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Child Maltreatment, Problem Alcohol Use And Physical Revictimization: Examining Longitudinal Trajectories In A Nationally Representative Sample

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CHILD MALTREATMENT, PROBLEM ALCOHOL USE AND PHYSICAL REVICTIMIZATION: EXAMINING LONGITUDINAL TRAJECTORIES IN A NATIONALLY REPRESENTATIVE SAMPLE

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CHAPTER 1 Child Maltreatment, Problem Alcohol Use and Physical Revictimization: Examining Longitudinal Trajectories in a Nationally Representative Sample

Introduction

Child maltreatment represents a serious problem associated with adverse mental and physical health outcomes, such as poor physical health (Maniglio, 2009; Sachs-Ericsson, Kendall-Tackett, & Hernandez, 2007; Springer, 2009), mood and anxiety disorders (Diaz, Simantov, & Rickert, 2002; Fergusson, Boden, & Horwood, 2008; Heim, Shugart, Craighead, & Nemeroff, 2010; Springer, Sheridan, Kuo, & Carnes, 2007), alcohol use (Diaz et al., 2002; Lown, Nayak, Korcha, & Greenfield, 2011), drug use (Diaz et al., 2002; Maniglio, 2011), and revictimization (Maniglio, 2009; Messman-Moore & Long, 2003). Epidemiological data from wave 2 (2004-2005) of the National Epidemiological Survey on Alcohol and Related Conditions indicates that the lifetime prevalence of child maltreatment is high. Specifically, 15.8% of adults reported physical neglect, 14.9% of adults reported physical abuse, 12.0% reported emotional abuse, and 10.1% reported sexual abuse (Fenton et al., 2013). In addition, recent data from the Department of Health and Human Services, Children's Bureau (2013), indicate that there were 686,000 substantiated cases (i.e., verified or validated by a case worker) of child maltreatment in the United States in 2012. Further, there were over twice as many unsubstantiated cases of child maltreatment that same year. Although these numbers are high, they should be viewed as a significant underestimate of the number of children who actually experience child maltreatment as many cases go unreported (H. L. MacMillan, Jamieson, & Walsh, 2003).

Two maltreatment outcomes that have been noted as being particularly problematic are alcohol use and revictimization. Individuals with a history of child

maltreatment evidence an increased risk for (1) early-onset drinking, (2) heavy drinking, (3) alcohol-related problems, and (4) alcohol use disorders (Lown et al., 2011; Thompson, Kingree, & Desai, 2004; Widom, White, Czaja, & Marmorstein, 2007). Similarly, numerous studies have shown that individuals exposed to child maltreatment are more likely to be victimized again than their non-maltreated peers (Desai, Arias, & Thompson, 2002; Widom, Czaja, & Dutton, 2008). Importantly, studies have suggested that alcohol use, particularly problematic use, such as heavy drinking, may be a potential causal mechanism linking child maltreatment and revictimization (Breitenbecher, 2001; Messman-Moore & Long, 2002). This suggests that interventions aimed at reducing alcohol use might, in turn, reduce the likelihood of revictimization.

Although several studies suggest that problem alcohol use may mediate the child maltreatment/revictimization relationship, these studies are limited in at least three important ways. First, these studies have relied on cross-sectional designs, which are unable to examine the impact of child maltreatment on later alcohol use and revictimization. Second, these studies have rarely used nationally representative datasets (Walsh et al., 2014), which hampers our ability to draw generalizable conclusions about the nature of the relationships between child maltreatment, alcohol use and revictimization. Third, and finally, the majority of research examining the child maltreatment/revictimization pathway has focused on the relationship between childhood sexual abuse and sexual revictimization, rather than examining child maltreatment and revictimization more broadly. This is problematic as there is evidence that individuals exposed to child maltreatment other than childhood sexual abuse (i.e., physical abuse, psychological/emotional abuse, neglect) are also at increased risk for problem alcohol

use (Thompson et al., 2004) and revictimization (Desai et al., 2002; Widom et al., 2008). Further, studies examining the sequelae of childhood sexual abuse in community and treatment-seeking samples have found that childhood sexual abuse is associated with an increased risk for physical revictimization in the community (J. E. Barnes, Noll, Putnam, & Trickett, 2009; Schaaf & McCanne, 1998) and in intimate relationships (Renner & Whitney, 2012; Whitfield, Anda, Dube, & Felitti, 2003).

The present study seeks to address these limitations by examining relationships between child maltreatment, problem alcohol use, and physical revictimization in a nationally representative sample. More specifically, the study aims are three-fold: (1) to examine the impact of child maltreatment on heavy drinking trajectories from adolescence to young adulthood; (2) to examine the impact of child maltreatment on physical (re)victimization trajectories from adolescence to young adulthood; (3) to examine whether alcohol use trajectories mediate the relationship between child maltreatment and physical (re)victimization trajectories.

Child maltreatment and alcohol use

A large body of research has revealed robust relationships between child maltreatment and alcohol use among treatment-seeking, epidemiological, and prospective samples.

Treatment-seeking samples. Child maltreatment is highly prevalent among individuals seeking treatment for alcohol use disorders. For example, Berry and Sellman (2001) found that 51% of adult women seeking out-patient treatment for alcohol and drug dependence reported a history of childhood sexual abuse (oral, vaginal, or anal contact before the age of 15). The authors reported even higher rates for other forms of abuse:

66% of women reported experiencing emotional abuse and 85% of women reported physical abuse, all before the age of 15. Windle, Windle, Scheidt, and Miller (1995) examined rates of childhood physical and sexual abuse among individuals being treated for alcohol dependence at an inpatient setting and found similarly high rates of childhood sexual and physical abuse among women, 49% and 33%, respectively. In addition, 24% of men reported a history of physical abuse, while 12% of men reported a history of childhood sexual abuse. Langeland, Draijer, and van den Brink (2004) reported similarly high rates of childhood sexual abuse (45.4% of women and 18% of men) and physical abuse (12% of women and 14.7% of men) among alcohol dependent in- and out-patients. In sum, while rates of child maltreatment vary, to some degree, across treatment-seeking samples (e.g., Boles, Joshi, Grella, & Wellisch, 2005; Schwandt, Heilig, Hommer, George, & Ramchandani, 2013), the literature clearly indicates a substantially increased rate of child maltreatment among individuals seeking treatment for alcohol problems compared to rates seen in the general population. Specifically, in the studies reviewed above, rates of childhood sexual abuse ranged from 18-51% among treatment seekers, while the rate in the general population is estimated to be 10.1% (Fenton et al., 2013). Similarly, in alcohol-dependent samples, rates of physical abuse ranged from 12-85%, while the rate in the general population is estimated to be 14.9% (Fenton et al., 2013). Moreover, data indicate that the presence of child maltreatment predicts greater severity of alcohol dependence (Schwandt et al., 2013) and poorer treatment outcomes (Boles et al., 2005), suggesting that individuals with abuse histories may face unique challenges within therapeutic settings.

Epidemiological studies. Large-scale epidemiological studies also demonstrate strong relationships between child maltreatment and problem alcohol use. For example, in a nationally representative sample of non-institutionalized adults, Molnar, Buka, and Kessler (2001) found that women exposed to childhood sexual abuse were more likely to be diagnosed with alcohol dependence and to report alcohol-related problems than were women without abuse histories, while men with abuse histories were more likely to be diagnosed with alcohol dependence only. Using data from the 2005 National Alcohol Survey, Lown et al. (2011) found that histories of childhood sexual and physical abuse were associated with greater odds of having a current diagnosis of alcohol dependence (Odds Ratios = 7.2 and 5.0, respectively), as well as lifetime alcohol consequences (ORs = 3.5 and 2.1, respectively). Further, Lown and colleagues (2011) found that the odds of reporting frequent intoxication in the past 12 months were 1.8 times greater for those with a history of childhood physical abuse than for those without. In addition, using the National Epidemiological Survey on Alcohol and Related Conditions, Fenton et al. (2013) found higher odds of alcohol dependence for adults who self-reported sexual abuse (OR = 1.79), physical abuse (OR = 1.74), emotional abuse (OR = 1.62), and physical neglect (OR = 1.40). Notably, relationships between childhood sexual abuse and problem alcohol use have remained significant, even after controlling for age, ethnicity, parental factors (e.g., education, alcohol use, psychopathology, divorce), education, and other forms of maltreatment/childhood adversity (Fenton et al., 2013; Lown et al., 2011; Molnar et al., 2001). However, these studies have failed to account for other important variables, such as intelligence and socioeconomic status. Further, the cross-sectional nature of these

studies limits our understanding of how child maltreatment may impact alcohol use during different developmental periods and limits causal inferences.

Prospective and twin studies. Studies using prospective designs and twin-study methodology have addressed some of the methodological limitations associated with cross-sectional data. For example, Kendler et al. (2000) examined rates of childhood sexual abuse and psychological disorders in 1411 female twin pairs from the longitudinal, population-based Virginia Twin Registry study. Results showed that the presence of any childhood sexual abuse was associated with nearly three times greater odds of alcohol dependence (OR = 2.80), compared to the odds of alcohol dependence in the non-exposed twin. Kendler et al. (2000) also received reports on family functioning from the parents of the twins and conducted interviews with each parent to assess their history of psychopathology. Using only twin pairs whose families participated in these interviews, and controlling for family environment and parental psychopathology, the authors again found that childhood sexual abuse was associated with significantly higher odds of alcohol dependence. Specifically, twins reporting any sexual abuse had almost three times greater odds of being diagnosed with alcohol dependence (OR = 2.90). These data are particularly important given that parental alcohol problems have been associated with child maltreatment, leaving abused youth at both genetic and environmental risk for problematic drinking (Anda et al., 2002; Fergusson, Lynskey, & Horwood, 1996).

Prospectively-designed studies have also uncovered relationships between child maltreatment and problem alcohol use. For example, Fergusson and colleagues tracked a New Zealand-based birth cohort for over 30 years (Christchurch Health and Development Study) and gathered retrospective reports of childhood sexual abuse at age

18, and again at age 21 (multiple reports were gathered to control for biased recall). Data indicated that 16 to 18 year-old youth who had been exposed to sexual abuse had greater odds of developing an alcohol use disorder (ORs ranged between 2.7 and 3.2) than their non-abused peers (Fergusson, Horwood, & Lynskey, 1996). Further, the authors estimated that a history of sexual abuse uniquely accounted for 9.3% of the alcohol use disorders in the cohort. Follow-up data were gathered when the cohort was 21, and again when they were 25. Results indicated that exposure to sexual abuse conferred risk for later substance dependence, even after controlling for family variables, child maltreatment, and attachment style (Fergusson et al., 2008). Further, Fergusson and colleagues found good reliability for reports of childhood sexual abuse over time. Other prospective studies have yielded similar findings for neglect (Shin, Miller, & Teicher, 2013; Widom, Ireland, & Glynn, 1995; Widom et al., 2007) and physical abuse (Shin et al., 2013; Widom et al., 2007).

One concern with many prospectively designed studies on child maltreatment is that the report of child maltreatment is typically retrospective in nature. Given that some work has shown that recall of early traumatic events is influenced by current mood states (Hardt & Rutter, 2004), questions have been raised about what the association truly means (Scott, Smith, & Ellis, 2010). More specifically, it is unclear whether it is the maltreatment itself that is associated with problematic alcohol use or the adult perceptions of maltreatment, which could be influenced by current mood and/or psychopathology. However, studies examining alcohol use among adults with documented cases of child maltreatment, also show similar associations with problem alcohol use (Jasinski, Williams, & Siegel, 2000; Scott et al., 2010). For example, Jasinski et al. (2000)

interviewed 113 African American adult women with substantiated cases of child maltreatment. These women were interviewed about their drinking behaviors 15-20 years after their abuse was documented. Results indicated that women who had experienced multiple incidents of sexual abuse had greater odds of heavy drinking than those experiencing only a single incident (OR = 6.24). In addition, Scott et al. (2010) found significantly higher odds of alcohol abuse/dependence for those with a history of documented child maltreatment (OR = 1.89), among a nationally representative sample of New Zealand young adults. Importantly, these results suggest that the association between child maltreatment and problem alcohol use, cannot be explained by an individual's perception of abuse only.

Theoretical explanations: Self-medication and stress-sensitization models. Although several theories have been posited to explain how child maltreatment confers risk for alcohol-related problems in adulthood, most theories are based on self-medication or tension-reduction models of alcohol use and/or stress sensitization.

Self-medication and tension reduction. In their simplest forms, tension-reduction and self-medication theories posit that individuals exposed to child maltreatment consume greater amounts of alcohol in an effort to diminish or 'self-medicate' their persistent, abuse-related distress. Indeed, several studies have found modest support for tension-reduction based theories of the child maltreatment/problem-alcohol use relationship. For example, studies have shown that distress mediates the relationship between childhood sexual abuse and alcohol use in community samples of women (Epstein, Saunders, Kilpatrick, & Resnick, 1998; Sarin & Nolen-Hoeksema, 2010) and female college students (K. Z. Smith, Smith, & Grekin, 2014). Similarly, self-reported

drinking motives, particularly drinking to cope with negative emotions, have been shown to partially mediate the relationship between child maltreatment and problem-alcohol use among community samples of women (Grayson & Nolen-Hoeksema, 2005), women with a history of early sexual assault (Ullman, Relyea, Peter-Hagene, & Vasquez, 2013), and female college students (Lindgren, Neighbors, Blayney, Mullins, & Kaysen, 2012).

Despite these findings, it is important to note that support for tension-reduction models of drinking has been mixed. While survey data have revealed robust associations between negative affect and alcohol use among individuals diagnosed with DSM-IV mood and anxiety disorders, these relationships have been much weaker in non-clinical samples. Moreover, mood induction and ecological momentary assessment (EMA) studies have also yielded mixed support for tension-reduction models (see Greeley & Oei, 1999; Sher & Grekin, 2007), leading researchers to conclude that the mechanisms whereby childhood sexual abuse leads to problem alcohol use are likely qualified by intraindividual and contextual factors (Marx & Sloan, 2003). In other words, tension-reduction and self-medication models of alcohol use may only explain some maltreated individuals' alcohol use, and only in some circumstances or contexts.

