depression, suicidality, and interpersonal problems (McGee et al., 1997; Mullen, Martin, Anderson, Romans, & Herbison, 1993; Rohner & Rohner, 1980; Vissing et al., 1991). Emotionally, victims of emotional abuse are more likely to be unstable

or unresponsive, and have lower self-esteem than unexposed counterparts (Mullen et al., 1993; Rohner & Rohner, 1980). Further, they may evince disruptive attachment patterns, with emotionally abused individuals more likely to be insecurely attached (Rohner & Rohner, 1980).

In the long-term, emotional abuse has been found to predict lifetime psychiatric disorders (Chapman, Woltering, Lam, & Lewis, 2010; Mullen et al., 1996; Rich, Gingerich, & Rosen, 1997), personality disorders (Johnson et al., 2001), and eating disorders (Rorty, Yager, & Rossotto, 1994).

Emotional neglect. Emotional neglect, also conceptualized as "psychological neglect/unavailability" (Egeland & Erickson, 1987) is defined as "emotional detachment or unresponsiveness to children's bids for attention and [emotional] care" (Hildyard & Wolfe, 2002).

In the CDC ACE studies, emotional neglect was measured by the following reverse-scored statements: 1) "There was someone in my family who helped me feel important or special." 2) "I felt loved." 3) "People in my family looked out for each other." 4) "People in my family felt close to each other." 5) "My family was a source of strength and support." (Dube et al., 2003).

The effects of emotional nurturance on psychological development have been compared to those of food and safety on physical development (Scarr, 1992). Emotionally neglected children have been found to be more developmentally and cognitively delayed than physically or sexually abused children and have been uniquely characterized by high levels of negative affect, low levels of positive affect, and fewer displays of a sense of humor (Egeland et al., 1983; Erickson et al., 1989). In the Minnesota Mother-Child project, now known as the Minnesota Longitudinal Study of Risk and Adaptation, a prospective longitudinal study that followed 267 children of at-risk first-time mothers, the emotionally neglected group showed the largest decline in Bayley Scales of Infant Development scores between 9 and 24 months of age relative to the other maltreatment groups (Egeland & Erickson, 1987). Gowen (1993) followed children at 6-month intervals from ages one to three, and found that emotional neglect was predictive of IQ and age-appropriate play.

Later in childhood, expressive and receptive language has been found to be delayed in emotionally neglected preschool children when compared with both physically abused and non-abused children (Culp et al., 1991; Gowen, 1993).

There is less research on the independent effects of emotional neglect in adolescence and adulthood. Research has suggested, however, that emotional neglect is associated with increased substance abuse and delinquency (Campo & Rohner, 1992; Simons, Robertson, & Downs, 1989), as well as low serotonin levels in both humans and non-human primates in the long-term (Higley & Linnoila, 1997; Roy, 2002). Serotonin is a neurotransmitter associated with aggressive and suicidal behavior and impulsivity (Roy, 2002).

Since emotional neglect is often comorbid with other types of maltreatment, it is difficult to parse the independent effects of such experience. However, the current research base indicates that exposure to emotional neglect confers serious risks.

Expanded ACEs

Neighborhood disorder. Neighborhood disorder (e.g., neighborhoods characterized by danger, poorly maintained public and private spaces, crime, and substance use and a dearth of private services like organized sports and recreational groups like Boy Scouts; Brooks-Gunn & Duncan, 1993) has been found to relate to a host of adverse outcomes (García Coll et al., 1996; Acevedo-Garcia & Osypuk, 2008, Phillips & Shonkoff, 2000) above and beyond the effects of SES. Again, African-Americans are more likely to be exposed to neighborhood disorder (García Coll et al, 1996). This may be partly due to residential segregation (Williams & Collins, 2001). However, it is likely not segregation in and of itself that accounts for the differences in outcomes. The relation between violent crime and neighborhood factors is the same across races, but primarily African-American neighborhoods are more likely to be characterized by poverty (Lichter, Parisi, & Taquino, 2012), and therefore segregation makes it more likely that African Americans are exposed to neighborhood disorder. Furthermore, primarily African American neighborhoods may be more likely to be perceived as disordered: even when controlling for socioeconomic status, African American adolescents perceive their neighborhoods as more dangerous than adolescents of other races (Aneshensel and Sucoff, 1996). Neighborhood disorder has been tied to perceptions of

threat and danger (Hill, Ross, & Angel, 2005). These perceptions are experienced as stressful (Latkin & Curry 2003; Hill et al. 2005), and may contribute to the observed health disparities (Acevedo-Garcia & Osypuk, 2008). As it relates to ACEs, children in particular are also more "place-bound" than adults are, and are therefore "the risks attached to the local landscape, along with the youths' ties to local actors and institutions, become crucial factors in shaping their overall well-being" (Fitzpatrick et al., 2005).

Discrimination. In their 1999 theoretical paper, García Coll and colleagues called for a conceptual model of child development "anchored within social stratification theory, emphasizing the importance of racism, prejudice, discrimination, oppression, and segregation on the development of minority children and families," and argued that children's racial, ethnic, and class contexts are powerful environmental forces and can create social stress (García Coll et al., 1999). Research has supported this theory, suggesting that non-white Americans experience greater levels of stress than White Americans (Hicken, Lee, Ailshire, Brugard, & Williams, 2013), with evidence from a variety of disciplines linking this discrepancy in stress levels and related adverse health outcomes specifically to the experience or expectation of institutional and interpersonal discrimination (Clark, Anderson, Clark, & Williams, 1999; Wyatt et al., 2003; Davis, Liu, Quarells, & Din Dziethem, 2005; Harrell et al., 2011). The mental preparation for the possibility of discrimination in particular has been documented for centuries (Du Bois & Eaton, 1899), and has been termed "racism-related vigilance" (Hicken et al., 2013). This vigilance can overactivate the stress system much like any other chronic stressor. Williams & Jackson (2005) report that discrimination actually increases with SES among African-Americans, and they postulate that it may contribute to the surprising findings of increased rates of certain diseases (e.g., cardiovascular disease; diabetes) in middle-class African Americans when compared to their white counterparts.

Homelessness. Homeless children are exposed to more stressors above and beyond homelessness than their housed counterparts also living in poverty (Masten, Miliotis, Graham-Bermann, Ramirez, & Neemann, 1993) and are more likely to have experienced trauma (Hopper, Bassuk, & Olivet, 2010; however, research also indicates that homelessness itself can be a type of psychological trauma (Hopper et al., 2010). Children who have experienced homelessness are at an increased risk for myriad threats to

well-being in the short-term, including malnutrition, emotional and behavior problems, poor health, developmental delays, and poor achievement (Rafferty & Shinn, 1991). Rates of psychiatric disorders have been found to be threefold for homeless children (Kazdin, 1992). In adulthood, individuals who were exposed to homelessness before age 21 have been found to have higher levels of depressive symptoms in adulthood (DeForge, Belcher, O'Rourke, & Lindsey, 2008). While there is a preponderance of research on childhood adversities as they relate to later homelessness (e.g., Chen, Tyler, Whitbeck, & Hoyt, 2004; Herman, Susser, Struening, & Link, 1997; Martijn & Sharpe, 2006; Roos et al., 2013), the long-term effects of childhood homelessness are largely unknown.

Bullying. Research on bullying, defined as "a distinct type of aggression characterized by a repeated and systematic abuse of power," including physical, verbal, relational, and cyber-aggression (Cook, Williams, Guerra, Kim, & Sadek, 2010), has received increased attention from researchers and educators since Daniel Olweus's bullying investigations in the 1970s (Olweus, 1978), which were triggered by suicides of several bullying victims. While suicide is a rare consequence (Kaltiala-Heino, Rimpelä, Marttunen, Rimpelä, & Rantanen, 1999; Rigby & Slee, 1999), children who are bullied have been found to be more likely to have long-term psychological problems, school dropout (Sharp, 1995), and be victims of bullying in college (Adams & Lawrence, 2011) and in the workplace (Shafer et al., 2004). Children growing up in poverty are not necessarily more likely to be bullied, but ongoing bullying itself has been found to cause significant distress across populations (Finkelhor et al., 2013).