Despite the importance of examining these intraindividual and contextual factors, few studies have examined potential moderators of the maltreatment/alcohol use pathway. K. Z. Smith et al. (2014) examined a moderated-mediation model and found that psychological distress mediated the pathway between childhood sexual abuse and alcohol-related problems, but only among those who reported alcohol consumption motivated by coping motives. This finding underscores the importance of considering coping and its developmental antecedents (e.g., intelligence) in studies investigating the

relationship between child maltreatment and problem alcohol use. In addition, it is worth noting that the moderated-mediated pathway supporting the tension-reduction model was reduced to non-significance after controlling for other types of child maltreatment. While most studies have focused almost exclusively on childhood sexual abuse, it may not be unique in its negative impact on problem alcohol use.

Stress-sensitization. Current stress-sensitization models of psychopathology are generally considered to be a variant of diathesis-stress models (Hammen, Henry, & Daley, 2000). While diathesis-stress models posit that disorders are the product of an interaction of a diathesis (i.e., a genetic, neurobiological, or acquired environmental vulnerability) and a stressor (Zubin & Spring, 1977), stress-sensitization models argue that early life stress (e.g., child maltreatment) leads to neurobiological changes that cause individuals to be more reactive and less able to cope with stressors, which can lead to the development of disorders even after low-level stressors (Hammen et al., 2000). The stress-sensitization model is relevant to a broad spectrum of disorders, ranging from substance dependence to mood and anxiety disorders. Moreover, the stress-sensitization model may help to explain tension-reduction drinking, indeed, research based on this model has shown that stress precipitates relapse to alcohol use (for a review, see Sinha, 2012). Further, research examining neurobiological changes related to early adversity, such as child maltreatment, has supported this model. For example, human and animal studies have found changes in neuronal plasticity, following neglect or abuse, in areas of the brain responsive to reward (i.e., mesolimbic system dopamine pathway) (Enoch, 2011; Sinha, 2001). This, can lead to alcohol being more rewarding through both negative and positive reinforcement (Enoch, 2011; Sinha, 2001). Research has also found reduced

hippocampal volume among those with a history of child maltreatment (Enoch, 2011; Pechtel & Pizzagalli, 2011), which is implicated in the stress response through its impact on the hypothalamic-pituitary-adrenal (HPA) axis. In addition, studies have found changes in white matter density in areas of the brain that connect to the prefrontal cortex (Enoch, 2011; Pechtel & Pizzagalli, 2011), which is crucial in regulating emotional and behavioral responses to stress (Jackowski et al., 2008).

Recent studies have directly tested the stress-sensitization model for alcohol use. Using data from the Detroit Neighborhood Health Study, Keyes et al. (2012) examined the relationship between neighborhood physical stress (e.g., high poverty, dilapidated buildings) and heavy drinking (i.e., maximum number of drinks per occasion, frequency of binge drinking) in a largely African American sample of young adults. Keyes and colleagues found support for stress-sensitization as the relationship between neighborhood physical stress and heavy drinking was more robust for those with high levels of child maltreatment. Similarly, Kim et al. (2014) found evidence of stress sensitization in a nationally-representative sample, such that the relationship between stressful life events and severe alcohol craving was moderated by a history of child maltreatment. In addition, Young-Wolff, Kendler, and Prescott (2012) found that a history of child maltreatment moderated the relationship between independent stressful life events (i.e., events that were judged to be independent of the individuals' actions) and past-year alcohol use among male and female twin pairs. These studies have shown strong support for stress sensitization, suggesting that it is a useful framework through which to understand how child maltreatment leads to problematic alcohol use.

Limitations of the child maltreatment and alcohol use literature. A large empirical literature has established that there is a substantial relationship between child maltreatment and alcohol use, particularly problem alcohol use. However there are several important limitations of this research. First, the majority of research examining child maltreatment and alcohol use has focused only on childhood sexual abuse (Norman et al., 2012). Relatedly, few studies have accounted for other forms of maltreatment in their models, which is problematic as the presence of one form of maltreatment is associated with greater odds of experiencing another form of maltreatment (Dong et al., 2004; Dong et al., 2003). For example, Dong et al. (2004) found that those exposed to physical neglect in childhood had higher odds of experiencing emotional abuse (OR = 6.3), physical abuse (OR = 3.7), and sexual abuse (OR = 2.5). Second, many studies have not accounted for a family history of alcohol use, which is confounded with child maltreatment (Fergusson, Horwood, et al., 1996; Fergusson, Lynskey, et al., 1996). Further, data from epidemiological genetic studies suggest that a family history of alcohol use may interact with child maltreatment to predict alcohol use disorders (Keyes, Hatzenbuehler, & Hasin, 2011). Third, many studies are cross-sectional or are limited to an end-point analysis (i.e., only examining two time points, baseline and end), which does not allow for a greater understanding of how adolescence and the transition to adulthood impacts alcohol use. Finally, few studies have used representative samples to examine mechanisms underlying the relationship between child maltreatment and alcohol use, limiting their generalizability.

Child maltreatment and risk of revictimization

Over the last twenty years there has been an increasing interest in investigating the relationship between a history of child maltreatment and the risk for revictimization.

Sexual revictimization. Since the mid-1990s at least nine reviews have been published on sexual revictimization and childhood sexual abuse (Arata, 2002; Breitenbecher, 2001; Classen, Palesh, & Aggarwal, 2005; Grauerholz, 2000; Messman-Moore & Long, 2003; Messman & Long, 1996; Muehlenhard, Highby, Lee, Bryan, & Dodrill, 1998; Noll, 2005; Roodman & Clum, 2001). Although several of these reviews have noted methodological issues in the study of the childhood sexual abuse/sexual revictimization pathway (e.g., Muehlenhard et al., 1998; Roodman & Clum, 2001), each of these reviews has concluded that childhood sexual abuse is, indeed, a substantial risk factor for sexual revictimization. For example, research has found that childhood sexual abuse is associated with increased risk for adult sexual revictimization among female (Messman-Moore & Long, 2000) and male (Aosved, Aosved, Long, & Voller, 2011) college students.

Prospectively-designed studies have also found significant relationships between childhood sexual abuse and sexual revictimization. Using data from the New Zealand-based birth cohort study, Fergusson, Horwood, and Lynskey (1997) examined sexual revictimization among women in the cohort at the age of 18. Results indicated that childhood sexual abuse (assessed by self-report) conferred an increased risk of future rape/attempted rape, even after controlling for demographic variables, family of origin factors (e.g., maternal age, maternal education, family stability, childhood adversity, familial history of substance use, parental attachment) and age of sexual debut. Similarly, in a sample of women with documented cases of childhood sexual abuse and a matched-

control group, J. E. Barnes et al. (2009) found that women with a history of childhood sexual abuse were at substantially greater risk for sexual revictimization. Specifically, being sexually abused as a child was associated with 99% greater odds of sexual revictimization. In addition, J. E. Barnes et al. (2009) found that a history of childhood sexual abuse was associated with 96% greater odds of physical revictimization.

Most studies examining risk for sexual revictimization have focused on childhood sexual abuse as the primary risk factor; however, research has shown that those exposed to other types of maltreatment are also at increased risk for sexual revictimization (e.g., Desai et al., 2002; McIntyre & Widom, 2011; Widom et al., 2008). For example, Widom et al. (2008) examined how a history of child maltreatment predicted lifetime victimization incidents in a sample of low-SES adults with documented cases of neglect, childhood physical and/or sexual abuse. Those experiencing neglect and multiple forms of abuse had a higher number of lifetime victimization incidents, particularly for events characterized by interpersonal violence, such as sexual assault and physical assault. Interestingly, those with only a history of childhood sexual or physical abuse (as opposed to multiple forms of abuse) were similar to controls in terms of lifetime rates of revictimization. Likewise, McIntyre and Widom (2011) found that a documented history of child maltreatment (i.e., physical and/or sexual abuse, neglect) led to an increased risk of sexual and physical revictimization in adulthood. In a nationally representative sample, Desai et al. (2002), found that the experience of childhood physical and/or sexual abuse was associated with an increased risk for adult sexual and physical revictimization for both men and women. Collectively, these studies indicate that individuals with a history of maltreatment, not just childhood sexual abuse, are at risk for sexual revictimization.

Further, several of these studies suggest that child maltreatment is a risk factor for physical revictimization (e.g., J. E. Barnes et al., 2009; Desai et al., 2002; McIntyre & Widom, 2011; Widom et al., 2008), suggesting that child maltreatment may present more of a general risk for interpersonal revictimization, rather than a specific risk for sexual revictimization.

Physical revictimization. Unlike sexual revictimization, research into physical revictimization has been far less prevalent. However, the few studies that do exist, have found that child maltreatment presents an increased risk for both sexual and physical revictimization (e.g., J. E. Barnes et al., 2009; Desai et al., 2002; McIntyre & Widom, 2011; Widom et al., 2008). Unfortunately, in most of these studies, the authors did not specify who the perpetrator was and so it is unclear whether the victimization was perpetrated by a stranger or by an intimate partner.

Intimate partner violence. The few studies examining revictimization that have taken into account the individuals' relationship to the perpetrator have indicated that those with a history of maltreatment are at greater risk for intimate partner violence than those without such a history. Noll, Horowitz, Bonanno, Trickett, and Putnam (2003) examined risk for intimate partner violence among a sample of women with documented cases of childhood sexual abuse who were followed for approximately 7 years. They found that those with a history of childhood sexual abuse had higher rates of intimate partner violence (re)victimization than a comparison group (51.4% vs. 31.5%). These findings were replicated in a nationally representative sample. Specifically, Desai et al. (2002) found that child maltreatment (child physical and sexual abuse) was associated with greater odds of physical and sexual (re)victimization by an intimate partner in men (ORs

= 3.4 and 4.9, respectively) and women (ORs = 3.4 and 1.8). Similar results were also reported using the World Health Organization (WHO) Multi-Country Study on Women's Health and Domestic Violence. Abramsky et al. (2011) found that a history of abuse was associated with higher odds of reporting intimate partner violence in women in four countries (ORs ranged between 1.9 and 3.8). In addition, research has indicated that a history of child maltreatment is associated with dating violence among adolescents (Foshee, Benefield, Ennett, Bauman, & Suchindran, 2004; Gagné, Lavoie, & Hébert, 2005) and undergraduate women (Rich, Gidycz, Warkentin, Loh, & Weiland, 2005).

Theoretical models of revictimization. Individuals with multiple types of maltreatment (i.e. sexual abuse, physical abuse, neglect) appear to be at increased risk for a broad spectrum of revictimization experiences. Despite this, most research on revictimization has focused exclusively on sexual revictimization. Further, theories intended to explain revictimization have also focused on childhood sexual abuse and sexual revictimization (Breitenbecher, 2001) and thus there is little theory about how child maltreatment leads to increased risk for revictimization more broadly.

With regards to childhood sexual abuse and sexual revictimization, many theories have been proposed. In a review, Breitenbecher (2001) delineates eight categories of theories: (1) spurious factors; (2) lifestyle or situational variables; (3) disturbed interpersonal relationships; (4) cognitive attributions; (5) self-blame and self-esteem; (6) coping skills; (7) perceptions of threat and trauma symptoms; and (8) general psychological and psychosocial adjustment. Notably, however, no single theory has received substantial empirical support (for a review, see Breitenbecher, 2001; Messman-Moore & Long, 2003). Researchers have also noted that because revictimization is such

a complex phenomenon, good theories will likely need to incorporate many factors in order to be valid (Arata, 2002; Noll, 2005). This may account for the lack of support for theories focused on individual factors. In that regard, Messman-Moore and Long's (2003) ecological model is promising as it looks beyond individual factors and incorporates several models of risk, and resilience.

Messman-Moore and Long's (2003) model proposes that the way we understand sexual revictimization must include a consideration of ontogenic factors (e.g., psychological factors in the individual, sequelae of abuse, family environment), factors related to the microsystem that the individual is in (e.g., others' perceptions that the individual is a 'victim', individuals' conflict with close others, other people that the individual interacts with), exosystem factors (e.g., socioeconomic status), and macrosystem factors (e.g., cultural beliefs about violence, gender roles). By examining factors on each of these levels, as well as how factors interact across levels, this model has the potential for aiding in the understanding of how exposure to child maltreatment leads to revictimization for adults.

In line with Messman-Moore and Long's model, a number of specific micro and macro-level factors have been proposed as potential mediators and moderators of the maltreatment/revictimization relationship. These include, high-risk sexual behaviors, impaired threat perception, and alcohol use (Breitenbecher, 2001; Messman-Moore & Long, 2003). Although many factors may uniquely and interactively increase risk for revictimization, alcohol use may be a particularly important factor for several reasons. First, individuals tend to initiate alcohol use during adolescence (Grant, Stinson, & Harford, 2001), a developmental period where revictimization is particularly likely to occur

(Halpern, Spriggs, Martin, & Kupper, 2009; Humphrey & White, 2000), and decrease alcohol use during developmental periods associated with less (re)victimization (Brennan, Schutte, Moos, & Moos, 2011; D. A. Smith & Jarjoura, 1989). Second, alcohol use is associated with both child maltreatment and (re)victimization (Messman-Moore & Long, 2000; Siegel & Williams, 2003), suggesting that it may serve as an underlying causal link between child maltreatment and revictimization. Third, alcohol use is a modifiable factor that can be targeted through intervention and secondary or tertiary prevention efforts.

Limitations of the child maltreatment and revictimization literature. Although there is substantial support for the relationship between childhood sexual abuse and sexual revictimization, the literature is sparser with regards to whether other types of maltreatment present a risk for sexual revictimization, and whether child maltreatment is a risk factor for other types of revictimization. In particular, few studies have examined risk for physical revictimization. Additionally, the vast majority of studies reviewed have focused on revictimization among women, and thus it is unclear whether child maltreatment presents a similar risk for revictimization among men. Similar to the literature on child maltreatment and alcohol use, few studies employ prospective designs that allow for the examination of how maltreatment may impact risk for revictimization across different developmental periods. Finally, although many theories have been postulated to explain the child maltreatment/revictimization pathway, few empirical studies have examined mechanisms underlying this relationship.

Alcohol use as a potential mechanism

Alcohol use, particularly problem alcohol use (i.e., heavy drinking, binge drinking, alcohol-related problems) has been proposed as a mechanism which may underlie the

child maltreatment/revictimization pathway. Messman-Moore and Long (2003) proposed in their ecological model that alcohol use may serve as a causal mechanism by (1) increasing exposure to perpetrators and (2) affecting the drinker physiologically and emotionally (e.g., viewed as an easy target/disabled due to intoxication). In addition, given the substantial overlap between perpetration of violence and (re)victimization (P. H. Smith, Homish, Leonard, & Cornelius, 2012), alcohol may mediate through its ability to increase disinhibited behavior/aggression (for a review, see Giancola, Josephs, Parrott, & Duke, 2010), which may increase an individual's risk for (re)victimization.

Several studies have empirically examined problem alcohol use as a potential mediator of the maltreatment/revictimization relationship. An early study examining the impact of alcohol use on revictimization found that female college students with a history of childhood sexual abuse had a higher odds of being sexually victimized by acquaintances and strangers when they were intoxicated with alcohol and/or drugs than those without a history of childhood sexual abuse (Messman-Moore & Long, 2000). Further, in a prospectively-designed study of female college students, Messman-Moore, Ward, and Brown (2009) found that childhood sexual abuse and childhood trauma were predictive of PTSD symptoms which, in turn, predicted sexual (re)victimization (across 30 weeks) through a latent substance use variable, which included alcohol use. Stronger support was found in a three-wave study of African American women with a documented history of childhood sexual abuse (Fargo, 2008). Results of this study indicated that alcohol problems and using alcohol before sex were predictive of adult sexual revictimization, as well as intimate partner violence revictimization. In addition, recent support was found by McCart et al. (2012) using data from the 2005 National Survey of

Adolescents—Replication. Although the study did not examine child maltreatment specifically, McCart et al. (2012) found that early trauma (before the age of 13) had an indirect relationship with revictimization through concurrent alcohol-related problems.

Some studies have not found support for problem alcohol use as a mediator of the maltreatment/revictimization relationship. For example, McIntyre and Widom (2011) found that a lifetime alcohol use disorder diagnosis (based on DSM-III-R) did not mediate the relationship between childhood abuse and neglect and physical and sexual revictimization. Merrill et al. (1999) also did not find support for the mediating influence of alcohol. However, the authors found that alcohol problems were related to both childhood sexual abuse and adult rape. Similarly, reviews have noted that although alcohol use consistently predicts victimization, findings regarding alcohol use as a mediator of the maltreatment/revictimization relationship have been mixed (Classen et al., 2005; Messman-Moore & Long, 2003).

Complicating the mixed support that alcohol use has received as a mediator, is the fact that few studies have examined maltreatment other than childhood sexual abuse. In addition, no studies have examined alcohol use as a mediator between child maltreatment and physical revictimization. Moreover, few studies have examined important covariates of this relationship, which may account for the varied support.

Covariates

As noted earlier, revictimization is a complex process and, as such, models of revictimization must account for multiple factors (Arata, 2002; Noll, 2005), such as parental problem alcohol use, intelligence, sex, and socioeconomic status.

Parental problem alcohol use. A substantial body of literature documents a relationship between parental and offspring alcohol-related problems (Lieberman, 2000). In addition, research has shown that parental alcohol use is a risk factor for child maltreatment. For example, in the New Zealand-based birth cohort study, Fergusson, Lynskey, et al. (1996) found that heavy parental alcohol use was predictive of childhood sexual abuse. Further, research has shown that a family history of alcohol problems is also a risk factor for sexual revictimization (for a review, see Classen et al., 2005). It may be that a family history of alcohol use also presents a liability for other types of revictimization, as Chermack, Wryobeck, Walton, and Blow (2006) found that paternal alcohol use was predictive of intimate partner violence perpetration, which is, in turn, strongly associated with intimate partner violence victimization (P. H. Smith et al., 2012).

Cognitive abilities. In a review, Heller, Larrieu, D'Imperio, and Boris (1999) argued that intelligence should be a potent resiliency factor against child maltreatment; however, at that time, no studies had directly examined that hypothesis. More recent studies have found evidence that intelligence serves as a buffer to the deleterious effects of child maltreatment. For example, in a probability sample of twin-pairs, intelligence emerged as a predictor of resiliency to child maltreatment among boys, but not girls, in early childhood (Jaffee, Caspi, Moffitt, Polo-Tomás, & Taylor, 2007). In addition, Brown, Cohen, Johnson, and Salzinger (1998) found that low cognitive abilities are a risk factor for child maltreatment. Similarly, reviews have noted that children with disabilities (including cognitive disabilities) are at much greater risk for abuse and neglect (Hibbard, Desch, Abuse, Neglect, & Disabilities, 2007; Sobsey, 2002). Therefore, higher

intelligence may be protective against the negative impact of child maltreatment, while lower intelligence may serve as a risk factor for being maltreated.

Sex. There has been a suggestion in the literature that the impact of child maltreatment, specifically, childhood sexual abuse, may have a greater impact on the stress-response system in women than in men (Enoch, 2011; Simpson & Miller, 2002). Further, being female has been identified as a significant risk factor for the occurrence of childhood sexual abuse (Brown et al., 1998; Fergusson, Lynskey, et al., 1996). These findings suggest that the relationships between child maltreatment and alcohol use may be stronger for women. Moreover, it may be that the risk for revictimization through alcohol use, may be stronger for women.

Socioeconomic status. Neighborhoods characterized by poverty are often conceptualized as stressors and associated with increased levels of violence and substance use (Keyes et al., 2012). Conversely, neighborhoods characterized by higher socioeconomic status, have been proposed as an important buffer (DuMont, Widom, & Czaja, 2007; Jaffee et al., 2007). Indeed, research has shown that socioeconomic status is an important resiliency/risk factor to examine. Using data from a cohort of individuals with documented histories of abuse and/or neglect that were followed into adulthood, DuMont et al. (2007) found that living in a neighborhood above the 50th percentile for socioeconomic status was found to interact with cognitive ability in predicting resiliency in young adulthood. Further, Jaffee et al. (2007) found that individuals with a history of child maltreatment were less resilient when they lived in neighborhoods with high crime rates. This suggests that higher socioeconomic status may buffer the relationship between child maltreatment and problem alcohol use. Moreover, low socioeconomic status has been

identified as a risk factor for both child maltreatment (Brown et al., 1998) and victimization in adulthood (Cunradi, Caetano, & Schafer, 2002).

Longitudinal methods

In a brief review, Noll (2005) emphasized the importance of examining complex longitudinal models that allow researchers to investigate (1) how risk factors change during the course of development and (2) how these changes affect risk for revictimization. However, most studies use statistical methods that cannot examine how variables change and interact across time. Numerous studies that examine revictimization are cross-sectional (e.g., Abramsky et al., 2011; Desai et al., 2002; Gagné et al., 2005; Messman-Moore & Long, 2000) or use end-point analysis (e.g., J. E. Barnes et al., 2009; Fergusson et al., 1997; Rich et al., 2005), which effectively limits the data to two time points. Neither of these methods allow for modeling of change over time. Traditional methods that do allow for modeling change, such as repeated-measures analysis of variance (rANOVA) and repeated-measures multivariate analysis of variance (rMANOVA), have several limitations that limit their ability to flexibly work with longitudinal data. Gueorguieva and Krystal (2004) discussed limitations of traditional methods and noted that both rANOVA and rMANOVA struggle to handle missing values (a common occurrence in longitudinal data), which leads to a loss of power and decreases the ability to detect differences. In addition, traditional methods require that assessments be evenly spaced across time, which is not always the case in longitudinal data. Fortunately, a group of newer methods, referred to as multi-level models or mixed-effects models, overcome many of these difficulties (Gueorguieva & Krystal, 2004).

Mixed-effects models have many advantages over traditional methods (Gueorguieva & Krystal, 2004). First, mixed-effects models are robust to missing data and can use all available data for each individual, which effectively increases power to detect differences. Second, these models can treat time flexibly. Mixed-effects models do not require that the timing of assessments be evenly spaced, or that each individual is assessed at the same time points. Third, unlike traditional methods, mixed-effects models assume that each individual will vary randomly from the average (i.e., each individual will have different intercepts and slopes). This is advantageous as these models can examine the average growth observed in the sample, as well as individual growth curves. Fourth, mixed-effects models can account for nesting on multiple levels. For example, mixed-effects models can look at how individual patterns of alcohol use may differ based upon groupings within groupings, such as time being nested within individuals (i.e., multiple measurements for each individual), individuals who are nested within neighborhoods of different socioeconomic status, and so on. Fifth, and finally, mixed-effects models allow for testing of different correlation patterns and thus allow for more realistic examinations of change over time. For example, using latent growth modeling, one can compare model fit for change that is linear versus quadratic. Overall, mixed-effects models have many advantages over traditional methods of analyzing longitudinal data and are well-suited to examine complex models of revictimization.

Purpose of the present study

Past investigations examining the relationships between child maltreatment, alcohol use and physical revictimization have been limited by their use of cross-sectional designs and their focus on childhood sexual abuse and sexual revictimization. In addition,

there is a paucity of epidemiological studies examining child maltreatment, alcohol use, and physical revictimization, which hampers our ability to draw generalizable conclusions about the relationships between these variables. The present study sought to address these limitations by examining relationships between child maltreatment, problem alcohol use, and physical revictimization in a nationally representative sample. More specifically, the study aims were three-fold: (1) to examine the impact of child maltreatment on heavy drinking trajectories from adolescence to young adulthood (see figure 1); (2) to examine the impact of child maltreatment on physical (re)victimization trajectories from adolescence to young adulthood (see figure 2); and (3) to examine the extent to which heavy drinking mediated the relationship between child maltreatment and physical revictimization (see figure 3). In addition, we sought to explore the impact of several covariates (viz, cognitive abilities, parental alcoholism, sex, socioeconomic status) on these relationships.

In light of current theories and published literature, we hypothesized that a history of child maltreatment would be associated with a higher intercept for problem alcohol use and a more rapid escalation of alcohol use (i.e., steeper slope) as compared to no history of maltreatment. We further predicted that a history of child maltreatment would be associated with higher initial intercepts for physical (re)victimization than no history of maltreatment. In addition, based upon past research showing a decline in physical victimization as individuals age out of adolescence (R. Macmillan, 2001; D. A. Smith & Jarjoura, 1989; Thompson, Sims, Kingree, & Windle, 2008), we predicted that the shape of physical (re)victimization would be curvilinear, with an initial positive slope for late adolescence, and then a negative slope representing less (re)victimization as individuals

aged through adulthood. We predicted that the overall shape of the trajectory for physical (re)victimization would be similar among those with and without child maltreatment (i.e., that both groups would generally experience a decline in physical (re)victimization over their lifespan); however, we predicted that the overall level of physical (re)victimization would be higher among those with a history of maltreatment. Lastly, we predicted that problem alcohol use would mediate the relationship between child maltreatment and physical revictimization through an autoregressive model, whereby alcohol use at each wave predicts physical revictimization at each wave, after controlling for alcohol use and physical revictimization from the previous waves. Given that few studies have adequately examined the impact of our proposed covariates, no specific hypotheses were made regarding these variables.

Chapter 2

Method

Data source

Data were analyzed from the public-use data set of the National Longitudinal Study of Adolescent to Adult Health (Add health; Harris & Udry, 2014), waves I-IV. Add Health identified 26,666 eligible high schools (both public and private) in the United States using the Quality Education Database. From the list of eligible high schools, 80 schools were identified based on stratification on type of school, percentage of white students, size, geographic region, and urban setting. One feeder school was identified for each of these high schools and was then asked to participate. This led to a total sample of 132 schools.

During the 1994-1995 school year, over 90,000 students completed an in-class survey and based on responses to that survey, as well as information from school rosters, a core sample of students (*N* = 12,105) were chosen to participate in the Wave I in-home interview. This core sample is representative of adolescents from 12-17 in the United States. Additional participants were then identified based upon answers to the in-school survey so that certain populations were oversampled based on ethnicity, parental education in African American families, genetic relatedness to siblings, disability, and adoption status, resulting in a total sample at Wave I of 20,745. During in-home interviews, a resident parent of all participants was interviewed, resident mothers were preferentially chosen.

During the 1996-1997 school year, participants from Wave I were contacted to participate in a Wave II, in-home interview and approximately 71% of the original sample completed the interview (*N* = 14,738; age range 13-18). Approximately six years after

Wave I, the original Wave I sample was contacted to participate in a third wave and 73% of the Wave I sample participated (*N* = 15,197; age range 18-28). Finally, in 2008, the original Wave I sample was contacted again to participate in a fourth and final interview/survey. The response rate for Wave IV was approximately 76% (*N* = 15,701; age range 24-34). For all waves, measures were administered via in-person interview or audio-computer-assisted interview, based upon the sensitivity of the questions.

The public-use dataset includes a subset of the original Wave I respondents, followed across the four waves. This subset was created by randomly sampling half of the original core sample and half of the over sampled group of African American adolescents who were chosen because of their parents' education. This procedure resulted in 6,504 respondents at Wave I, 4,834 respondents at Wave II, 4,882 respondents at Wave III, and 5,114 respondents at Wave IV. For the present study, individuals were only included in analyses if they had a Wave IV sample weight and participated in all of the previous waves, which resulted in the loss of 1,772 respondents. This was done because only individuals who participated in all four waves had a Wave IV sample weight appropriate for longitudinal analyses examining variables across all of the waves. In addition, we excluded individuals who did not have data on the child maltreatment variable, which is described below. This procedure resulted in a final sample size of 3,198.

Measures

Child Maltreatment. At Waves III and IV all participants were asked questions about their experiences with child maltreatment. At Wave III four questions assessed the frequency of supervision neglect, physical neglect, physical abuse, and sexual abuse that

occurred prior to sixth grade (see Appendix A). At Wave IV three questions assessed the frequency of psychological/emotional abuse, physical abuse, and sexual abuse that occurred prior to age 18 (see Appendix B). In addition, at Wave IV, the age at which each type of abuse first occurred was assessed. At both waves III and IV, each type of abuse was rated on a 6-point Likert-type scale: 0 = “never happened”; 1 = “one time”; 2 = “two times”; 3 = “3-5 times”; 4 = “6-10 times”; and 5 = “more than 10 times”. In order for the child maltreatment variable to capture moderate to severe forms of child maltreatment, each type of maltreatment was defined based on the coding scheme used in the adverse childhood experiences (ACE) study (Dube et al., 2003). Specifically, neglect was defined by scores of 3 or higher, emotional abuse was defined by scores of 4 or higher, and sexual abuse was defined by scores of 1 or higher at either wave. With regards to physical abuse, scores of 3 or higher defined abuse at Wave III, while scores of 2 or higher defined physical abuse at Wave IV. The reason for this difference in scoring was that the language assessing physical abuse at Wave IV was more severe than the language used at Wave III (i.e., “hit you with a fist, kick you, or throw you down on the floor, into a wall, or down stairs” vs. “slapped, hit, or kicked”).