Appendix E

Descriptive Tables: ACE Prevalence and Inconsistency Analyses

Table E1 *Prevalence of Individual ACEs at Age 35*

	N	Overall prevalence %	Males %	Females %	CPC preschool participation %	Comparison group %	Extended Participation %	No Extended Participation %
Age 35								
Parent arrest	1091	22.64	23.74	21.72	22.04	22.95	20.83	24.27
Witness domestic violence	1091	20.26	19.35	21.01	23.06^{t}	18.80	21.01^{t}	16.36
Family member with mental Illness	1096	4.65	4.02	5.18	4.27	4.85	4.31	5.00
Family financial problems	1094	23.95	25.96	22.28	26.01	22.88	22.84	24.27
Frequent family conflict	1093	18.66	20.16	17.42	19.79	18.08	17.82	19.84
Parent absence or divorce	1100	35.73	39.60*	32.50	35.01	36.10	33.28	36.58
Parent substance abuse	1096	34.12	32.73	35.28	36.27	33.01	34.48	34.21
Witness to a violent crime	1094	19.01	28.97***	10.72	19.03	19.00	17.44	21.11
Victim of a violent crime	1094	7.68	10.66**	5.19	10.13^{t}	6.40	6.93	7.63
Death of a parent	1097	10.12	9.64	10.52	10.67	9.83	11.38	8.95
Death of a brother or sister	1096	6.66	6.84	6.51	7.18	6.39	7.43	5.26
Death of a friend or relative	1095	23.01	29.12***	17.92	25.33	21.81	22.80	23.22
Parent arrest	1091	22.64	23.74	21.72	22.04	22.95	20.83	24.27
Witness domestic violence	1091	20.26	19.35	21.01	23.06†	18.80	21.01†	16.36
Family member with mental Illness	1096	4.65	4.02	5.18	4.27	4.85	4.31	5.00

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{**}p < .001$

Table E2. *Bivariate Correlations Among Outcomes*

	1	2	3	4	5	6	7	8
1. Incarceration								
2. Felony arrest	.61***							
3. Income	-.25***	-.30***						
4. Highest grade completed	-.25***	-.29***	.41***					
5. BA/AA	-.18***	-.23***	.35***	.75***				
6. Obesity	-.11***	-.07*	-.02	.00	.00			
7. Smoking	-.25***	.26***	-.22***	-.31***	-.25***	-.03		
8. Depression	.10***	.10*	-.14***	-.18***	-.15***	.01	.18***	
9. Self-rated health	-.02	.02	-.12***	-.13***	-.14***	.20***	.07*	.20***

†p <.10 *p <. 05 **p <.01 ***p <.001

Table E3. *Inconsistency Analyses*

Participants with both:	N 24/35	% Yes at 24	% Yes at 35	% Yes at 24, No at 35	% No at 24, Yes at 35	% Agreement
Family financial problems	871	16.92	23.95	10.45	16.1	73.48
Frequent family conflict	884	15.76	18.66	10.52	12.56	76.92
Parent absence or divorce	890	32.05	35.73	11.6	15.51	72.92
Parent substance abuse	887	10.86	34.12	2.50	24.80	72.72
Witness to a violent crime	886	13.49	19.01	5.87	10.50	83.63
Victim of a violent crime	886	5.95	7.68	3.05	5.19	91.76
Death of a parent	887	8.67	10.12	2.14	2.48	95.38
Death of a brother or sister	888	5.25	6.66	1.91	2.93	95.16
Death of a friend or relative	887	19.70	23.01	13.19	13.53	73.28
CAN Self-Report vs Admin Records	Admin = Yes SR = Yes	Admin = Yes SR = No	Admin = No SR = Yes			
	42	87	70			

†p <.10 *p <. 05 **p <.01 ***p <.001

Table E4. *Inconsistency from age 24-35.*

Number inconsistent	N	Percent
0	231	25.96
1	240	26.97
2	193	21.69
3	124	13.93
4	64	7.19
5	29	3.26
6	5	0.56
7	4	0.45

Table E5. *Prevalence of ACEs and subtypes, 0-5*

	N	Overall prevalence %	Males %	Females %	CPC preschool participation %	Comparison group %	Extended Participation %	No Extended Participation %
ACEs-CE	1352							
0 ACEs-CE 05	903	66.79	63.9	69.34	66.52	67.31	67.31	67.59
1 ACEs-CE 05	269	19.90	20.12	19.69	20.07	19.57	20.69	18.98
2 ACEs-CE 05	180	13.31	15.91**	10.97	13.42	13.12	12.00	13.43
ACEs-C	888							
0 ACEs-C 0-5	662	74.55	71.84	76.57	73.38	76.82	73.83	76.81
1 ACEs-C 0-5	173	19.48	19.47	19.49	20.65	17.22	20.25	18.84
≥2 ACEs-C 0-5	53	5.97	8.68**	3.94	5.97	5.96	5.92	4.35
HD	1352							
0 HD 0-5	1066	78.85	76.44	81.01	78.69	79.14	78.46	80.83
1 HD 0-5	230	17.01	18.72	15.47	17.02	16.99	17.27	16.14
≥2 HD 0-5	56	4.14	4.84	3.52	4.28	3.87	4.26	3.03
Expanded	1352							
0 Expanded 0-5	1131	83.65	80.66	86.36	82.86	85.16	84.01	85.16
1 Expanded 0-5	151	11.17	12.48	9.99	11.72	10.11	10.02	10.11
≥2 Expanded 0-5	70	5.18	6.86**	3.66	5.41	4.73	5.97	4.73

†p <.10 *p <. 05 **p <.01 ***p <.00

Appendix F

Linear Regression Results with Continuous Versions of Dichotomized Outcomes

Table F1. *ACEs-C 0-18 and Continuous Outcomes*

Outcome	N	Marginal	95% CI	*P*-value
Income, continuous	856	--	--	--
No ACE (reference group)	382	--	--	--
1 ACE	246	2032.21	-1119.27 to 5191.70	.206
2 ACE	122	595.18	-3418.59 to 4608.96	.771
3 ACE	71	2250.12	-2754.92 to 7255.16	.378
4 or more ACE	35	-6.87	-6824.15 to 6810.41	.998
Smoking, Continuous	886	--	--	--
No ACE (reference group)	392	--	--	--
1 ACE	254	-.160	-.483 to .163	.332
2 ACE	128	.319	-.089 to .727	.126
3 ACE	75	.538*	.032 to 1.04	.037
4 or more ACE	37	.148	-.541 to .836	.674
Depression continuous	886	--	--	--
No ACE (reference group)	392	--	--	--
1 ACE	254	.096	-.026 to .218	.123
2 ACE	128	.139*	-.016 to .293	.078
3 ACE	75	.186*	-.005 to .377	.057
4 or more ACE	37	.344**	.084 to .604	.009
Self-rated health, continuous	884	--	--	--
No ACE (reference group)	391	--	--	--
1 ACE	253	.027	-.040 to .094	.426
2 ACE	128	.050	-.034 to .134	.244
3 ACE	74	.042	-.062 to .146	.428
4 or more ACE	37	.066	-.076 to .207	.363

†p <.10 *p <. 05 **p <.01 ***p <.001

Table F2. *ACEs-CE 0-18 and Continuous Outcomes*

Outcome		Marginal	95% CI	*P*-value
Smoking, Continuous	1102	--	--	--
No ACE (reference group)	321	--	--	--
1 ACE	237	.135	-.218 to .487	.454
2 ACE	175	.074	-.313 to .461	.708
3 ACE	122	.117	-.321 to .555	.601
4 or more ACE	247	.472**	-.118 to .826	.009
Income, continuous	1227	--	--	--
No ACE (reference group)	382	--	--	--
1 ACE	274	647.27	-.2230.87 to 3525.41	.659
2 ACE	186	1382.02	-1862.82 to 4626.87	.404
3 ACE	131	912.69	-2765.79 to 4591.17	.626
4 or more ACE	254	-.1476.98	-4456.65 to 1502.69	.331
Depression continuous	1102	--	--	--
No ACE (reference group)	321	--	--	--
1 ACE	237	.015	-.122 to .152	.828
2 ACE	175	.120	-.031 to .270	.119
3 ACE	122	.178	.008 to .349	.041
4 or more ACE	247	.336	.198 to .474	.000
Self-rated health, continuous	1102	--	--	--
No ACE (reference group)	320	--	--	--
1 ACE	237	.033	-.037 to .103	.351
2 ACE	175	.017	-.060 to .094	.667
3 ACE	122	.061	-.026 to .148	.171
4 or more ACE	248	.069†	-.001 to .139	.055

†p <.10 *p <. 05 **p <.01 ***p <.001

Appendix G

Expanded ACEs and Outcomes

Table G1. *Odds Ratios and Marginal Effects of Expanded ACEs on Adult Well-Being 0-18 controlling for HD and CAN*