Individuals that met the defined criteria for any of the abuse items at Wave III were categorized as having been exposed to child maltreatment. So that the assessment at Wave IV was equivalent to Wave III, individuals were only categorized as having been maltreated at Wave IV if they (1) met the defined criteria mentioned above and (2) the first age of abuse was less than 12. Individuals were coded as missing on this variable if they met the following conditions: (1) were coded missing for both of the of the neglect questions at Wave III; (2) were coded as missing for the psychological/emotional abuse

variable at Wave IV; (3) were coded as missing for the sexual abuse variable at both Waves III and IV (i.e., individuals were not coded as missing if they answered at least one of the sexual abuse questions); and (4) were coded as missing for the physical abuse variable at both Waves III and IV (i.e., individuals were not coded as missing if they answered at least one of the physical abuse questions).

Frequency of Heavy Drinking. Consistent with past research, a past 12-month heavy drinking scale was created using responses to three questions examining the frequency of heavy drinking in the past 12 months (Swahn & Donovan, 2004; Swahn, Swahn, & Donovan, 2005; Thompson et al., 2008). At each wave, participants were asked about the average frequency of alcohol use, frequency of binge drinking, and frequency of getting drunk or very high on alcohol (see Appendix C). Response options for these questions were the following: "every day or almost every day;" "3 to 5 days a week;" 1 or 2 days a week;" "2 or 3 days a month;" "3-12 times in the past 12 months;" "1 or 2 days in the past 12 months;" and "never." To increase the variability of this scale, response options were converted into the range of days in the last 12 months (e.g., 3 to 5 days a week → 156 to 260 days in the past 12 months). The mid-point of each range was then calculated to represent the score on the item (e.g., 156 to 260 days in the past 12 months = a mid-point of 208 days). At each wave, the scores on the three items were averaged to create respondents' frequency of heavy drinking score. The internal consistency of the three items at each wave was adequate to good (Wave I, $\alpha = .85$; Wave II, $\alpha = .84$; Wave III, $\alpha = .83$; Wave IV, $\alpha = .79$)

Physical (re)victimization. A count of physical (re)victimization events was calculated based upon responses to questions assessing witnessing serious violence,

being threatened with a gun or a knife, being shot at, and being jumped or beaten up in the last 12 months. At Waves I and II, individuals were asked how often they experienced each of these events (see Appendix D), but they were only asked whether or not they experienced the event at all in Waves III and IV (see Appendix E). Given this difference in assessment, responses were coded dichotomously at all waves. Scores ranged from 0 to 4.

Covariates. Several variables known to be related to alcohol and (re)victimization were explored as covariates: cognitive abilities, parental alcohol use, sex, and socioeconomic status (SES).

Cognitive Abilities. At the beginning of the Wave I home interview, all participants were administered a computerized version of the Peabody Picture Vocabulary Test-Revised (PPVT-R), which was shortened for the purpose of the Add Health data collection. Research has shown that PPVT-R scores are a reliable and valid indicator of cognitive abilities (T. C. Smith, Smith, & Dobbs, 1991). PPVT-R raw scores were standardized based on the individual's age. Respondents' standard scores, which have a mean of 100 and a standard deviation of 15, were used as the score for cognitive abilities.

Parental Alcohol Use. During Wave I, an in-home parent interview was conducted. The majority of these interviews were done with resident mothers (90.4% were mothers). Interviewed parents were asked whether they believed that the child's biological mother and biological father had a history of alcoholism. Response options were dichotomous (i.e., yes, no) (see Appendix F). Responses to these two questions

were combined into a binary variable, which represents parental history of problem alcohol use.

Age. Age was estimated by subtracting individuals' date of birth from the interview date at each wave. To protect individual's identities, the day of each respondents' birth was not used. Instead, 15 was entered as the day of birth for each respondent. For example, everyone born in January of 1983 would have a date of birth of January 15, 1983.

Sex. Biological sex was assessed at Wave I with a single question. This response was carried forward to the subsequent waves and re-assessed at Wave IV. When discrepancies existed (only 1 case), sex coded at Wave IV was used.

Socioeconomic status.

Income. At waves I, III, and IV income was assessed. At Wave I, a parent was interviewed during the in-home interview and asked the following: "About how much total income, before taxes, did your family receive in 1994?" Responses to this question were carried over to Wave II to represent income during childhood. At waves III and IV, income was assessed based on respondents' living situation. If respondents lived independently, either by themselves or with a roommate, their income was based on their own earnings. If respondents lived with a spouse or cohabitated with a romantic partner, their income was based on their individual earnings, as well as their spouse or romantic partner's earnings. If a respondent lived with their family of origin, income was based on the total family income, similar to the assessment at Wave I. At each wave, responses were coded into 12 categories ranging from 1 (less than $5,000) to 12 ($150,000 or more) (see Appendix G).

Highest level of education. At Wave IV, all respondents were asked what the highest level of education was that they had obtained (see Appendix G). Response options ranged from 1 "8th grade or less" to 13 "completed post-baccalaureate professional education". Responses were then coded into 8 categories to create an ordinal variable where higher numbers represented more years of education. The following categories were used: 1 "8th grade or less"; 2 "some high school"; 3 "high school diploma/GED"; 4 "vocational training after completing high school/GED", 5 "some college", 6 "Bachelor's degree", 7 "some graduate or professional education (e.g., law school, medical school)", 8 "graduate degree (e.g., M.A., Ph.D.) or professional degree (e.g., J.D., M.D.)" (see Appendix H).

Chapter 3

Data Analysis

The first two aims, which were to examine the impact of child maltreatment on heavy drinking and physical (re)victimization trajectories, were examined with multi-level models using Stata Statistical Software: Release 13 (StataCorp, 2013). All analyses used survey weights to account for the complex survey design. Because the two outcome variables (i.e., heavy drinking, physical (re)victimization) were not normally distributed and represented counts of behaviors, a Poisson distribution was specified. Models were run with the Generalized Linear Latent and Mixed Models program (GLLAMM; Rabe-Hesketh, Skrondal, & Pickles, 2005). GLLAMM is a user-written program for that allows for the estimation of multi-level models with count outcomes, while accounting for complex survey designs. These features are unavailable in Stata release 13. The Akaike Information criterion (AIC) was used to compare model fit.

Prior to examining the first aim, we graphed the weighted means of the frequency of heavy drinking variable across the four waves of data for the whole sample, and for men and women separately. To examine the first aim, we first estimated an unconditional growth model predicting frequency of heavy drinking from time. The initial model was represented by the following equation: $Y_{ij} = \exp(\pi_{0i} + \pi_{1i}(wave - 1)_{ij} + \varepsilon_{ij})$. In this model, Y_{ij} represents individual i's expected count of heavy drinking at time j. Note that time was represented by wave-1, so that the intercept (i.e., when X = 0) represents individual i's problem alcohol use at Wave I. A subsequent model tested whether a quadratic function of time fit the data better than a linear function ($Y_{ij} = \exp(\pi_{0i} + \pi_{1i}(wave - 1)_{ij} + \pi_{2i}(wave - 1)_{ij}^2 + \varepsilon_{ij})$). The next model examined the influence of

child maltreatment as a time-invariant predictor, as well the interaction between child maltreatment and time ($Y_{ij} = \exp(\pi_{0i} + \pi_{1i}\,(wave - 1)_{ij} + \pi_{2i}(maltreatment)_{ij} + + \pi_{3i}(maltreatment \text{ X } (wave - 1))_{ij} + \varepsilon_{ij})$. In this model, the main effect of child maltreatment shows the influence of child maltreatment on the intercept (i.e., heavy drinking at Wave I), while the interaction between child maltreatment and time shows the influence of child maltreatment on the slope (i.e., growth over the four waves). The next model examined the influence of covariates on the model by entering in each covariate as either a time-invariant predictor (i.e., cognitive abilities, parental problem alcohol use, sex, highest level of education) or a time-varying predictor (i.e., age, income) $Y_{ij} = \exp(\pi_{0i} + \pi_{1i}\,(wave - 1)_{ij} + \pi_{2i}(maltreatment)_{ij} + + \pi_{3i}(maltreatment \text{ X } (wave - 1))_{ij} + \pi_{3i}(age)_{ij} + \pi_{4i}(sex)_{ij} + \pi_{5i}(parental\ alcoholism)_{ij} + \pi_{6i}(education)_{ij} + \pi_{7i}(income)_{ij} + \pi(PPVT)_{ij} + \varepsilon_{ij})$. To present the most parsimonious model, the model was re-run after dropping non-significant covariates. This model is considered the final, fully-adjusted model. Lastly, we explored whether the relationship between child maltreatment and frequency of heavy drinking differed for men and women. This was done by adding to the fully-adjusted model a three-way interaction between child maltreatment, time, and sex, as well as all of the lower-order two-way interactions. Given that it was expected that individuals' initial level of drinking (i.e., intercept) and change in drinking over time (i.e., slope) would likely vary due to unmeasured variables, all models were estimated with a random intercept and random slope.

The same analytic procedures and equations outlined above were used to examine the second aim. Specifically, prior to running the multilevel model, we (1) graphed the weighted mean count of physical (re)victimization across the four waves of

data for the whole sample, and for men and women separately, (2) estimated an unconditional growth model that predicted physical (re)victimization from time, (3) examined whether a quadratic or linear function of time fit the data best, (4) examined the influence of child maltreatment on the intercept and slope, (5) examined the influence of covariates and estimated a final model which included only significant covariates, and (6) examined whether the final, fully-adjusted model was different for men and women.

The third aim, which was to examine the extent to which heavy drinking mediated the relationship between child maltreatment and physical revictimization, was examined with a path model with contemporaneous mediation, specifying a Poisson distribution for both endogenous variables (i.e., frequency of heavy drinking, count of physical revictimization). All models were estimated using Mplus, Version 7.2 (Mplus, 2012). In the first model, we regressed child maltreatment onto the frequency of heavy drinking and the count of physical revictimization at each wave. In addition, we specified paths between heavy drinking and physical revictimization at each wave (e.g., path from heavy drinking at Wave I to physical victimization at Wave I, path from heavy drinking at Wave II to physical revictimization at Wave II). These paths represented the potential indirect paths whereby mediation could occur. Finally, we included age as a covariate for frequency of heavy drinking as there was variability in ages at each wave.

The next model examined the influence of covariates by including time-invariant (i.e., cognitive abilities, parental problem alcohol use, sex, highest level of education) and time-varying (i.e., age, income) predictors. Each of these predictors were regressed onto the endogenous variables at each wave. To present the most parsimonious model, this model was estimated again with all of the non-significant paths fixed at 0. We then

specified an autoregressive path model, which was identical to the first model, except it included paths to assess the changes in endogenous variables (i.e., frequency of heavy drinking, count of physical revictimization) over time. For example, frequency of heavy drinking at Wave I was regressed onto frequency of heavy drinking at Wave II, and then frequency of heavy drinking at wave II was regressed onto frequency of heavy drinking at Wave III, and so on. This autoregressive component was added so that we could account for the effect of past behavior on future behavior, which allowed us to examine whether child maltreatment predicted heavy drinking or physical revictimization above and beyond the influence of the same variable at earlier waves. We then examined the influence of covariates on the autoregressive model by again including both time-invariant and time-varying predictors. Finally, we estimated the autoregressive model, fixing all non-significant paths at 0.

For all models, mediation was tested using the model constraint command in Mplus. Specifically, we created new variables which represented the product of the path from the predictor variable to the mediator (i.e., child maltreatment at Wave X → frequency of heavy drinking at Wave X) and the path from mediator to the outcome variable (i.e., frequency of heavy drinking at Wave X → physical revictimization at Wave X). A significance test was then computed using bootstrapped confidence intervals.

Chapter 4

Results

Descriptive Statistics

Means, standard deviations, frequencies, and percentages of study variables are presented in Table 1. All frequencies are unweighted, but all means, standard deviations, and percentages are weighted and account for the complex survey design.

Approximately one quarter of the sample was exposed to some type of child maltreatment before the age 12 (24.82%). Of those exposed to child maltreatment, 70.2% were exposed to one type of maltreatment, while 21.4% were exposed to two types, 7.7% were exposed to three types, and 0.7% were exposed to four types of maltreatment. The most prevalent type of maltreatment in the sample was physical abuse (52.6%), followed by emotional abuse (44.4%), sexual abuse (27.8%), and neglect (15.2%).

The presence of any alcohol use, any binge drinking, and any incidents of getting drunk was more common among those with a history of child maltreatment. For example, at Wave I, 48.4% of those with a history of child maltreatment had consumed alcohol in the 12 months prior to the interview, compared to 41.9% of those without a history of child maltreatment. In addition, those with a history of child maltreatment initiated alcohol use significantly earlier than those without. Figure 4 shows the weighted mean frequency of heavy drinking across the four waves for those with and without child maltreatment. These means show a pattern in which those with a history of child maltreatment have higher alcohol use across the first three waves of data. Figure 5 shows the mean frequency of heavy drinking for men and women separately. Based on inspection of these figures, it appears that the general pattern of growth for men and women is similar, but the overall

level of alcohol use is higher among men. In addition, there appear to be differences between men and women with regards to when alcohol use peaks. For men, the highest mean frequency of heavy drinking was in Wave III, whereas for women heavy drinking peaked in Wave IV.

With regards to physical (re)victimization, almost half (47.9%) of those with a history of child maltreatment experienced physical (re)victimization (not at the hands of a parent/caregiver) at least once during the four waves, compared to 34.9% of those without a history of child maltreatment. Further, it was more common for those with a history of child maltreatment to experience physical (re)victimization over multiple waves (53.7%) than for those without (41.3%). For both groups, the most common type of physical (re)victimization experienced was having a gun or a knife pulled in a threatening manner; however, this experience was more common among those with a history of child maltreatment (33.9%) than among those without (22.2%). Physical (re)victimization was most common at Wave I, regardless of exposure to child maltreatment (20.8% for those without child maltreatment vs. 29.9 for those with child maltreatment). Figure 6 shows the weighted mean count of physical (re)victimization across the four waves for those with and without child maltreatment. Overall, the Figure shows a decrease in physical (re)victimization over time and a pattern in which the overall level of physical (re)victimization is higher for those with a history of child maltreatment. Again, the pattern of growth appears similar for men and women, but the overall level of physical (re)victimization was higher for men across all four waves (see Figure 7).