Outcome	N	Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated		--	--	--	--
No ACES-E (reference group)	1352	--	--	--	--
1 ACES-E	650	1.35	.035	-.016 to .086	.177
2 ACES-E	342	1.39	.044	-.024 to -.111	.204
3 ACES-E	360	1.91	.095*	.006 to .184	.036
4 or more ACES-E	1352	1.71	.077	-.033 to .187	.169
Felony Arrest	650	--	--	--	--
No ACES-E (reference group)	342	--	--	--	--
1 ACES-E	360	1.22	.042	-.024 to .109	.213
2 ACES-E	1227	0.79	-.049	-.130 to .033	.244
3 ACES-E	600	1.32	.061	-.048 to .170	.275
4 or more ACES-E	302	1.22	.043	-.093 to .179	.534
Annual Income	325	--	--	--	--
No ACES-E (reference group)	1296	--	--	--	--
1 ACES-E	626	0.84	-.032	-.109 to .024	.213
2 ACES-E	327	0.79	-.054	-.138 to .031	.214
3 ACES-E	343	0.74	-.070	-.175 to .036	.197
4 or more ACES-E	1296	0.57	-.120t	-.241 to .001	.053
Highest Grade Completed	626	--	--	--	--
No ACES-E (reference group)	327	--	--	--	--
1 ACES-E	343	--	-.151	-.426 to .124	.281
2 ACES-E	1024	--	-.315t	-.668 to .039	.081
3 ACES-E	489	--	-.674**	-1.13 to -.214	.004
4 or more ACES-E	250	--	-.434	-.984 to -.116	.122
Bachelor's or AA Degree	285	--	--	--	--

No ACES-E (reference group)	1102	--	--	--	--
1 ACES-E	523	0.96	-.002	-.042 to .047	.933
2 ACES-E	272	0.90	-.016	-.078 to .045	.602
3 ACES-E	207	1.04	.004	-.084 to .092	.924
4 or more ACES-E	1102	0.97	-.002	-.102 to .098	.973
Obesity	523	--	--	--	--
No ACES-E (reference group)	272	--	--	--	--
1 ACES-E	207	1.16	.037	-.040 to .115	.343
2 ACES-E	1102	1.12	.027	-.070 to .124	.582
3 ACES-E	522	0.73	-.075	-.197 to .047	.229
4 or more ACES-E	272	1.27	.061	-.089 to .210	.427
Smoking 100 lifetime	206	--	--	--	--
No ACES-E (reference group)	1352	--	--	--	--
1 ACES-E	650	1.22	.048	-.027 to .124	.208
2 ACES-E	342	1.29	.063	-.033 to .158	.199
3 ACES-E	360	1.98	.169**	.049 to .290	.006
4 or more ACES-E	1352	3.02	.260***	.123 to .396	.000
Depression Dich.	650	--	--	--	--
No ACES-E (reference group)	342	--	--	--	--
1 ACES-E	360	1.18	.016	-.035 to .067	.534
2 ACES-E	1227	1.39	.034	-.032 to .100	.311
3 ACES-E	600	3.07	.156**	.050 to .263	.004
4 or more ACES-E	302	2.00	.089	-.023 to .200	.119
Self-rated Health, fair or poor	325	--	--	--	--
No ACES-E (reference group)	1296	--	--	--	--
1 ACES-E	626	1.11	.017	-.046 to .080	.594
2 ACES-E	327	1.09	.024	-.066 to .093	.733
3 ACES-E	343	1.12	.019	-.085 to .122	.724
4 or more ACES-E	1296	1.47	.070	-.060 to .200	.291

†p <.10 *p <. 05 **p <.01 ***p <.001

Table G2. *Odds Ratios and Marginal Effects of Expanded ACES-E 0-5 on Adult Well-Being controlling for HD and CAN*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1352	--	--	--	--
No ACES-E (reference group)	1131	--	--	--	--
1 ACES-E	151	1.63	.072*	.002 to .142	.043
2 or more ACES-E	70	2.01	.101ᵗ	-.010 to .211	.074
Felony Arrest	1352	--	--	--	--
No ACES-E (reference group)	1131	--	--	--	--
1 ACES-E	151	0.95	-.013	-.097 to .071	.760
2 or more ACES-E	70	1.23	.042	-.086 to .171	.518
Annual Income	1227	--	--	--	--
No ACES-E (reference group)	1030	--	--	--	--
1 ACES-E	133	1.12	.026	-.065 to .117	.574
2 or more ACES-E	64	0.84	-.037	-.165 to .090	.564
Highest Grade Completed	1296	--	--	--	--
No ACES-E (reference group)	1086	--	--	--	--
1 ACES-E	144	--	-.066	-.427 to .296	.722
2 or more ACES-E	66	--	-.331	-.869 to .207	.228
Bachelor's or AA Degree	1297	--	--	--	--
No ACES-E (reference group)	1087	--	--	--	--
1 ACES-E	144	1.17	.027	-.046 to .100	.470
2 or more ACES-E	66	0.93	-.013	-.116 to .089	.797
Obesity	1024	--	--	--	--
No ACES-E (reference group)	849	--	--	--	--
1 ACES-E	119	1.26	.058	-.040 to .157	.245
2 or more ACES-E	26	0.80	-.052	-.195 to .092	.480
Smoking 100 lifetime	1102	--	--	--	--
No ACES-E (reference group)	914	--	--	--	--
1 ACES-E	127	1.74	.136**	.040 to .232	.006
2 or more ACES-E	61	1.37	.077	-.065 to .219	.287

Depression Dich.	1102	--	--	--	--
No ACES-E (reference group)	914	--	--	--	--
1 ACES-E	127	2.07	.089*	.016 to .163	.017
2 or more ACES-E	61	3.61	.194**	.068 to .320	.003
Self-rated Health, fair or poor	1102	--	--	--	--
No ACES-E (reference group)	914	--	--	--	--
1 ACES-E	127	0.95	-.010	-.089 to .068	.794
2 or more ACES-E	61	1.25	.041	-.080 to .162	.509

†p <.10 *p <. 05 **p <.01 ***p <.001

Table G3. *Odds Ratios and Marginal Effects of Expanded ACES-Es on Adult Well-Being 6-10 controlling for HD and CAN*

Outcome	Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	0.80	-.025	-.070 to .020	.278
2 or more ACES-E	1.18	.023	-.042 to .087	.493
Felony Arrest	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	0.69	-.076*	-.142 to -.010	.024
2 or more ACES-E	0.96	-.009	-.100 to .083	.854
Annual Income	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.15	.033	-.041 to .107	.381
2 or more ACES-E	0.71	-.074	-.169 to .020	.123
Highest Grade Completed	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	--	.098	-.198 to .394	.516
2 or more ACES-E	--	-.433*	-.830 to -.037	.032
Bachelor's or AA Degree	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.07	.013	-.042 to .067	.653
2 or more ACES-E	1.08	.010	-.065 to .086	.792
Obesity	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	0.97	-.007	-.088 to .075	875
2 or more ACES-E	0.85	-.039	-.147 to .069	.475
Smoking 100 lifetime	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.23	.051	-.027 to .130	.202
2 or more ACES-E	1.76	.138*	.033 to .244	.010

Depression Dich.	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.30	.028	-.026 to .081	.307
2 or more ACES-E	2.80	.139**	.052 to .227	.002
Self-rated Health, fair or poor	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	0.96	-.008	-.073 to .056	.798
2 or more ACES-E	1.49	.075	-.018 to .169	.115

†p <.10 *p <. 05 **p <.01 ***p <.001

Table G4. *Odds Ratios and Marginal Effects of Expanded ACES-Es on Adult Well-Being 11-18 controlling for HD and CAN*

Outcome	Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.22	.027	-.024 to .077	.306
2 or more ACES-E	2.09	.106**	.043 to .168	.001
Felony Arrest	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.24	.046	-.021 to .113	.175
2 or more ACES-E	1.22	.042	-.034 to .117	.278
Annual Income	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	0.97	-.007	-.076 to .061	.835
2 or more ACES-E	0.69	-.084*	-.158 to -.010	.026
Highest Grade Completed	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	--	-.248	-.525 to .029	.079
2 or more ACES-E	--	-.545	-.859 to -.232	.001
Bachelor's or AA Degree	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	0.90	-.011	-.060 to .038	.668
2 or more ACES-E	0.88	-.015	-.071 to .041	.605
Obesity	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.03	.007	-.071 to .084	.864
2 or more ACES-E	0.98	-.006	-.092 to .080	.897
Smoking 100 lifetime	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.32	.067	-.009 to .143	.082
2 or more ACES-E	1.85	.150	.066 to .234	.000

Depression Dich.	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.24	.022	-.030 to .073	.410
2 or more ACES-E	1.92	.076*	.015 to .138	.015
Self-rated Health, fair or poor	--	--	--	--
No ACES-E (reference group)	--	--	--	--
1 ACES-E	1.08	.013	-.049 to .076	.673
2 or more ACES-E	1.28	.043	-.030 to .116	.244

†p <.10 *p <. 05 **p <.01 ***p <.001

Appendix H.

Child Abuse and Neglect and Household Dysfunction Subscales by Early Childhood, Middle Childhood, and Adolescence

Table H1. *Odds Ratios and Marginal Effects of Early Childhood CAN controlling for HD and Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Incarceration	1352	--	--	--	--
No Child Welfare 0-3 (reference group)	1306	--	--	--	--
Child Welfare 0-3	46	1.74	.085	-.042 to .213	.191
Felony Arrest	1352	--	--	--	--
No Child Welfare 0-3 (reference group)	1306	--	--	--	--
Child Welfare 0-3	46	2.05	.167*	.011 to .323	.036
Income	1227	--	--	--	--
No Child Welfare 0-3 (reference group)	1188	--	--	--	--
Child Welfare 0-3	39	0.57	-.115	-.260 to .029	.118
Highest Grade Completed	1296	--	--	--	--
No Child Welfare 0-3 (reference group)	1262	--	--	--	--
Child Welfare 0-3	44	--	-.991**	-1.61 to -.374	.002
Bachelor's or AA Degree^	1297	--	--	--	--
No Child Welfare 0-3 (reference group)	1253	--	--	--	--
Child Welfare 0-3	44	--	--	--	--
Obesity	1024	--	--	--	--
No Child Welfare 0-3 (reference group)	988	--	--	--	--
Child Welfare 0-3	36	0.77	-.065	-.230 to .100	.437
Smoking	1102	--	--	--	--
No Child Welfare 0-3 (reference group)	1064	--	--	--	--
Child Welfare 0-3	38	1.37	.074	-.097 to .245	.395
Depression	1102	--	--	--	--
No Child Welfare 0-3 (reference group)	1064	--	--	--	--
Child Welfare 0-3	38	1.69	.072	-.048 to .192	.240

Self-rated Health	1102	--	--	--	--
No Child Welfare 0-3 (reference group)	1064	--	--	--	--
Child Welfare 0-3	38	1.39	.061	-.085 to .207	.409

^ *Note:* None of the participants with a history of child welfare involvement prior to age 3 attained a BA or AA.

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table H2. *Odds Ratios and Marginal Effects of CAN in Middle Childhood controlling for HD and Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Incarceration	1352	--	--	--	--
No CAN (reference group)	1280	--	--	--	--
1 or more CAN	72	3.63	.185**	.051 to .319	.007
Felony Arrest	1352	--	--	--	--
No CAN (reference group)	1280	--	--	--	--
1 or more CAN	72	2.38	.202**	.065 to .339	.004
Income	1227	--	--	--	--
No CAN (reference group)	1161	--	--	--	--
1 or more CAN	66	0.37	-.194**	-.306 to -.083	.001
Highest Grade Completed	1296	--	--	--	--
No CAN (reference group)	1224	--	--	--	--
1 or more CAN	72	--	-.693	-1.22 to -.169	.010
Bachelor's or AA Degree	1297	--	--	--	--
No CAN (reference group)	1225	--	--	--	--
1 or more CAN	72	0.25	-.125***	-.184 to -.067	.000
Obesity	1024	--	--	--	--
No CAN (reference group)	975	--	--	--	--
1 or more CAN	49	0.41	-.201	-.344 to -.059	.006
Smoking	1102	--	--	--	--
No CAN (reference group)	1046	--	--	--	--
1 or more CAN	56	1.39	.081	-.073 to .234	.304
Depression	1102	--	--	--	--
No CAN (reference group)	1046	--	--	--	--
1 or more CAN	56	0.93	-.002	-.087 to .083	.967
Self-rated Health	1047	--	--	--	--
No CAN (reference group)	55	--	--	--	--
1 or more CAN	1102	1.43	.068	-.068 to .205	.326

†p <.10 *p <. 05 **p <.01 ***p <.001

Table H3. *Odds Ratios and Marginal Effects of CAN in Adolescence, controlling for HD and Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Incarceration	1354	--	--	--	--
No ACE (reference group)	1273	--	--	--	--
1 ACE	81	1.92	.089^{t}	-.011 to .190	.082
Felony Arrest	1354	--	--	--	--
No ACE (reference group)	1273	--	--	--	--
1 ACE	81	1.81	.138*	- .018 to .257	.024
Income	1228	--	--	--	--
No ACE (reference group)	1152	--	--	--	--
1 ACE	76	0.61	-.105^{t}	-.213 to .004	.059
Highest Grade Completed	1298	--	--	--	--
No ACE (reference group)	1219	--	--	--	--
1 ACE	79	--	-.277	-.747 to .192	.247
Bachelor's or AA Degree	1299	--	--	--	--
No ACE (reference group)	1220	--	--	--	--
1 ACE	79	1.01	.008	-.081 to .097	.958
Obesity	1025	--	--	--	--
No ACE (reference group)	965	--	--	--	--
1 ACE	60	0.65	-.103	-.229 to .024	.111
Smoking	1104	--	--	--	--
No ACE (reference group)	1040	--	--	--	--
1 ACE	64	0.83	-.044	-.171 to .083	.496
Depression	1104	--	--	--	--
No ACE (reference group)	1040	--	--	--	--
1 ACE	64	0.62	-.040	-.104 to .023	.215
Self-rated Health	1103	--	--	--	--
No ACE (reference group)	1038	--	--	--	--
1 ACE	65	0.78	-.040	-.137 to .057	.421

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table H4. *Odds Ratios and Marginal Effects of Early Childhood Household Dysfunction, controlling for CAN and Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Incarceration	1354	--	--	--	--
No HD (reference group)	1068	--	--	--	--
1 HD	230	.959	-.005	.636 to 1.45	.851
2 or more HD	56	2.33	.140*	1.16 to 4.67	.033
Felony Arrest	1354	--	--	--	--
No HD (reference group)	1068	--	--	--	--
1 HD	230	0.85	-.033	-.103 to .037	.351
2 or more HD	56	1.81	.140t	-.008 to .287	.063
Income	1228	--	--	--	--
No HD (reference group)	975	--	--	--	--
1 HD	202	1.11	.022	-.055 to .099	.576
2 or more HD	51	1.16	.034	-.113 to .180	.651
Highest Grade Completed	1298	--	--	--	--
No HD (reference group)	1025	--	--	--	--
1 HD	219	--	.334*	.028 to .640	.032
2 or more HD	54	--	.081	-.501 to .663	.785
Bachelor's or AA Degree	1299	--	--	--	--
No HD (reference group)	1026	--	--	--	--
1 HD	219	1.30	.036	-.025 to .098	.249
2 or more HD	54	1.40	.049	-.074 to .172	.431
Obesity	1025	--	--	--	--
No HD (reference group)	805	--	--	--	--
1 HD	173	.979	-.005	-.089 to .079	.904
2 or more HD	47	.541	-.146	-.290 to -.001	.048
Smoking	1104	--	--	--	--
No HD (reference group)	864	--	--	--	--
1 HD	188	1.15	.064	-.048 to .118	.405
2 or more HD	52	2.87	.253***	.111 to .395	.000

Depression	1104	--	--	--	--
No HD (reference group)	864	--	--	--	--
1 HD	188	1.28	.028	-.027 to .082	.317
2 or more HD	52	1.67	.064	-.042 to .169	.236
Self-rated Health	1103	--	--	--	--
No HD (reference group)	862	--	--	--	--
1 HD	189	1.27	.042	-.028 to .112	.241
2 or more HD	52	1.00	-.001	-.125 to .122	.983

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table H5. *Odds Ratios and Marginal Effects of Middle Childhood Household Dysfunction, Controlling for CAN and Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Incarceration	1354	--	--	--	--
No HD (reference group)	948	--	--	--	--
1 HD	291	1.54	.051[t]	-.001 to .104	.054
2 or more HD	115	2.47	.143[**]	.046 to .240	.004
Felony Arrest	1354	--	--	--	--
No HD (reference group)	948	--	--	--	--
1 HD	291	1.18	.031	-.036 to .099	.365
2 or more HD	115	1.03	.007	-.096 to .109	.898
Income	1228	--	--	--	--
No HD (reference group)	865	--	--	--	--
1 HD	259	1.26	.054	-.017 to .125	.138
2 or more HD	104	1.14	.034	-.075 to .142	.545
Highest Grade Completed	1298	--	--	--	--
No HD (reference group)	907	--	--	--	--
1 HD	280	--	.276[t]	-.003 to .557	.053
2 or more HD	111	--	.453[*]	.027 to .880	.037
Bachelor's or AA Degree	1299	--	--	--	--
No HD (reference group)	908	--	--	--	--
1 HD	280	1.22	.026	-.027 to .079	.337
2 or more HD	111	2.07	.117[*]	.020 to .213	.018
Obesity	1025	--	--	--	--
No HD (reference group)	703	--	--	--	--
1 HD	225	1.06	.014	-.063 to .092	.721
2 or more HD	97	0.84	-.042	-.155 to .071	.467
Smoking	1104	--	--	--	--
No HD (reference group)	755	--	--	--	--
1 HD	243	1.42	.086[*]	.010 to .162	.026
2 or more HD	106	1.95	.162[**]	.053 to .271	.004