Aim One: Heavy Drinking Trajectories

Parameter estimates and fit statistics for the following models are presented in Table 2. Parameter estimates are presented exponentiated (i.e., exp(b)) and are interpreted as either expected counts (e.g., intercepts) or ratios of expected counts/incident rate ratios (e.g., slopes, predictors).

Unconditional growth model. A linear growth model was fit to the data with a random intercept and slope. Consistent with the descriptive statistics, results of this model indicated that heavy drinking increased across the four waves (linear slope, exp(b) = 2.02, $p < .001$). Specifically, for every one unit increase in time, heavy drinking increased by 102%. A model including a quadratic term was specified and fit statistics suggested that it had a better fit to the data (difference in AIC = 1.58e+08). However, when the data was plotted it showed a poor fit as it estimated that Wave IV heavy drinking was lower than Wave I heavy drinking. Given that descriptive statistics clearly show higher heavy drinking at Wave IV than at Wave I, we decided that a linear growth factor fit the data best. Therefore, all subsequent models are based on a linear growth factor.

Model including child maltreatment. Child maltreatment was included in the model as a time-invariant predictor. In addition, the interaction between child maltreatment and time was included. The parameter estimate for child maltreatment was 1.43 ($p < .001$), indicating that child maltreatment was associated with 43% greater heavy drinking at Wave 1. Although child maltreatment was associated with a higher intercept, the parameter estimate for the interaction term indicated that those with child maltreatment had a less steep slope (exp(b) = 0.91, $p = .01$) and, therefore, heavy drinking did not increase as rapidly among those with child maltreatment. The model fit did not change with the inclusion of these two parameters (difference in AIC = 0).

Final adjusted model. The next model included both time-varying and time-invariant covariates. With the inclusion of these covariates, the parameter estimate for child maltreatment increased slightly (exp(b) = 1.47, $p < .001$), while the interaction term (i.e., child maltreatment x time) was unchanged (exp(b) = 0.91, $p = .004$). The final adjusted model fit the data better than the two previous models (difference in AIC = 1.28e+08). An estimated prototypical trajectory for those with and without child maltreatment is illustrated in Figure 8.

***Final adjusted model with sex interactions*.** Sex was examined as a moderator by specifying a three-way interaction between child maltreatment, time, and sex, as well as all lower-order interactions. First, we examined the impact of sex on the intercept. The parameter estimate for sex indicated that being female was associated with lower heavy drinking at Wave I (exp(b) = 0.78, $p < .001$. Specifically, women without child maltreatment had a 22% lower expected count of heavy drinking at Wave I, than men without child maltreatment.

Second, we examined the two-way interactions between sex and child maltreatment, as well as the interaction between sex and time. The two-way interaction between sex and child maltreatment was significant (exp(b) = 0.49, $p < .001$). This interaction was probed by examining the expected count at Wave I for men and women with and without child maltreatment. The expected count revealed that at Wave I, child maltreatment was associated with a larger increase in heavy drinking for men than women. Specifically, child maltreatment was associated with a 167% increase in the expected count of heavy drinking for men, compared with a 32% increase in the expected count of heavy drinking for women. Similarly, the two-way interaction between sex and

time was significant (exp(b) = 0.70, $p < .001$). Examination of the expected counts for men and women without child maltreatment between Wave I and Wave II revealed that heavy drinking increased more rapidly for men than women. The slope for men without child maltreatment was 6.97, indicating that the expected count of heavy drinking increased by almost 700% at each wave, while for women without child maltreatment the slope was 4.89, indicating that expected count increased by almost 500% at each wave.

Finally, we examined the three-way interaction between sex, child maltreatment, and time. This three-way interaction was also significant (exp(b) = 1.32, $p <.001$). Inspection of the plotted trajectories (see Figure 9) and expected counts at each wave revealed that the slope for men with child maltreatment was significantly less steep (exp(b) = 5.18) than the slope for men without child maltreatment (exp(b) = 6.97). However, for women, the slopes between those with and without child maltreatment were more similar. Specifically for women without child maltreatment the slope was 4.94, while for women with child maltreatment the slope was 4.75. As can be seen in Figure 9, by Wave IV, these differences in slope meant that the relative differences in heavy drinking due to child maltreatment were greater for women than men. Specifically, at Wave IV, the expected count for men's heavy drinking was estimated to be 125.92 (approximately 126 days of heavy drinking) for those without child maltreatment and 136.22 (approximately 136 days of heavy drinking) for men with child maltreatment. Therefore, men with child maltreatment had an expected count for heavy drinking that was 8% higher than the expected count for men without child maltreatment. For women, the expected count for heavy drinking at Wave IV was estimated to be 39.11 (approximately 39 days of heavy drinking) for women without child maltreatment, while women with child maltreatment had

an expected count of 47.48 (approximately 47.5 days of heavy drinking). Therefore, women with child maltreatment had an expected count for heavy drinking that was 21% higher than the expected count for women without child maltreatment.

Aim Two: Physical (Re)Victimization Trajectories

Parameter estimates and fit statistics for all physical (re)victimization models are presented in Table 3. Parameter estimates are presented exponentiated (i.e., exp(b)) and are interpreted as either expected counts (e.g., intercepts) or ratios of expected counts/incident rate ratios (e.g., slopes, predictors).

Unconditional growth model. A linear growth model was fit to the data with a random intercept and slope. Results of this model indicated that physical (re)victimization decreased across the four waves (linear slope, exp(b) = 0.78, $p < .001$). Specifically, for every one unit increase in time, physical (re)victimization decreased by 22%. A model including a quadratic term was then specified. The quadratic term was significant (exp(b) = 0.92, $p = .003$), indicating that for every squared increase in time, the rate of change was reduced by 8%. With the inclusion of the quadratic term, the linear slope was no longer significant (exp(b) = 0.97, $p = .697$). Fit statistics indicated that this model fit the data better (difference in AIC = 1.00e+06) than the model including only the linear term. The data was then plotted, and the plot also indicated that the quadratic term fit the data well. Therefore, this was considered to be the final unconditional growth model (seen in Table 3) and all subsequent models include the quadratic term.

Model including child maltreatment. Child maltreatment was included in the model as a time-invariant predictor. In addition, the interaction between child maltreatment and time (linear), as well as the interaction between child maltreatment and

the quadratic term, were included. The parameter estimate for child maltreatment was 1.45 (p < .001), indicating that child maltreatment was associated with 45% greater physical (re)victimization at Wave I. The interaction terms were non-significant for both the linear slope (exp(b) = 1.12, p = .488) and quadratic term (exp(b) = 0.99, p = .856). Therefore, the trajectories for those with and without child maltreatment were not different from one another. Fit statistics indicated that the model fit improved with the inclusion of child maltreatment and its interactions with time and the quadratic term (difference in AIC = 4.60e+04).

Final adjusted model. The next model included both time-varying and time-invariant covariates. With the inclusion of these covariates, the parameter estimate for child maltreatment increased (exp(b) = 1.74, p < .001), while the interaction terms remained non-significant and unchanged. The final adjusted model fit the data better than the two previous models (difference in AIC = 1.80e+07). An estimated prototypical trajectory for those with and without child maltreatment is illustrated in Figure 10.

***Final adjusted model with sex interactions*.** Sex was examined as a moderator by specifying two three-way interactions between child maltreatment, time, and sex (one for linear time and one for the quadratic), as well as all lower-order interactions. First, we examined the impact of sex on the intercept. The parameter estimate for sex indicated that being female was associated with lower physical (re)victimization at Wave I (exp(b) = 0.35, p < .001). Specifically, among men and women without maltreatment, being a women was associated with 65% lower physical (re)victimization at Wave I.

Second, we examined the two-way interactions between sex and child maltreatment, as well as the interactions between sex and time (both linear and quadratic). All of these two-way interactions were non-significant (see Table 3).

Finally, we examined the three-way interactions between sex, child maltreatment, and time (both linear and quadratic). Both of these three-way interactions were non-significant (see Table 3). Figure 11 includes prototypical trajectories for men and women. Inspection of these plotted trajectories shows that women's expected count of physical (re)victimization was low across all four waves compared to men. In addition, the plotted trajectories appear to show that women's expected count of physical (re)victimization is consistent across time. However, it is important to note that given that the interactions were all non-significant, great caution is needed when interpreting these apparent differences in slope between men and women.

Aim Three: Mediation Model

Unadjusted path model with contemporaneous mediation. Unstandardized and exponentiated parameter estimates and significance values for the initial path model are shown in Table 4. Parameter estimates are presented exponentiated (i.e., exp(b)) and are interpreted as either expected counts (e.g., intercepts) or ratios of expected counts/incident rate ratios (e.g., slopes, predictors).

Consistent with the trajectory analyses, child maltreatment was significantly associated with frequency of heavy drinking and physical revictimization. As can be seen in Figure 12, child maltreatment was significantly associated with heavy drinking at Wave I (exp(b) = 1.76, $p < .001$) and Wave II (exp(b) = 1.38, $p = .017$), while it evidenced a strong, significant (ps < .001) relationship with physical revictimization

across all four waves (exp(b)s = 1.45, 1.56, 1.86, and 1.68, respectively). The paths between heavy drinking and physical revictimization were significant (*p*s < .001) at Waves I-III (exp(b)s = 0.02, 0.02, and 0.01, respectively), but were non-significant at Wave IV (*p* =.793). There was some evidence of mediation as the indirect path between child maltreatment and physical revictimization, through heavy drinking, was significant at Waves I (exp(b) = 1.01, *p* <.001) and II (exp(b) = 1.01, *p* = .018), both accounting for a 1% increase in the expected count.

Adjusted path model with contemporaneous mediation. Table 5 contains the unstandardized and exponentiated parameter estimates, along with significance values, for the adjusted model. Parameter estimates are presented exponentiated (i.e., exp(b)) and are interpreted as either expected counts (e.g., intercepts) or ratios of expected counts/incident rate ratios (e.g., slopes, predictors). Fit statistics indicated that the inclusion of covariates improved the fit of the model (difference in AIC = 184697.70). After controlling for covariates, child maltreatment was only significantly associated with heavy drinking at Wave I (exp(b) = 1.39, *p* =.020). Conversely, child maltreatment remained significantly associated with physical revictimization at all four waves: Wave I, exp(b) = 1.52, *p* < .001; Wave II, exp(b) = 1.54, *p* =.001; Wave III, (exp(b) = 1.77, *p* = .001; Wave IV, exp(b) = 1.67, *p* = .006). Again, there was some evidence of mediation at Wave I (exp(b) =1.01, *p* = .025). Given that child maltreatment was only associated with heavy drinking at Wave I, the indirect paths at other waves were not tested.

Unadjusted path model with contemporaneous mediation and autoregressive paths. Table 6 contains the unstandardized and exponentiated parameter estimates, along with significance values, for the unadjusted model that

included autoregressive paths for heavy drinking (e.g., heavy drinking at Wave I was regressed onto heavy drinking at Wave II) and physical revictimization (e.g., physical revictimization at Wave I was regressed onto physical revictimization at Wave II). Parameter estimates are presented exponentiated (i.e., exp(b)) and are interpreted as either expected counts (e.g., intercepts) or ratios of expected counts/incident rate ratios (e.g., slopes, predictors).

When compared with the previous unadjusted model, fit statistics indicated that this model was a better fit to the data (difference in AIC = 38769.60). As expected, these autoregressive paths were all significant and had an impact on estimates at later waves, when compared with the model without autoregressive paths. Specifically, unlike the previous unadjusted model, child maltreatment was no longer related to heavy drinking at Wave II (exp(b) = 0.83, p = .80). In addition, although child maltreatment remained a significant predictor of physical revictimization at Waves I (exp(b) = 1.45, p < .001), III (exp(b) = 1.56, p = .001), and IV (exp(b) = 1.51, p = .004), the association was non-significant at Wave II (exp(b) = 1.12, p = .280).

With regards to the relationship between heavy drinking and physical revictimization, the autoregressive paths did not have an impact on the pattern of results. More specifically, heavy drinking was significantly associated with physical revictimization at Waves I (exp(b) = 1.02, p < .001), II (exp(b) = 1.01, p < .001), and III (exp(b) = 1.01, p < .001), but not at Wave IV (exp(b) = 1.00, p = .872). Consistent with the previous models, there was again a small, but significant indirect effect at Wave I (exp(b) = 1.01, p < .001).

Adjusted path model with contemporaneous mediation and autoregressive paths. Table 7 contains the unstandardized and exponentiated parameter estimates, along with significance values, for the adjusted model that included autoregressive paths for heavy drinking (e.g., heavy drinking at Wave I was regressed onto heavy drinking at Wave II) and physical revictimization (e.g., physical revictimization at Wave I was regressed onto physical revictimization at Wave II). Parameter estimates are presented exponentiated (i.e., exp(b)) and are interpreted as either expected counts (e.g., intercepts) or ratios of expected counts/incident rate ratios (e.g., slopes, predictors).

The pattern of findings in the final adjusted model was consistent with results from the previous adjusted model, as well as the previous unadjusted model with autoregressive paths. More specifically, child maltreatment remained a significant predictor of heavy drinking, but only at Wave I (exp(b) = 1.39, p = .026), while it maintained a significant relationship with physical revictimization only at Waves I (exp(b) = 1.52, p < .001), III (exp(b) = 1.57, p = .017), and IV (exp(b) = 1.58, p = .013). Consistent with the previous model with autoregressive paths, heavy drinking was significantly associated with physical revictimization at Waves I (exp(b) = 1.02, p < .001), II (exp(b) = 1.01, p < .001), and III (exp(b) = 1.01, p = .001). And, lastly, there remained a small, significant indirect path from child maltreatment to physical revictimization, through heavy drinking: exp(b) = 1.01, p = .025.

This final model evidenced the best fit to the data and had an AIC that was lower than all previous models. The difference in AIC between this model and the previous

adjusted model was 21376.70, while the difference in AIC between this model and the previous model with autoregressive paths was 167304.80.

Chapter 4

Discussion

The present study had three aims: (1) to examine the impact of child maltreatment on heavy drinking trajectories from adolescence to young adulthood; (2) to examine the impact of child maltreatment on physical (re)victimization trajectories from adolescence to young adulthood; and (3) to examine the extent to which heavy drinking mediates the relationship between child maltreatment and physical revictimization. As predicted, child maltreatment was a robust predictor of heavy drinking trajectories and physical (re)victimization. Specifically, child maltreatment was associated with greater heavy drinking at Wave I, but a slower growth (i.e., less steep slope) of heavy drinking across time, when compared to individuals without a history child maltreatment. With regards to physical (re)victimization, child maltreatment was associated with a greater count of (re)victimization experiences at Wave I, but was not associated with how the count of physical (re)victimization changed over time. Ultimately, this meant that those with a history of child maltreatment had a greater rate of physical (re)victimization across all four waves. For both outcomes, adjustment for covariates did not change the overall pattern of findings, which may be due to the fact that Add Health was designed to be nationally representative. These results add to a growing body of literature documenting that child maltreatment broadly defined (i.e., not just physical and/or sexual abuse) has an impact on negative sequelae, such as heavy drinking and physical revictimization, even after controlling for theoretically important covariates (viz., age, sex, cognitive abilities, family history of alcoholism, education, income).

Although child maltreatment was associated with greater heavy drinking and physical (re)victimization, results did not suggest that heavy drinking played a mechanistic role in the relationship between child maltreatment and physical revictimization. Specifically, autoregressive models indicated that there was a small, but significant, indirect effect of heavy drinking on the relationship between child maltreatment and physical revictimization at Wave I, but not at later waves. This finding suggests that heavy drinking may not explain the relationship between child maltreatment and physical revictimization.

Child Maltreatment and Problem Alcohol Use

Past studies have shown that specific types of child maltreatment, particularly sexual abuse (e.g., Fergusson et al., 2008; Fergusson, Horwood, et al., 1996; Kendler et al., 2000; K. Z. Smith et al., 2014) and physical abuse (e.g., Fenton et al., 2013; Shin et al., 2013; Widom et al., 2007), are associated with increased problem alcohol use. However, few studies have examined how a broader definition of child maltreatment (i.e., any type of child maltreatment) is associated with problem alcohol use. In the present study, we found that the presence of any child maltreatment was associated with a lower age of initiation of alcohol use and greater heavy drinking. Importantly, even after controlling for covariates (viz., age, sex, cognitive abilities, family history of alcoholism, education, income), the presence of any type of child maltreatment before age 12 was associated with a 47% greater expected count for heavy drinking at Wave I. These results extend past research on child maltreatment and problem alcohol use and highlight the impact of child maltreatment on early indicators of problem alcohol use in a nationally representative sample.

Although child maltreatment was associated with greater heavy drinking initially, it was not associated with a more rapid escalation of alcohol use in adolescence and young adulthood. Contrary to expectations, the interaction between child maltreatment and time indicated that child maltreatment was associated with a slower escalation (i.e., less steep slope) of heavy drinking over time. Therefore, despite early indicators of greater problem alcohol use at Wave I, the overall trajectory of heavy drinking for those with child maltreatment became more similar over time to the trajectory for those without child maltreatment. Further, autoregressive models indicated that child maltreatment was only a significant predictor of heavy drinking at Wave I, suggesting that child maltreatment may only be related to heavy drinking in adolescence, during a developmental period that has a closer proximity to the onset of abuse. Indeed, researchers have argued that child maltreatment may be a strong, proximal predictor of problem alcohol use during early developmental periods, but that other factors may emerge as stronger predictors later in development (Dube et al., 2006; Sartor et al., 2007). Alternatively, it may be that heavy drinking is a good indicator of problem alcohol use at early developmental stages, but that other indicators, such as alcohol-related problems or drinking in risky contexts, may better capture problem alcohol use in adulthood.

A small number of studies have examined the impact of child maltreatment on the development of problem alcohol use across time (Sartor et al., 2007; Shin et al., 2013). For example, Shin et al. (2013) found that physical abuse and neglect was associated with greater binge drinking over time, including a more rapid escalation, but that overall rates of binge drinking were similar between those with and without child maltreatment (i.e., predicted binge drinking scores in adulthood fell between 1-2 days a year and 3-12

days a year, regardless of child maltreatment). More similar to our results, Sartor et al. (2007) found that the course of alcohol use disorders did not vary by child maltreatment status. More specifically, in a study using female twin-pairs, they found that childhood sexual abuse was associated with a younger age of initiation of alcohol use and greater odds of developing an alcohol use disorder, but was not associated with a shorter time to the development of an alcohol use disorder. In fact, Sartor and colleagues (2007) found that a younger age of initiation of alcohol use was associated with a longer time to the development of an alcohol use disorder. Therefore, although we did not find evidence in our sample that those exposed to child maltreatment will have greater heavy drinking over time, they may still be more likely to develop an alcohol use disorder because of differences in alcohol-related problems or reasons for drinking. Indeed, K. Z. Smith et al. (2014) found that child maltreatment was associated with alcohol-related problems, but not quantity and frequency of alcohol use in a sample of female college students. It will be important for future studies to better characterize problem alcohol use across developmental periods in order to understand how problem alcohol use may differ between those with and without child maltreatment.

Sex differences. Results of analyses that examined sex differences suggested that the relationship between child maltreatment and problem alcohol use may be different for men and women. More specifically, we found that child maltreatment exerted a stronger influence on heavy drinking for men at Wave I(i.e., child maltreatment was associated with a 167% increase in heavy drinking at Wave I for men, but only a 32% increase in heavy drinking for women). However, the significant three-way interaction between child maltreatment, time, and sex indicated that child maltreatment was

associated with a much slower escalation of heavy drinking for men, but not for women. Consequently, by Wave IV, child maltreatment was only associated with an 8% increase in heavy drinking for men, but a 21% increase in heavy drinking for women. Therefore, over time, the relative impact of child maltreatment was greater for women than men.

There has been a suggestion in the literature that childhood sexual abuse, may have a greater impact on the stress-response system in women than in men (Enoch, 2011; Simpson & Miller, 2002), which may lead to greater problem alcohol use among women. However, a limitation of the literature on child maltreatment and problem alcohol use is that few studies have examined sex differences. This may be due, in part, to the fact that most research has focused on childhood sexual abuse (Norman et al., 2012), which is more prevalent among women (Brown et al., 1998; Fergusson, Lynskey, et al., 1996), and thus leads to challenges in recruiting samples large enough to examine sex differences. The studies that have explored sex differences have produced equivocal results, with some studies finding no differences between men and women (Moran, Vuchinich, & Hall, 2004; Southwick Bensley, Spieker, Van Eenwyk, & Schoder, 1999; Thompson et al., 2004), others finding a greater impact of child maltreatment on women (H. L. MacMillan et al., 2001; Widom et al., 1995), and others finding a greater impact on men (for a review, see Norman et al., 2012). Our results add to this complicated picture and suggest that the impact of child maltreatment on alcohol use may be different for men and women during different developmental periods, with the effect diminishing over time for men. However, it is possible that this is an artifact of problem alcohol use becoming more normative for men across time, consequently weakening the impact of child maltreatment as a predictor. Prospectively designed studies that examine problem

alcohol use, alcohol expectancies, and motivations to drink among those with a history of child maltreatment may aid us in understanding these complex relationships.

Implications of results on child maltreatment and problem alcohol use. Overall, results suggest that child maltreatment confers the greatest risk for problem alcohol use during early developmental periods for both men and women. Given that numerous studies have found that both early initiation of alcohol use (Grant et al., 2001; McGue, Iacono, Legrand, Malone, & Elkins, 2001; Pitkänen, Lyyra, & Pulkkinen, 2005; Prescott & Kendler, 1999) and early heavy drinking (Morean, Corbin, & Fromme, 2012) are associated with an increased risk of problem alcohol use and alcohol use disorders in adulthood, these results suggest that intervention efforts for those exposed to child maltreatment should be implemented before and during adolescence.

Intervention/prevention efforts that focus on improving family functioning have been effective in reducing early substance use. For example, the strengthening families program, a multi-modal program for youth or adolescents and their parents, has been shown to delay the onset of alcohol use and other drugs (Spoth, Redmond, Shin, & Azevedo, 2004; Spoth, Redmond, Trudeau, & Shin, 2002), improve family functioning (Kumpfer, Whiteside, Greene, & Allen, 2010), and reduce child maltreatment (Brook, McDonald, & Yan, 2012). Targeting an intervention such as this to youth who have documented cases of child maltreatment, or who are at-risk of being maltreated, may therefore reduce early-onset alcohol use and heavy drinking in this high-risk population. However, long-term follow-up data indicating that these interventions reduce rates of problem alcohol use and alcohol use disorders in adulthood is lacking (i.e., no published data beyond 12th grade). This is concerning given that Prescott and Kendler (1999) have

argued that early drinking in adolescence does not have a causal association with the development of alcohol use disorders. Therefore, delaying the age of initiation of alcohol use and heavy drinking alone is not likely to reduce future rates of alcohol use disorders. However, in a twin-study, Agrawal et al. (2009) found that age of initiation interacted with genes in the prediction of alcohol use disorder symptoms. Given these mixed findings, it will be important for future studies to examine whether interventions that have demonstrated delays for the onset of alcohol use and heavy drinking are effective in changing adult outcomes among individuals who may have both an environmental and genetic risk.

Child Maltreatment and Physical (Re)Victimization

In a nationally representative sample, we found that physical revictimization was prevalent among individuals with a history of child maltreatment. Almost half of those with a history of maltreatment experienced some form of revictimization by the end of the fourth wave. Notably, results indicated that even after controlling for covariates, child maltreatment was associated with an increased risk of physical revictimization. Specifically, we found that the presence of one or more types of child maltreatment was associated with a 74% increase in risk of physical (re)victimization at Wave I. Further, results from autoregressive models show that show that child maltreatment is a potent, and fairly consistent, predictor of physical revictimization across adolescence and through early adulthood. These results are consistent with studies showing an increased risk of sexual revictimization among those with histories of childhood sexual abuse (e.g., Aosved et al., 2011; J. E. Barnes et al., 2009; Fergusson et al., 1997; Messman-Moore & Long, 2000), as well as a growing number of studies showing that other forms of maltreatment

engender risk for both sexual and physical revictimization (e.g., Desai et al., 2002; McIntyre & Widom, 2011; Widom et al., 2008). In addition, our findings expand upon existing literature by demonstrating that the impact of child maltreatment on revictimization outcomes is not limited to a single developmental period.

Consistent with our predictions, the interaction between child maltreatment and time was non-significant, indicating that shape of the trajectory for physical (re)victimization does not differ based upon a history of child maltreatment. These results suggest that regardless of child maltreatment history, individuals will experience a decline in physical (re)victimization as they age out of adolescence and into early adulthood, which is commensurate with other research showing that physical victimization declines across the transition to adulthood (R. Macmillan, 2001; Thompson et al., 2008). However, given that our results indicated that child maltreatment was associated with greater risk of physical (re)victimization at Wave I, the lack of difference in slope also suggests that the impact of child maltreatment on physical revictimization is rather fixed.

This persistent, increased risk for physical revictimization for those with a history of child maltreatment is highly concerning due to the risks inherent in violent victimization, as well as the associated poor health outcomes (Boynton-Jarrett, Ryan, Berkman, & Wright, 2008). It is unclear why individuals exposed to child maltreatment maintain an elevated risk for revictimization in adulthood. In a study that looked at repeated victimization among female college students, Daigle, Fisher, and Cullen (2008) reasoned that risk of repeated victimization is likely high among victimized individuals because incident level factors remain unchanged across time. For example, if a contributing factor to an incident of physical victimization for an individual that was shot or stabbed was that

he or she was carrying a weapon, that same weapon will continue to be a risk factor for future violence if it is still carried. This makes good sense and is logical when we are discussing observable behaviors in adults, but is tricky when we are trying to understand the added, persistent risk for revictimization due to child maltreatment. It is likely that there are multiple stable and dynamic risk factors that lead to greater rates of revictimization among those with a history of child maltreatment, such as impulsivity, executive functioning, genetic influences, and substance use. Unfortunately, few studies have investigated potential mechanisms underlying this relationship. Future investigations that focus on incident-level factors, as well as broader vulnerabilities for physical revictimization among those exposed to child maltreatment are needed.

Sex differences. The majority of studies investigating the child maltreatment/revictimization pathway have focused on sexual revictimization among women. Thus, we know little regarding sex differences in risk for revictimization. In the present study, although we found that men were more likely to experience physical (re)victimization, we did not find evidence that the impact of child maltreatment differed by sex (i.e., the two-way interaction between child maltreatment and sex and the three-way interaction that included time were non-significant). These results are important as they suggest that child maltreatment presents a similar risk for physical revictimization among men and women. Notwithstanding, it should be noted that physical victimization among children and adolescents has been shown to be more strongly related to depressive symptoms for boys than girls (Sinclair et al., 2012). Therefore, future studies should explore whether there are sex differences on the impact of physical revictimization or other sequelae among individuals exposed to child maltreatment.

Implications of results on child maltreatment and physical revictimization.

Numerous intervention programs have been tested to reduce (re)victimization among children/adolescents (e.g., Cunningham et al., 2012; Espelage, Low, Polanin, & Brown, 2013; Tillyer, Fisher, & Wilcox, 2010; Walton et al., 2010), families (for a review, see Hickman et al., 2013), and adults (for a review, see Grove, Farrell, Farrington, & Johnson, 2012). These programs are diverse and have focused on varied treatment targets (e.g., risk recognition, violence perpetration, improving resources/case management, attachment, alcohol-related consequences, self-efficacy, violence attitudes) and have been delivered in emergency departments (Cunningham et al., 2012; Walton et al., 2010), schools (Espelage et al., 2013; Tillyer et al., 2010), homes (Jaycox et al., 2011), and community clinics (Jaycox et al., 2011). Although not all of these programs have undergone rigorous testing, nor have they all produced positive intervention effects, overall, interventions have shown promise for reducing revictimization among individuals previously exposed to violence (Grove et al., 2012; Snider & Lee, 2009).

Despite the considerable number of interventions designed to reduce (re)victimization, few interventions account for the impact of child maltreatment. However, it is likely that these interventions have included individuals exposed to child maltreatment as many have focused on high-risk groups for revictimization based upon factors such as low socioeconomic status and/or family substance use, which are known risk factors for child maltreatment. Given the high rates of revictimization among those with a history of child maltreatment, it will be important for intervention efforts to determine whether existing interventions are effective for this high-risk and understudied group. In addition, in order to appropriately modify existing interventions, continued research needs

to be done to determine factors associated with the increased risk for revictimization among those with a history of child maltreatment.