Depression	1104	--	--	--	--
No HD (reference group)	755	--	--	--	--
1 HD	243	1.78	.064	.011 to .118	.018
2 or more HD	106	1.58	.052	-.026 to .130	.194
Self-rated Health	1103	--	--	--	--
No HD (reference group)	753	--	--	--	--
1 HD	244	1.34	.050	-.015 to .114	.131
2 or more HD	106	1.41	.062	-.036 to .160	.214

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table H6. *Odds Ratios and Marginal Effects of Household Dysfunction in Adolescence, controlling for CAN and Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Incarceration	1354	--	--	--	--
No HD (reference group)	938	--	--	--	--
1 HD	288	1.08	.008	-.039 to .056	.729
2 or more HD	128	1.08	.012	-.056 to .079	.735
Felony Arrest	1354	--	--	--	--
No HD (reference group)	938	--	--	--	--
1 HD	288	1.18	.034	-.034 to .101	.329
2 or more HD	138	0.85	-.039	-.131 to .054	.410
Income	1228	--	--	--	--
No HD (reference group)	861	--	--	--	--
1 HD	249	1.18	.038	-.034 to .110	.296
2 or more HD	118	1.47	.092^{t}	-.012 to .195	.084
Highest Grade Completed	1298	--	--	--	--
No HD (reference group)	896	--	--	--	--
1 HD	278	--	.239^{t}	-.040 to .518	.093
2 or more HD	124	--	.887***	.486 to 1.29	.000
Bachelor's or AA Degree	1299	--	--	--	--
No HD (reference group)	896	--	--	--	--
1 HD	278	1.59	.064*	.006 to .121	.029
2 or more HD	125	2.22**	.129**	.037 to .221	.006
Obesity	1025	--	--	--	--
No HD (reference group)	700	--	--	--	--
1 HD	217	1.16	.037	-.041 to .115	.350
2 or more HD	108	1.13	.031	-.076 to .138	.573
Smoking	1104	--	--	--	--
No HD (reference group)	756	--	--	--	--
1 HD	232	1.13	.029	.047 to .105	.451
2 or more HD	116	1.34	.071	-.034 to .177	.183

Depression	1104	--	--	--	--
No HD (reference group)	756	--	--	--	--
1 HD	232	1.37	.034	-.017 to .086	.192
2 or more HD	116	1.61	.057	-.017 to .132	.134
Self-rated Health	1103	--	--	--	--
No HD (reference group)	754	--	--	--	--
1 HD	233	1.05	.010	-.053 to .072	.756
2 or more HD	116	1.01	.000	-.085 to .086	.990

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Appendix I

Alternate Version of CAN from 0-18, Augmented with Self-Report of CAN

Table I1. *Odds Ratios and Marginal Effects of CAN on Adult Well-Being, 0-18, Augmented with Self-Report of CAN*

Outcome		Log odds	Marginal	95% CI	*P*-value
Incarceration	1352	--	--	--	--
No CAN (reference group)	1116	--	--	--	--
1 CAN	236	1.87	.077*	.016 to .139	.014
Felony Arrest	1352	--	--	--	--
No CAN (reference group)	1116	--	--	--	--
1 CAN	236	1.78	.130**	.052 to .209	.001
Income	1227	--	--	--	--
No CAN (reference group)	1013	--	--	--	--
1 CAN	214	0.58	-.117**	-.191 to -.043	.002
Highest Grade Completed	1296	--	--	--	--
No CAN (reference group)	1068	--	--	--	--
1 CAN	228	--	-.358*	-.673 to -.043	.026
Bachelor's or AA Degree	1297	--	--	--	--
No CAN (reference group)	1069	--	--	--	--
1 CAN	228	0.55	-.068**	-.128 to -.019	.007
Obesity	1024	--	--	--	--
No CAN (reference group)	838	--	--	--	--
1 CAN	186	0.85	-.039	-.125 to .047	.376
Smoking	1102	--	--	--	--
No CAN (reference group)	902	--	--	--	--
1 CAN	200	1.03	.008	-.077 to .093	.856
Depression	1102	--	--	--	--
No CAN (reference group)	902	--	--	--	--

1 CAN	200	1.56	.053^{t}	-.004 to .110	.069
Self-rated Health	1102	--	--	--	--
No CAN (reference group)	902	--	--	--	--
1 CAN	200	1.42	.064^{t}	-.010 to .137	.089

†p <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Appendix J

Appendix J: CAN and HD Analyses Without Concurrent Control of other ACEs

Table J1. *Odds Ratios and Marginal Effects of CAN on Adult Well-Being, 0-18, not controlling for HD or Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1354	--	--	--	--
No ACE (reference group)	1188	--	--	--	--
1 ACE	131	2.42	.128**		.003
2 or more ACE	35	4.17	.219*		.021
Felony Arrest by age 35	1354	--	--	--	--
No ACE (reference group)	1188	--	--	--	--
1 ACE	131	2.12	.182***		.000
2 or more ACE	35	2.17	.178t		.053
Annual Income 2014, 20,415	1228	--	--	--	--
No ACE (reference group)	1078	--	--	--	--
1 ACE	119	0.50	-.142**		.001
2 or more ACE	31	0.56	-.120		.137
Highest Grade Completed	1298	--	--	--	--
No ACE (reference group)	1136	--	--	--	--
1 ACE	127	--	-.566**		.003
2 or more ACE	35	--	-.587t		.094
Bachelor's or AA Degree	1299	--	--	--	--
No ACE (reference group)	1137	--	--	--	--
1 ACE	127	0.75	-.031		.342
2 or more ACE	35	0.14	-.137***		.000
Age 35 obese	1025	--	--	--	--
No ACE (reference group)	905	--	--	--	--
1 ACE	93	0.59	-.122*		.019
2 or more ACE	27	0.71	-.081		.389

Smoking 100 lifetime	1104	--	--	--	--
No ACE (reference group)	974	--	--	--	--
1 ACE	102	1.03	.007		.888
2 or more ACE	28	1.65	.123		.212
Depression Dich.	1104	--	--	--	--
No ACE (reference group)	974	--	--	--	--
1 ACE	102	1.11	.012		.693
2 or more ACE	28	1.21	.028		.682
Self-rated Health, fair or poor	1103	--	--	--	--
No ACE (reference group)	973	--	--	--	--
1 ACE	101	1.21	.033		.473
2 or more ACE	29	1.22	.034		.677

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table J2. *Odds Ratios and Marginal Effects of HD on Adult Well-Being ACEs 0-18 not controlling for CAN or Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1354	--	--	--	--
No HD (reference group)	717	--	--	--	--
1 HD	379	1.21	.014		.556
2 HD	169	2.20	.119**		.002
3 or more HD	89	2.36	.132*		.013
Felony Arrest by age 35	1354	--	--	--	--
No HD (reference group)	717	--	--	--	--
1 HD	379	1.00	-.003		.931
2 HD	169	1.28	.051		.232
3 or more HD	89	1.14	.023		.690
Annual Income 2014, 20,415	1228	--	--	--	--
No HD (reference group)	655	--	--	--	--
1 HD	337	1.30	.059t		.075
2 HD	153	1.07	.014		.758
3 or more HD	83	1.14	.031		.592
Highest Grade Completed	1298	--	--	--	--
No HD (reference group)	685	--	--	--	--
1 HD	362	--	.151		.257
2 HD	164	--	.264		.137
3 or more HD	87	--	.455t		.050
Bachelor's or AA Degree	1299	--	--	--	--
No HD (reference group)	685	--	--	--	--
1 HD	362	1.42	.047t		.074
2 HD	165	1.71	.080*		.037
3 or more HD	87	1.83	.095t		.066
Age 35 obese	1025	--	--	--	--
No ACE (reference group)	523	--	--	--	--
1 HD	281	0.98	-.006		.870

2 HD	138	0.97	-.006		.900
3 or more HD	83	0.79	-.056		.337
Smoking 100 lifetime	1104	--	--	--	--
No HD (reference group)	565	--	--	--	--
1 HD	304	1.10	.023		.522
2 ACE	146	1.79	.143**		.002
3 or more HD	89	2.71	.240***		.000
Depression Dich.	1104	--	--	--	--
No ACE (reference group)	565	--	--	--	--
1 ACE	304	1.68	.054*		.041
2 ACE	146	2.62	.122**		.002
3 or more ACE	89	2.46	.119*		.016
Self-rated Health, fair or poor	1103	--	--	--	--
No ACE (reference group)	562	--	--	--	--
1 ACE	305	1.09	.014		.646
2 ACE	147	1.59	.086*		.043
3 or more ACE	89	1.18	.028		.581