Alcohol Use as a Potential Mechanism

Problem alcohol use has been proposed as a potential mechanism underlying the child maltreatment/revictimization pathway (Messman-Moore & Long, 2003). However, strong support was not found for this mechanism in the present study. Rather, results of autoregressive models indicated that there was a significant, but small, indirect effect of child maltreatment on physical revictimization, through heavy drinking, at Wave I, but not at later waves. Although this indirect effect was significant at Wave I, results indicated that heavy drinking was only associated with a 1% increase in the expected count of physical revictimization. These results run contrary to several previous studies that found modest support for problem alcohol use as a mediator of the relationship between childhood sexual abuse and sexual revictimization (Fargo, 2008; Messman-Moore & Long, 2000; Messman-Moore et al., 2009). While it is possible that our data reflect a true absence of mediation, there are several alternative explanations for our findings.

First, the lack of mediation may be due to our measurement of problem alcohol use. As noted earlier, child maltreatment was not a robust predictor of heavy drinking in later waves. Additionally, heavy drinking was not a strong predictor of physical (re)victimization in autoregressive models. These findings are inconsistent with previous literature which shows strong relationships between (1) child maltreatment and problem alcohol use in young (e.g., Goldstein, Flett, & Wekerle, 2010; Scott et al., 2010) and middle adulthood (e.g., Fenton et al., 2013; Widom et al., 2007) and (2) problem alcohol use and violence victimization and perpetration (e.g., Leonard, 2005; P. H. Smith et al.,

2012). Although these divergent findings are puzzling, research has indicated that the relationship of problem alcohol use to violence may be dependent on the definition used. For example, in a meta-analysis that examined the relationship between problem alcohol use and intimate partner violence victimization among women, Devries et al. (2014) found that effect sizes varied greatly based on the definition of problem alcohol use used.

Two studies that have found support for problem alcohol use as a mediator of the child maltreatment/revictimization pathway used measures that captured alcohol use that was proximal to victimization incidents. Messman-Moore and Long (2000) found that women with a history of childhood sexual abuse had higher odds of being sexually victimized by acquaintances and strangers when they were intoxicated with alcohol and/or drugs. Similarly, Fargo (2008) found that using alcohol before sex was predictive of adult sexual revictimization, as well as intimate partner violence revictimization among those with documented cases of childhood sexual abuse. Therefore, it may not be that generalized heavy drinking mediates the relationship between child maltreatment and physical revictimization, but drinking in contexts that increases vulnerability to victimization (e.g., by making the drinker appear more disabled, impairing cognition, increasing conflict).

Second, given that results do show that child maltreatment is a predictor of both heavy drinking in earlier developmental periods, and, to a greater magnitude, physical revictimization, it is possible that a third variable plays a mechanistic role in the relationship between child maltreatment and revictimization. For example, it may be that heavy drinking is related to child maltreatment and revictimization through its relationship to other drug use. Indeed, heavy drinking is predictive of illicit drug use among high school

students (Miller, Naimi, Brewer, & Jones, 2007), but the association weakens as individuals age (G. M. Barnes, Welte, & Hoffman, 2002). In addition, early illicit drug use, is associated with greater risk for developing a substance use disorder in adulthood (Merline, O'Malley, Schulenberg, Bachman, & Johnston, 2004). Further, studies examining the relationship between opioid use (i.e., heroin, non-medical use of prescription pain medications) and posttraumatic stress disorder have found that use of opioids precedes exposure to trauma, suggesting that the use of particular substances may lead to greater victimization (Cottler, Compton III, & Mager, 1992; K. Z. Smith, Smith, Cerone, Homish, & McKee, 2015). Perhaps, individuals exposed to child maltreatment who engage in heavy drinking and illicit drug use at early developmental periods are at the highest risk of revictimization, but the risk is a consequence of illicit drug use, rather than heavy drinking,

There is some support in the literature for the role of illicit drug use in revictimization. Two studies that have found support for problem alcohol use as a mediator of the relationship between child maltreatment and revictimization examined substance use more broadly, rather than problem alcohol use alone. Messman-Moore and colleagues (2009) found that a latent substance use variable, which included alcohol use, mediated the relationship between childhood sexual abuse/childhood trauma and sexual revictimization over a 30-week period. And, as noted above, Messman-Moore and Long (2000) found that intoxication from alcohol and/or drugs increased the odds of sexual revictimization among women with histories of childhood sexual abuse. However, from these studies, it is unclear if it is the synergistic effect of alcohol and illicit drug use that is driving the association, alcohol alone, or illicit drug use alone. Therefore, it will be

important for future studies to examine the impact of illicit drug use individually and in combination with heavy drinking.

Third, and finally, it may be that alcohol interacts with another vulnerability to increase the risk of revictimization. Research has identified certain polymorphisms in genes that impact serotonergic, GABAergic, and dopaminergic function, which may interact with alcohol to lead to greater risk for violence perpetration (for a review, see Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011), and, perhaps, also (re)victimization.

In a review, Heinz and colleagues (2011) discuss how individuals who have the variable-number tandem repeat of monoamine oxidase A (MAOA uVNTR) and/or the serotonin-transporter-linked polymorphic region (5-HTTLPR) polymorphism exhibit trait-like differences in executive control and limbic system activity, which are associated with greater disinhibited behavior, as well as a heightened stress response. These differences have been shown to interact with acute intoxication of alcohol, as well as alcohol dependence, to produce greater risk of violence perpetration/aggression (Heinz et al., 2011). In addition, research examining antisocial behavior has found that a history of child maltreatment interacts with the MAOA uVNTR polymorphism to predict greater antisocial behavior, suggesting that there is possibly a three-way interaction between child maltreatment, genetic polymorphisms in MAOA uVNTR, and alcohol in the prediction of violence (Bellani, Nobile, Bianchi, Van Os, & Brambilla, 2012; Fergusson, Boden, Horwood, Miller, & Kennedy, 2011).

With regards to victimization, it has been suggested that some of the same factors that increase the likelihood of perpetration of violence, also increase the risk of

victimization (Esbensen & Huizinga, 1997; Taylor, Peterson, Esbensen, & Freng, 2007). Indeed, impaired executive control, a significant risk factor for alcohol-involved violence (Heinz et al., 2011), has been identified as a risk factor for victimization in a recent meta-analysis (Pratt, Turanovic, Fox, & Wright, 2014). Further, research has identified other genetic polymorphisms implicated in executive control that are associated with greater risk of (re)victimization. For example, a polymorphism in the DRD2 gene has been shown to interact with peer alcohol and drug use in the prediction of adolescent victimization(Beaver et al., 2007). Similarly, Daigle (2010) found that a polymorphism on the DRD4 gene has been associated with increased risk of revictimization. Given research demonstrating that acute intoxication of alcohol leads to further impairments in executive control (Heinz et al., 2011), it seems possible that these genetic vulnerabilities may interact with alcohol, and possibly also child maltreatment, in the prediction of (re)victimization.

Limitations

Although this study represents an important addition to the literature, there are several limitations of the methodology. An important limitation is that Add Health assessed child maltreatment retrospectively, during Waves III and IV. This means that individuals were aged between 18 and 34 when they were asked to recall their own history of maltreatment. However, several studies have noted that retrospective reports of childhood trauma are reliable and valid (Fergusson, Horwood, & Boden, 2011; Hardt & Rutter, 2004; Widom & Morris, 1997; Widom & Shepard, 1996). Further, J. E. Barnes et al. (2009) examined the retrospective recall of details of documented cases of child

maltreatment and found that individuals were good at recalling details that could impact severity.

There are limitations of this study based upon the fact that data came from an existing, large dataset. This meant that some constructs (e.g., child maltreatment severity, alcohol problems) could not be examined as they were either not assessed in the data, or were not assessed at multiple time points. Also, we were limited in our options for defining our key constructs (i.e., problem alcohol use, physical (re)victimization, child maltreatment), which may have biased our findings. For example, our measure of problem alcohol use, heavy drinking, may not be the optimal indicator of problem alcohol use throughout the life span. As discussed earlier, some literature suggests that alcohol-related problems, symptoms of alcohol use disorders, or alcohol use that occurs in certain contexts may drive the association between child maltreatment and revictimization (e.g., Fargo, 2008; Messman-Moore & Long, 2000). Unfortunately, measures of frequency of heavy drinking and quantity of alcohol use were the only items that were consistently measured across all four waves, which meant that we were unable to examine other indicators of problem alcohol use for these analyses.

In addition, results may be biased due to how we defined physical (re)victimization. Given that the frequency of physical (re)victimization was only assessed at two waves, we were limited to looking at physical (re)victimization as a count variable. This may have biased estimates as it is possible that individuals will receive a low score if they have only experienced one type of (re)victimization, even if that type occurred repeatedly. Moreover, physical (re)victimization was only assessed for the 12 month period prior to the interview, which may also result in an underestimate of the true rate of physical (re)victimization.

For example, an individual may not have been (re)victimized for the 12 months prior to the interview at Wave III, but may have been (re)victimized repeatedly during the other four years between Wave II and Wave III. Further, the assessment of physical (re)victimization did not include information about who the perpetrators were. Implications of our findings may be different if perpetrators were same-aged peers, romantic partners, or strangers in the community. Unfortunately, that information was not assessed in Add Health. Future studies should include questions about perpetrators, including their relationship to the victim, as well as their sex.

Our measure of child maltreatment may have also biased our results. In order to maximize our sample size, we chose to use a measure of child maltreatment that took advantage of the assessments at Waves III and IV. This was done because there were individuals who were missing items at one wave, but not the other wave. Given that the Wave III assessment asked whether individuals had experienced maltreatment prior to sixth grade, we had to define child maltreatment as abuse or neglect that occurred before age 12 in order for the two assessments to be equivalent. Therefore, our measure of child maltreatment is limited in that it only captures maltreatment that started prior to adolescence. This could have impacted results as some research suggests that risk of sexual revictimization varies based upon the age of onset of abuse, with greater risk of revictimization for those victimized in late childhood to early adolescence (Roodman & Clum, 2001). In addition, this definition reduced the number of individuals who fit the research criteria for child maltreatment, which may have reduced our ability to find significant results. Further, although our total sample size for those with child maltreatment was large (n = 790), we were underpowered to look at different definitions

of child maltreatment that would be of interest (e.g., sexual abuse only, physical and sexual abuse, physical abuse only, neglect only).

Although the Add Health dataset is large, representative of high-school students in the United States, and prospective, there remain issues in understanding risk factors and mechanisms for constructs that are multiply determined in this dataset. More specifically, despite the longitudinal nature of the data, we still cannot determine whether child maltreatment causes greater problem alcohol use and/or physical revictimization. It is possible that another variable explains these associations or that physical revictimization influences problem alcohol use, rather than problem alcohol use influencing physical revictimization. However, given that our definition of child maltreatment meant that all child maltreatment occurred prior to the outcomes of interest, we can be certain that problem alcohol use and physical revictimization after age 12 does not cause early child maltreatment. In addition, given that both problem alcohol use and physical (re)victimization are caused by numerous risk factors, it is possible that the impact of any one risk factor, even if it is highly related to an outcome, can be reduced to non-significance. This reduction can happen in a large dataset due to the presence of other risk factors that may be largely independent of child maltreatment. Therefore, although we did not find evidence that our definition of problem alcohol use, heavy drinking, was related to physical (re)victimization, it is still possible that it is a significant risk factor.

Conclusion

These limitations notwithstanding, the present study is one of a few studies that examine the role of problem alcohol use in the relationship between child maltreatment

and physical revictimization. Results of the present study add to a growing body of literature demonstrating that child maltreatment, broadly defined (i.e., not just physical and sexual abuse), engenders numerous risks, years after the abuse has occurred. Indeed, in a nationally representative sample, we found that child maltreatment was associated with a higher risk of physical revictimization across four waves of data. Further, results also suggest that the relationship between early child maltreatment and problem alcohol use is complex, with differences based on (1) developmental stage and (2) sex. Finally, results underscore the importance of continuing to identify mechanisms of the child maltreatment/physical revictimization pathway.

Our results indicate that the negative impact of child maltreatment on problem alcohol use and physical revictimization can be seen in early adolescence. These findings suggest that intervention/prevention efforts should be delivered when individuals are young, prior to adolescence. Interventions that target family functioning and attachment have shown promise for reducing child maltreatment, early problem alcohol use, and adolescent (re)victimization (Brook et al., 2012; Jaycox et al., 2011; Kumpfer et al., 2010)). However, studies focused on reducing rates of problem alcohol use and physical (re)victimization have not reported whether interventions are efficacious with this high-risk group. Future studies should investigate whether results from studies testing interventions for early problem alcohol use and physical (re)victimization extend to those with histories of child maltreatment. Moreover, given the sex differences that emerged for problem alcohol use, studies should examine sex differences in response to interventions.

Our findings with regards to the role of problem alcohol use in the child maltreatment/physical revictimization pathway diverge from past studies showing a role

of problem alcohol use in victimization (Leonard, 2005; P. H. Smith et al., 2012; Testa, 2004). We believe that this difference may be due to several factors, such as (1) measurement of problem alcohol use; (2) a third variable, related to problem alcohol use; and/or (3) an interaction between problem alcohol use and polymorphisms in genes that impact serotonergic, GABAergic, and dopaminergic function, which may also interact with child maltreatment. It is recommended that future studies examine the role of these factors in explaining the relationship between child maltreatment and physical victimization.

Overall, the present study emphasizes that individuals with histories of child maltreatment are at a greater risk of experiencing physical revictimization, and that child maltreatment is, indeed, associated with greater early heavy drinking. Continued work must be done in this area to understand the mechanisms that lead to greater physical revictimization.