†p <.10 *p <. 05 **p <.01 ***p <.001

Table J3. *Odds Ratios and Marginal Effects of CAN on Adult Well-Being, 0-3 (CW03i) not controlling for HD or Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1352	--	--	--	--
No Child Welfare 0-3 (reference group)	1306	--	--	--	--
Child Welfare 0-3	46	2.13	.116[t]	-.019 to .251	.091
Felony Arrest by age 35	1352	--	--	--	--
No Child Welfare 0-3 (reference group)	1306	--	--	--	--
Child Welfare 0-3	46	2.09	.172[*]	.017 to .327	.030
Annual Income 2014, 20,415	1227	--	--	--	--
No Child Welfare 0-3 (reference group)	1188	--	--	--	--
Child Welfare 0-3	39	0.57	-.116	-.259 to .028	.114
Highest Grade Completed	1296	--	--	--	--
No Child Welfare 0-3 (reference group)	1262	--	--	--	--
Child Welfare 0-3	44	--	-1.03[**]	-1.64 to -.413	.001
Bachelor's or AA Degree^	1297	--	--	--	--
No Child Welfare 0-3 (reference group)	1253	--	--	--	--
Child Welfare 0-3	44	--	--	--	--
Age 35 obese	1024	--	--	--	--
No Child Welfare 0-3 (reference group)	988	--	--	--	--
Child Welfare 0-3	36	0.76	-.066	-.223 to .098	.430
Smoking 100 lifetime	1102	--	--	--	--
No Child Welfare 0-3 (reference group)	1064	--	--	--	--
Child Welfare 0-3	38	1.53	.105	-.063 to .272	.220
Depression Dich.	1102	--	--	--	--
No Child Welfare 0-3 (reference group)	1064	--	--	--	--
Child Welfare 0-3	38	2.16	.111	-.021 to .243	.100
Self-rated Health, fair or poor	1102	--	--	--	--
No Child Welfare 0-3 (reference group)	1064	--	--	--	--
Child Welfare 0-3	38	1.43	.066	-.080 to .213	.374

^ *Note:* None of the participants with a history of child welfare involvement prior to age 3 attained a BA or AA.

$^{\dagger}p$ <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table J4. *Odds Ratios and Marginal Effects of CAN on Adult Well-Being, 4-9 Not controlling for expanded ACEs or HD*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1354	--	--	--	--
No ACE (reference group)	1282	--	--	--	--
1 ACE	58	3.13	.163*		.01
2 or more ACE	14	5.42	.283*		.074
Felony Arrest by age 35	1354	--	--	--	--
No ACE (reference group)	1282	--	--	--	--
1 ACE	58	2.23	.183**		.009
2 or more ACE	14	3.11	.274^{t}		.054
Annual Income 2014, 20,415	1228	--	--	--	--
No ACE (reference group)	1162	--	--	--	--
1 ACE	53	0.37	-.188**		.001
2 or more ACE	13	0.36	-.188^{t}		.091
Highest Grade Completed	1298	--	--	--	--
No ACE (reference group)	1226	--	--	--	--
1 ACE	58		-.605*		.028
2 or more ACE	14		-.315		.565
Bachelor's or AA Degree	1299	--	--	--	--
No ACE (reference group)	1227	--	--	--	--
1 ACE	58	0.44	-.084*		.029
2 or more ACE	14	--	All = 0		--
Age 35 obese	1025	--	--	--	--
No ACE (reference group)	976	--	--	--	--
1 ACE	38	0.48	-.169*		.024
2 or more ACE	11	0.25	-.287*		.010
Smoking 100 lifetime	1104	--	--	--	--
No ACE (reference group)	1048	--	--	--	--

1 ACE	44	1.58	.113		.146
2 or more ACE	12	1.29	.062		.679
Depression Dich.	1104	--	--	--	--
No ACE (reference group)	1048	--	--	--	--
1 ACE	44	1.75	.078		.194
2 or more ACE	12	--	All = 0		--
Self-rated Health, fair or poor	1103	--	--	--	--
No ACE (reference group)	1048	--	--	--	--
1 ACE	43	1.40	.061		.378
2 or more ACE	12	1.67	.098		.468

$^{\dagger}p$ <.10 $^{*}p$ <. 05 $^{**}p$ <.01 $^{***}p$ <.001

Table J5. *Odds Ratios and Marginal Effects of CAN on Adult Well-Being 11-18 not controlling for HD or Expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1354	--	--	--	--
No ACE (reference group)	1273	--	--	--	--
1 ACE	81	2.19*	.113*		.033
Felony Arrest by age 35	1354	--	--	--	--
No ACE (reference group)	1273	--	--	--	--
1 ACE	81	1.88*	.144*		.017
Annual Income 2014, 20,415	1228	--	--	--	--
No ACE (reference group)	1152	--	--	--	--
1 ACE	76	0.63†	-.100†		.072
Highest Grade Completed	1298	--	--	--	--
No ACE (reference group)	1219	--	--	--	--
1 ACE	79	--	-.221		.355
Bachelor's or AA Degree	1299	--	--	--	--
No ACE (reference group)	1220	--	--	--	--
1 ACE	79	1.20	.031		.526
Age 35 obese	1025	--	--	--	--
No ACE (reference group)	965	--	--	--	--
1 ACE	60	0.66	-.097		.132
Smoking 100 lifetime	1104	--	--	--	--
No ACE (reference group)	1040	--	--	--	--
1 ACE	64	0.96	-.010		.874
Depression Dich.	1104	--	--	--	--
No ACE (reference group)	1040	--	--	--	--
1 ACE	64	0.76	-.028		.451
Self-rated Health, fair or poor	1103	--	--	--	--
No ACE (reference group)	1038	--	--	--	--
1 ACE	65	0.81	-.035		.479

$^{\dagger}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table J6. *Odds Ratios and Marginal Effects of Household Dysfunction on Adult Well-Being, Ages 0-5 not controlling for CAN or expanded ACEs*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1354	--	--	--	--
No HD (reference group)	1068	--	--	--	--
1 HD	230	1.16	.018		.488
2 or more HD	56	3.12	.197**		.003
Felony Arrest by age 35	1354	--	--	--	--
No HD (reference group)	1068	--	--	--	--
1 HD	230	0.88	-.028		.421
2 or more HD	56	1.88	.146*		.042
Annual Income 2014, 20,415	1228	--	--	--	--
No HD (reference group)	975	--	--	--	--
1 HD	202	1.10	.020		.602
2 or more HD	51	1.14	.030		.673
Highest Grade Completed	1298	--	--	--	--
No HD (reference group)	1025	--	--	--	--
1 HD	219	--	.286t		.059
2 or more HD	54	--	-.017		.952
Bachelor's or AA Degree	1299	--	--	--	--
No HD (reference group)	1026	--	--	--	--
1 HD	219	1.31	.037		.220
2 or more HD	54	1.39	.048		.404
Age 35 obese	1025	--	--	--	--
No HD (reference group)	805	--	--	--	--
1 HD	173	0.97	-.006		.883
2 or more HD	47	0.54	-.143*		.043
Smoking 100 lifetime	1104	--	--	--	--
No HD (reference group)	864	--	--	--	--
1 HD	188	1.29	.061		.134

2 or more HD	52	3.49	.295***		.000
Depression Dich.	1104	--	--	--	--
No HD (reference group)	864	--	--	--	--
1 HD	188	1.72	.062*		.037
2 or more HD	52	2.68	.146*		.018
Self-rated Health, fair or poor	1103	--	--	--	--
No HD (reference group)	862	--	--	--	--
1 HD	189	1.30	.046		.191
2 or more HD	52	1.04	.006		.923

†p <.10 *p <. 05 **p <.01 ***p <.001

Table J7. *Odds Ratios and Marginal Effects of Household Dysfunction on Adult Well-Being, Ages 6-10 not controlling for CAN and Expanded*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1354	--	--	--	--
No HD (reference group)	948	--	--	--	--
1 HD	291	1.60	.057*		.031
2 or more HD	115	2.80	.164**		.001
Felony Arrest by age 35	1354	--	--	--	--
No HD (reference group)	948	--	--	--	--
1 HD	291	1.17	.030		.376
2 or more HD	115	1.05	.009		.859
Annual Income 2014, 20,415	1228	--	--	--	--
No HD (reference group)	865	--	--	--	--
1 HD	259	1.19	.041		.244
2 or more HD	104	0.98	-.005		.922
Highest Grade Completed	1298	--	--	--	--
No HD (reference group)	907	--	--	--	--
1 HD	280	--	.237		.121
2 or more HD	111	--	.294		.152
Bachelor's or AA Degree	1299	--	--	--	--
No HD (reference group)	908	--	--	--	--
1 HD	280	1.20	.024		.365
2 or more HD	111	1.90	.102*		.023
Age 35 obese	1025	--	--	--	--
No HD (reference group)	703	--	--	--	--
1 HD	225	1.01	.003		.945
2 or more HD	97	0.74	-.074		.165
Smoking 100 lifetime	1104	--	--	--	--
No HD (reference group)	755	--	--	--	--
1 HD	243	1.57	.110**		.003

2 or more HD	106	2.43	.215***		.000
Depression Dich.	1104	--	--	--	--
No HD (reference group)	755	--	--	--	--
1 HD	243	2.10	.087**		.002
2 or more HD	106	2.25	.105*		.014
Self-rated Health, fair or poor	1103	--	--	--	--
No HD (reference group)	753	--	--	--	--
1 HD	244	1.41	.060†		.067
2 or more HD	106	1.63	.090†		.059

†p <.10 *p <. 05 **p <.01 ***p <.001

Table J8. *Odds Ratios and Marginal Effects of Household Dysfunction on Adult Well-Being, Ages 11-15 not controlling for CAN and Expanded*

Outcome		Log odds	Marginal	95% CI	*P*-value
Ever Incarcerated	1354	--	--	--	--
No HD (reference group)	938	--	--	--	--
1 HD	288	1.28	.030		.223
2 or more HD	128	1.58[t]	.065[t]		.095
Felony Arrest by age 35	1354	--	--	--	--
No HD (reference group)	938	--	--	--	--
1 HD	288	1.25	.047		.167
2 or more HD	138	1.01	-.002		.972
Annual Income 2014, 20,415	1228	--	--	--	--
No HD (reference group)	861	--	--	--	--
1 HD	249	1.11	.023		.522
2 or more HD	118	1.22	.047		.342
Highest Grade Completed	1298	--	--	--	--
No HD (reference group)	896	--	--	--	--
1 HD	278	--	.133		.341
2 or more HD	124	--	.650[**]		.001
Bachelor's or AA Degree	1299	--	--	--	--
No HD (reference group)	896	--	--	--	--
1 HD	278	1.56[*]	.061[*]		.032
2 or more HD	125	2.12[**]	.123[**]		.005
Age 35 obese	1025	--	--	--	--
No HD (reference group)	700	--	--	--	--
1 HD	217	1.15	.034		.384
2 or more HD	108	1.07	.019		.712
Smoking 100 lifetime	1104	--	--	--	--
No HD (reference group)	756	--	--	--	--
1 HD	232	1.26	.056		.141

2 or more HD	116	1.65**	.123**		.015
Depression Dich.	1104	--	--	--	--
No HD (reference group)	756	--	--	--	--
1 HD	232	1.51	.044		.101
2 or more HD	116	1.92*	.084*		.031
Self-rated Health, fair or poor	1103	--	--	--	--
No HD (reference group)	754	--	--	--	--
1 HD	233	1.09	.015		.638
2 or more HD	116	1.07	.010		.807

†p <.10 *p <. 05 **p <.01 ***p <.001

Appendix K

Appendix K: ACEs-C Analyses with Augmented Sample

Table K1. *Odds Ratios and Marginal Effects of ACEs-C 0-18 on Adult Well-Being, Maximized Sample*

Outcome	N	Log odds	Marginal	95% CI	*P*-value	Stand.
Incarceration	1100	--	--	--	--	--
No ACE (reference group)	475	--	--	--	--	--
1 ACE	299	.851	-.022	-.071 to .027	.374	--
2 ACE	161	1.59[t]	.063[t]	-.008 to .134	.084	--
3 ACE	102	1.85[*]	.097[*]	.007 to .187	.035	--
4 or more ACE	63	2.51[*]	.122[t]	-.005 to .250	.059	.41
Felony Arrest	1100	--	--	--	--	--
No ACE (reference group)	1100	--	--	--	--	--
1 ACE	475	.924	-.018	-.088 to .053	.624	--
2 ACE	299	1.48[t]	.085[t]	-.006 to .177	.068	--
3 ACE	161	1.07	.012	-.093 to .116	.826	--
4 or more ACE	102	1.37	.064	-.072 to .201	.356	.19
Income	1055	--	--	--	--	--
No ACE (reference group)	462	--	--	--	--	--
1 ACE	288	1.44[*]	.085[*]	.012 to .159	.023	--
2 ACE	152	1.23	.047	-.046 to .141	.318	--
3 ACE	97	1.08	.018	-.092 to .129	.746	--
4 or more ACE	56	0.82	-.041	-.178 to .096	.557	-.14
Highest Grade Completed	1066	--	--	--	--	--
No ACE (reference group)	461	--	--	--	--	--
1 ACE	294	--	.140	-.164 to .445	.367	--
2 ACE	153	--	.188[t]	-.195 to .570	.335	--
3 ACE	99	--	-.030	-.484 to .424	.897	--

4 or more ACE	59	--	-.312	-.877 to .252	.278	-.14
Bachelor's or AA Degree	1067	--	--	--	--	--
No ACE (reference group)	461	--	--	--	--	--
1 ACE	294	1.35	.043	-.017 to .104	.162	--
2 ACE	154	1.51^{t}	.064	-.017 to .145	.123	--
3 ACE	99	1.12	.020	-.072 to .114	.667	--
4 or more ACE	59	1.11	.013	-.103 to .130	.820	.04
Obesity	1021	--	--	--	--	--
No ACE (reference group)	441	--	--	--	--	--
1 ACE	276	0.91	-.023	-.098 to .053	.556	--
2 ACE	153	1.18	.041	-.051 to .134	.386	--
3 ACE	95	0.89	-.027	-.138 to .083	.629	--
4 or more ACE	56	0.53*	-.150*	-.280 to -.020	.024	-.40
Smoking	1100	--	--	--	--	--
No ACE (reference group)	475	--	--	--	--	--
1 ACE	299	1.04	.008	-.066 to .082	.833	--
2 ACE	161	2.02***	.171***	.081 to .262	.000	--
3 ACE	102	2.09**	.180**	.073 to .287	.001	--
4 or more ACE	63	2.81***	.250***	.124 to .376	.000	.64
Depression	1100	--	--	--	--	--
No ACE (reference group)	475	--	--	--	--	--
1 ACE	299	1.54	.043	-.108 to .097	.117	--
2 ACE	161	2.32**	.099*	.023 to .175	.011	--
3 ACE	102	3.24***	.159**	.060 to .257	.002	--
4 or more ACE	63	3.50***	.180**	.055 to .304	.005	.80
Self-rated Health fair or poor	1098	--	--	--	--	--
No ACE (reference group)	474	--	--	--	--	--
1 ACE	298	1.15	.024	-.039 to .087	.454	--
2 ACE	161	1.45^{t}	.067	-.105 to .149	.107	--
3 ACE	102	1.13	.023	-.071 to .117	.639	--

4 or more ACE	63	1.79[†]	.112[†]	-.014 to .237	.081	.34

[†]p <.10 [*]*p* <. 05 [**]*p* <.01 [***]*p* <.001

Table K2. *Odds Ratios and Marginal Effects of ACEs-C in Early Childhood on Adult Well-Being, Maximized Sample*

Outcome		Log odds	Marginal	95% CI	*P*-value	Stand.
Incarceration	1098	--	--	--	--	--
No ACEs-C (reference group)	793	--	--	--	--	--
1 ACE-C	219	1.28	.032	-.024 to .088	.262	--
2 or more ACEs-C	86	1.95[*]	.103[*]	.009 to .197	.032	.34
Felony Arrest	1098	--	--	--	--	--
No ACE-C (reference group)	793	--	--	--	--	--
1 ACE-C	219	1.10	.019	-.054 to .092	.607	--
2 or more ACEs-C	86	1.20	.037	-.074 to .147	.515	.11
Income	1053	--	--	--	--	--
No ACE-C (reference group)	767	--	--	--	--	--
1 ACE-C	209	1.09	.020	-.056 to .096	.608	--
2 or more ACEs-C	77	1.09	.019	-.098 to .136	.751	.05
Highest Grade Completed	1064	--	--	--	--	--
No ACE-C (reference group)	774	--	--	--	--	--
1 ACE-C	210	--	.042	-.274 to .358	.795	--
2 or more ACEs-C	80	--	-.365	-.844 to .114	.135	-.17
Bachelor's or AA Degree	1065	--	--	--	--	--
No ACE-C (reference group)	775	--	--	--	--	--
1 ACE-C	210	1.04	.002	-.058 to .063	.938	--
2 or more ACEs-C	80	0.81	-.031	-.118 to .056	.483	-.11
Obesity	1021	--	--	--	--	--
No ACE-C (reference group)	743	--	--	--	--	--
1 ACE-C	199	1.02	.005	-.073 to .084	.893	--
2 or more ACEs-C	79	0.75	-.071	-.186 to .044	.228	.18
Smoking	1098	--	--	--	--	--

No ACE-C (reference group)	793	--	--	--	--	--
1 ACE-C	219	1.29	.062	-.014 to .138	.111	--
2 or more ACEs-C	86	3.12***	.273***	.167 to .379	.000	.72
Depression	1098	--	--	--	--	--
No ACE-C (reference group)	793	--	--	--	--	--
1 ACE-C	219	1.69*	.059*	.005 to .114	.033	--
2 or more ACEs-C	86	3.32**	.175**	.076 to .275	.001	.70
Self-rated Health	1096	--	--	--	--	--
No ACE-C (reference group)	791	--	--	--	--	--
1 ACE-C	219	1.21	.034	-.031 to .098	.304	--
2 or more ACEs-C	86	1.35	.053	-.047 to .154	.299	.20

†p <.10 *p <. 05 **p <.01 ***p <.001

Table K3. *Odds Ratios and Marginal Effects of ACEs-C in Middle Childhood on Adult Well-Being, Maximized Sample*

Outcome		Log odds	Marginal	95% CI	*P*-value	Stand.
Incarceration	1098	--	--	--	--	--
No ACE-C (reference group)	678	--	--	--	--	--
1 ACE-C	257	1.38	.036	-018 to .089	.192	--
2 or more ACEs-C	163	2.39	.125**	.048 to .202	.001	.41
Felony Arrest	1098	--	--	--	--	--
No ACE-C (reference group)	678	--	--	--	--	--
1 ACE-C	257	1.08	.013	-.057 to .083	.720	--
2 or more ACEs-C	163	1.07	.010	-.074 to .094	.810	.03
Income	1053	--	--	--	--	--
No ACE-C (reference group)	662	--	--	--	--	--
1 ACE-C	241	1.15	.032	-.041 to .104	.398	--
2 or more ACEs-C	150	0.88	-.031	-.117 to .056	.484	-.08
Highest Grade Completed	1064	--	--	--	--	--
No ACE-C (reference group)	656	--	--	--	--	--
1 ACE-C	251	--	.095	-.207 to .397	.538	--
2 or more ACEs-C	157	--	-.049	-.411 to .314	.792	-.02
Bachelor's or AA Degree	1065	--	--	--	--	--
No ACE-C (reference group)	657	--	--	--	--	--
1 ACE-C	251	1.20	.027	-.032 to .087	.366	--
2 or more ACEs-C	157	1.16	.021	-.051 to .093	.566	.11
Obesity	1021	--	--	--	--	--
No ACE-C (reference group)	635	--	--	--	--	--
1 ACE-C	238	1.03	.007	-.068 to .081	.863	--
2 or more ACEs-C	148	0.71	-.082t	-.169 to .006	.069	-.21
Smoking	1098	--	--	--	--	--

No ACE-C (reference group)	678	--	--	--	--	--
1 ACE-C	257	1.62	.117**	.044 to .190	.002	--
2 or more ACEs-C	163	2.27	.200***	.114 to .285	.000	.51
Depression	1098	--	--	--	--	--
No ACE-C (reference group)	678	--	--	--	--	--
1 ACE-C	257	2.37	.101***	.045 to .157	.000	--
2 or more ACEs-C	163	2.48	.113**	.042 to .184	.002	.53
Self-rated Health	1096	--	--	--	--	--
No ACE-C (reference group)	677	--	--	--	--	--
1 ACE-C	256	1.42	.061[t]	-.002 to .125	.059	--
2 or more ACEs-C	163	1.48	.070	-.008 to .148	.077	.23

Table K4. *Odds Ratios and Marginal Effects of ACEs-C in Adolescence on Adult Well-Being, Maximized Sample*

Outcome		Log odds	Marginal	95% CI	*P*-value	Stand.
Incarceration	1100	--	--	--	--	--
No ACEs-C (reference group)	675	--	--	--	--	--
1 ACE-C	257	1.18	.020	-.032 to .072	.458	--
2 or more ACEs-C	168	1.24	.028	-.034 to .090	.380	.14
Felony Arrest	1100	--	--	--	--	--
No ACEs-C (reference group)	675	--	--	--	--	--
1 ACE-C	257	1.09	.015	-.055 to .086	.673	--
2 or more ACEs-C	168	0.98	-.006	-.089 to .076	.878	.00
Income	1055	--	--	--	--	--
No ACEs-C (reference group)	655	--	--	--	--	--
1 ACE-C	244	1.25	.051	-.023 to .125	.174	--
2 or more ACEs-C	156	1.14	.031	-.057 to .119	.491	.08
Highest Grade Completed	1066	--	--	--	--	--
No ACEs-C (reference group)	655	--	--	--	--	--
1 ACE-C	253	--	.111	-.191 to .412	..472	--
2 or more ACEs-C	158	--	.334[t]	-.030 to .697	.072	.16
Bachelor's or AA Degree	1067	--	--	--	--	--
No ACEs-C (reference group)	655	--	--	--	--	--
1 ACE-C	253	1.72	.083[*]	.020 to .147	.010	--
2 or more ACEs-C	159	1.68	.085[*]	.005 to .165	.038	.31
Obesity	1021	--	--	--	--	--
No ACEs-C (reference group)	626	--	--	--	--	--
1 ACE-C	240	1.03	.006	-.068 to .081	.865	--
2 or more ACEs-C	155	1.00	.000	-.088 to .089	.991	.00
Smoking	1100	--	--	--	--	--

No ACEs-C (reference group)	675	--	--	--	--	--
1 ACE-C	257	1.27	.057	-.016 to .131	.125	--
2 or more ACEs-C	168	1.77**	.140**	.054 to .227	.001	.36
Depression	1100	--	--	--	--	--
No ACEs-C (reference group)	675	--	--	--	--	--
1 ACE-C	257	1.66	.055*	.003 to .108	.040	--
2 or more ACEs-C	168	2.28	.104**	.036 to .172	.003	.47
Self-rated Health	1098	--	--	--	--	--
No ACEs-C (reference group)	673	--	--	--	--	--
1 ACE-C	257	0.98	-.003	-.063 to .057	.917	--
2 or more ACEs-C	168	1.03	.005	-.066 to .077	.887	.03

Table K5. *Interactions between ACEs-C from 0-5 and CPC Preschool Attendance, Maximized Sample*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	CPC = 1 ACEs = 1	CPC = 0 ACEs = 1	CPC = 1 ACES = 0	CPC = 0 ACEs = 0	Effect Size
Incarceration	1098	0.78	0.37 to 1.65	.518	18.5	29.0	15.1	21.3	-.10
Felony	1098	0.91	0.49 to 1.71	.780	33.2	37.8	31.6	34.3	-.07
Annual Income	1053	1.16	0.62 to 2.16	.647	41.8	33.0	38.7	33.2	.08
Highest Grade Completed	1064	0.47	-0.13 to 1.07	.122	13.1	12.2	13.0	12.6	.22
Bachelor's or AA Degree	1065	2.61*	1.05 to 6.46	.040	24.5	9.2	21.2	17.4	.53*
Obesity	1021	0.90	0.50 to 1.64	.735	42.0	47.2	44.3	47.1	-.05
Smoking	1098	0.88	0.50 to 1.58	.678	49.8	54.9	39.1	41.2	.08
Depression	1098	.833	0.37 to 1.86	.656	19.0	17.9	10.6	8.5	.10
Self-rated health fair/poor	1096	.657	0.34 to 1.26	.207	22.8	29.7	21.6	20.1	-.15

†p <.10 *p <. 05 **p <.01 ***p <.001

Table K6. *Interactions between ACEs-C from 0-5 and Extended Program Participation, Maximized Sample*

Outcome	N	Log odds Ratio/Beta	95% CI	*P*-value	EXT = 1 ACEs = 1	EXT = 0 ACEs = 1	EXT = 1 ACES = 0	EXT = 0 ACEs = 0	Effect size
Incarceration	961	1.06	0.47 to 2.39	.897	17.1	25.9	11.8	19.8	.02
Felony Arrest	961	0.72	.37 to 1.38	.321	32.2	38.0	32.1	32.3	-.16
Income	929	1.25	.67 to 2.34	.481	46.8	33.6	41.4	33.5	.15
Highest Grade Completed	949	0.23	-0.39 to 0.85	.469	13.2	12.5	13.1	12.6	.11
Bachelor's or AA Degree	949	1.44	0.67 to 3.08	.352	26.5	14.7	24.3	17.7	.22
Obesity	896	0.76	0.41 to 1.40	.380	42.2	46.5	46.7	44.3	-.05
Smoking	961	0.94	0.51 to 1.71	.833	46.5	52.0	36.8	40.7	-.03
Depression	961	1.10	0.47 to 2.55	.826	13.9	18.6	8.2	12.3	.04
Self-rated Health	959	0.93	0.46 to 1.89	.850	21.9	25.0	20.1	21.9	-.03

†p <.10 *p <. 05 **p <.01 ***p <.001