Table 1

Descriptives for Those With and Without Child Maltreatment

	No child maltreatment		1 or more types	
	n = 2408	(75.18%)	n = 790	(24.82%)
	n or *M*	(% or *SD*)	n or *M*	(% or *SD*)
Biological Sex				
Female	1,357	(50.7)	439	(49.1)
Age *M (SD)*				
Wave I	14.95	(1.62)	15.07	(1.59)
Wave II	15.85	(1.62)	15.99	(1.63)
Wave III	21.32	(1.62)	21.46	(1.61)
Wave IV	27.82	(1.65)	27.96	(1.61)
Race				
White	1,557	(71.2)	479	(66.5)
Black	525	(14.8)	159	(15.6)
Native American	23	(1.1)	10	(0.9)
Asian	59	(2.0)	37	(3.7)
Other	19	(0.7)	10	(1.1)
Hispanic	221	(10.1)	90	(12.1)
Highest education*				
Less than HSD	129	(6.5)	57	(9.1)
HSD/GED	493	(22.9)	171	(22.4)
Vocation	200	(8.4)	69	(8.8)
Some College	693	(28.3)	256	(32.6)
BA	554	(21.5)	147	(17.5)
Some grad	134	(5.1)	36	(4.3)
Grad or Professional	205	(7.4)	54	(5.2)

PPVT Standard Score	102.20	(13.89)	101.65	(15.28)
Income at Wave I*				
<20	342	(18.4)	139	(23.5)
20-29	280	(14.7)	92	(15.1)
30-49	527	(27.9)	180	(28.7)
50-75	463	(23.6)	136	(21.5)
75-99	180	(8.6)	38	(5.3)
100+	143	(6.8)	42	(6.0)
Income at Wave I				
<20	248	(11.38)	103	(12.7)
20-29	235	(11.0)	78	(10.3)
30-49	520	(22.9)	192	(26.0)
50-75	546	(23.7)	173	(25.1)
75-99	348	(16.5)	100	(11.6)
100+	349	(14.6)	105	(13.8)
Parental Alcoholism				
Yes**	291	(13.0)	146	(20.1)
Age of 1st alcohol use***	15.41	(3.35)	14.14	(3.55)
Exposure to Maltreatment Types				
One type	--	--	554	(70.2)
Two types	--	--	169	(21.4)
Three types	--	--	61	(7.7)
Four types	--	--	6	(0.7)
Types of Maltreatment Experienced				
Physical (ACE)	--	--	415	(52.6)
Sexual (any)	--	--	217	(27.8)
Emotional (ACE)	--	--	346	(44.1)

Neglect (ACE)	--	--	121	(15.2)
Physical and Sexual	--	--	87	(11.4)
Sexual and Emotional	--	--	56	(6.2)
Physical and Emotional	--	--	160	(20.4)
Neglect and Physical	--	--	79	(9.6)
Neglect and Sexual	--	--	27	(4.0)
Neglect and Emotional	--	--	30	(3.4)
Alcohol Use-12 months				
Wave I**	985	(41.9)	376	(48.4)
Wave II**	1,049	(45.2)	392	(50.8)
Wave III*	1,747	(73.5)	611	(77.8)
Wave IV	1,770	(74.8)	597	(76.4)
Binge Drinking-12 months				
Wave I*	509	(53.6)	204	(56.9)
Wave II	666	(65.2)	232	(60.3)
Wave III*	1,193	(72.7)	437	(76.4)
Wave IV	1,152	(68.1)	419	(72.7)
Drunk-12 months				
Wave I*	565	(57.2)	214	(58.5)
Wave II*	682	(65.6)	257	(66.5)
Wave III*	1,238	(73.1)	452	(77.0)
Wave IV*	1,167	(68.6)	433	(74.1)
Physical (Re)Victimization				
Any (across waves)***	817	(34.9)	362	(47.9)
Wave I***	483	(20.8)	231	(29.9)
Wave II***	363	(15.7)	178	(25.1)
Wave III**	235	(10.3)	115	(16.0)
Wave IV*	193	(9.3)	104	(14.4)

Physical (Re)Victimization Types (across waves)				
Jumped/beat up*	361	(17.5)	193	(28.3)
Witness stabbed/shot*	463	(21.0)	233	(32.6)
Stabbed/shot***	202	(9.25)	129	(19.2)
Knife or gun pulled*	479	(22.2)	224	(33.9)
Repeated Physical (Re)Victimization**	328	(41.3)	188	(53.7)

Note. Means, standard deviations, and percentages are weighted and account for the survey design. All frequencies are unweighted. Values for binge drinking and getting drunk in the last 12 months are for those who consumed alcohol in the same 12 month period. Values for repeated physical (re)victimization are for those who were victimized at any point during the study. Significance tests were adjusted Wald tests for categorical variables and a Generalized Linear Model test of mean difference. All tests accounted for the complex survey design.

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

Table 2
Exponentiated regression coefficients for models examining trajectories of frequency of heavy drinking

	Unconditional Growth Model	Model with Child Maltreatment	Final Adjusted Model	Final Adjusted Model with Sex Interactions
Initial Status:				
Intercept	1.83***	3.56***	0.80	0.37***
Child Maltreatment	--	1.43***	1.47***	2.67***
Sex	--	--	0.36***	0.90
Age	--	--	0.79***	0.78***
Parental Alcoholism	--	--	1.41***	1.14**
PPVT	--	--	1.01***	1.01***
Income	--	--	NS	NS
Highest Education	--	--	NS	NS
Sex x Child Maltreatment	--	--	--	0.49***
Rate of Change:				
Time (linear)	2.02***	1.79***	5.05***	6.97***
Time (linear) x Child Maltreatment	--	0.91*	0.91**	0.74***
Time (linear) x Sex	--	--	--	0.70***
Time (linear) x Child Maltreatment x Sex	--	--	--	1.32***

Fit Statistics:				
-2LL	560000000.0	560000000.0	496000000.0	493000000.0
AIC	1120000000.0	1120000000.0	992000000.0	987000000.0

Note. All models were specified with a Poisson distribution. Poisson regression coefficients are expected differences in log counts. All coefficients presented here are exponentiated. When exponentiated, the intercept represents an expected count and the slope represents a ratio of expected counts, or an incident rate ratio. For example, in the unconditional growth model, the exponentiated coefficient for the intercept is 1.83, which represents the expected count when time is 0. Conversely, in the same model, the exponentiated coefficient for the slope is 2.02, which is the ratio of counts, or incident rate ratio, at time t to time t-1. In other words, the expected count at time 1 = 2.02*the expected count at time 0 (1.83*2.02=3.70), and the count at time 2 equals 2.02*the expected count at time 1, (etc.). For every one unit increase in time, there is a 102% increase in expected count ($count_t/count_{t-1}$). All continuous predictors in the models were mean centered and standardized, dichotomous variables were dummy coded, and categorical variables were centered on the mean category. All predictors are also interpreted as ratios of expected counts, or incident rate ratios, and, therefore, their influence on the intercept can be seen by looking at the product of the intercept and the value of the predictor.

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

Table 3
Exponentiated regression coefficients for models examining trajectories of count of physical (re)victimization

	Unconditional Growth Model	Model with Child Maltreatment	Final Adjusted Model	Final Adjusted Model with Sex Interactions
Initial Status:				
Intercept	0.10***	0.09***	0.15***	0.15***
Child Maltreatment	--	1.45***	1.74***	1.63**
Sex	--	--	0.33***	0.35***
Age	--	--	NS	NS
Parental Alcoholism	--	--	1.65***	1.63***
PPVT	--	--	0.98***	0.98***
Income	--	--	0.95**	0.95**
Highest Education	--	--	0.83**	0.83*
Sex x Child Maltreatment	--	--	--	1.23
Rate of Change:				
Time (linear)	0.97	0.97	1.03	1.07
Time (quadratic)	0.92**	0.91*	0.90**	0.88**
Time (linear) x Child Maltreatment	--	1.12	0.99	1.10
Time (quadratic) x Child Maltreatment	--	0.99	1.00	0.98
Time (linear) x Sex	--	--	--	0.85

Time (quadratic) x Sex	--	--	--	1.06
Time (linear) x Child Maltreatment x Sex	--	--	--	0.70
Time (quadratic) x Child Maltreatment x Sex	--	--	--	1.10
Fit Statistics:				
-2LL	42300000.0	40100000.0	31100000.0	31100000.0
BIC	84700000.0	80100000.0	62100000.0	62100000.0

Note. All models were specified with a Poisson distribution. Poisson regression coefficients are expected differences in log counts. All coefficients presented here are exponentiated. When exponentiated, the intercept represents an expected count and the slope represents a ratio of expected counts, or an incident rate ratio. For example, in the unconditional growth model, the exponentiated coefficient for the intercept is 0.10, which represents the expected count when time is 0. Conversely, in the same model, the exponentiated coefficients for slopes (linear slope = 0.97, quadratic slope is 0.92) are the ratio of expected counts, or incident rate ratios, at time t to time t-1. In other words, the expected count at time 1 = 0.97*0.92*the expected count at time 0 (0.10*0.97*0.92=0.09), and the count at time 2 equals 0.97*0.92*the expected count at time 1, (etc.). For every one unit increase in time, there is a 10% decrease in expected count ($count_t/count_{t-1}$). All continuous predictors in the models were mean centered and standardized, dichotomous variables were dummy coded, and categorical variables were centered on the mean category. All predictors are also interpreted as ratios of expected

counts, or incident rate ratios, and, therefore, their influence on the intercept can be seen by looking at the product of the intercept and the value of the predictor.

*p < .05. **p < .01. *** p < .001.

Table 4

Unadjusted Parameter Estimates for Model in Figure 12

Parameter Estimate	Unstandardized	Exp(b)	*P*
Structural Model			
CM → FHD Wave 1	0.57	1.76	.000
CM → FHD Wave 2	0.32	1.38	.017
CM → FHD Wave 3	0.10	1.10	.148
CM → FHD Wave 4	0.05	1.05	.427
CM → PRV Wave 1	0.37	1.45	.000
CM → PRV Wave 2	0.45	1.56	.000
CM → PRV Wave 3	0.62	1.86	.000
CM → PRV Wave 4	0.52	1.68	.000
FHD Wave1 → PRV Wave 1	0.021	1.02	.000
FHD Wave1 → PRV Wave 2	0.015	1.02	.000
FHD Wave1 → PRV Wave 3	0.007	1.01	.000
FHD Wave1 → PRV Wave 4	0.001	1.00	.793
Covariates			
Age Wave 1 → FHD Wave 1	0.33	1.39	.000

Age Wave 2 → FHD Wave 2	0.33	1.39	.000
Age Wave 3 → FHD Wave 3	0.01	1.01	.649
Age Wave 4 → FHD Wave 4	0.01	1.01	.690
Indirect Effects			
CM → FHD Wave 1*FHD Wave 1→ PRV Wave 1	0.01	1.01	.000
CM → FHD Wave 2*FHD Wave 2→ PRV Wave 2	0.01	1.01	.018
CM → FHD Wave 3*FHD Wave 3→ PRV Wave 3	0.00	1.00	.170
CM → FHD Wave 4*FHD Wave 4→ PRV Wave 4	0.00	1.00	.807
Intercepts			
FHD Wave 1	1.64	5.16	.000
FHD Wave 2	2.24	9.37	.000
FHD Wave 3	3.54	34.47	.000
FHD Wave 4	3.51	33.48	.000
PRV Wave 1	-1.30	0.27	.000
PRV Wave 2	-1.59	0.20	.000
PRV Wave 3	-2.14	0.12	.000
PRV Wave 4	-1.81	0.16	.000

Note. Unadjusted model examining the influence of child maltreatment on physical revictimization through contemporaneous mediation by the frequency of heaving drinking. All endogenous variables were specified with a Poisson

distribution. Unadjusted parameter estimates are expected differences in log counts. When exponentiated, the intercept represents an expected count and the slope represents a ratio of expected counts, or an incident rate ratio. In addition, all predictors are also interpreted as ratios of expected counts, or incident rate ratios, and, therefore, their influence on the intercept can be seen by looking at the product of the intercept and the value of the predictor.

AIC = 458536.84

Table 5

Adjusted Parameter Estimates for Model in Figure 13

Parameter Estimate	Unstandardized	Exp(b)	*P*
Structural Model			
CM → FHD Wave1	0.33	1.39	.026
CM → FHD Wave 2	NS	NS	NS
CM → FHD Wave 3	NS	NS	NS
CM → FHD Wave 4	NS	NS	NS
CM → PRV Wave 1	0.42	1.52	.000
CM → PRV Wave 2	0.43	1.54	.001
CM → PRV Wave 3	0.57	1.77	.001
CM → PRV Wave 4	0.51	1.67	.006
FHD Wave1 → PRV Wave 1	0.02	1.02	.000
FHD Wave1 → PRV Wave 2	0.01	1.01	.000
FHD Wave1 → PRV Wave 3	0.01	1.01	.000
FHD Wave1 → PRV Wave 4	NS	NS	NS
Covariates			
Sex → FHD Wave 1	NS	NS	NS

Sex → FHD Wave 2	0.37	0.69	.011
Sex → FHD Wave 3	-0.91	0.40	.000
Sex → FHD Wave 4	-0.54	0.58	.000
Sex → PRV Wave 1	-0.74	0.48	.000
Sex → PRV Wave 2	-0.81	0.45	.000
Sex → PRV Wave 3	-1.00	0.37	.000
Sex → PRV Wave 4	-0.97	0.38	.000
Parental Alcoholism → FHD Wave 1	0.38	1.46	.003
Parental Alcoholism → FHD Wave 2	NS	NS	NS
Parental Alcoholism → FHD Wave 3	NS	NS	NS
Parental Alcoholism → FHD Wave 4	NS	NS	NS
Parental Alcoholism → PRV Wave 1	0.26	1.30	.016
Parental Alcoholism → PRV Wave 2	NS	NS	NS
Parental Alcoholism → PRV Wave 3	NS	NS	NS
Parental Alcoholism → PRV Wave 4	NS	NS	NS
PPVT → FHD Wave 1	NS	NS	NS
PPVT → FHD Wave 2	NS	NS	NS
PPVT → FHD Wave 3	0.01	1.01	.011
PPVT → FHD Wave 4	NS	NS	NS
PPVT → PRV Wave 1	NS	NS	NS

PPVT → PRV Wave 2	NS	NS	NS
PPVT → PRV Wave 3	NS	NS	NS
PPVT → PRV Wave 4	-0.02	0.98	.000
Highest Education → FHD Wave 1	-0.16	0.85	.000
Highest Education → FHD Wave 2	-0.21	0.81	.000
Highest Education → FHD Wave 3	NS	NS	NS
Highest Education → FHD Wave 4	NS	NS	NS
Highest Education → PRV Wave 1	-0.18	0.83	.000
Highest Education → PRV Wave 2	-0.20	0.82	.000
Highest Education → PRV Wave 3	-0.30	0.74	.000
Highest Education → PRV Wave 4	NS	NS	NS
Age Wave 1 → FHD Wave 1	0.33	1.39	.000
Age Wave 2 → FHD Wave 2	0.31	1.37	.000
Age Wave 3 → FHD Wave 3	NS	NS	NS
Age Wave 4 → FHD Wave 4	NS	NS	NS
Age Wave 1 → PRV Wave 1	NS	NS	NS
Age Wave 2 → PRV Wave 2	NS	NS	NS
Age Wave 3 → PRV Wave 3	NS	NS	NS
Age Wave 4 → PRV Wave 4	NS	NS	NS
Income Wave 1 → FHD Wave 1	NS	NS	NS

Income Wave 1 → FHD Wave 2	NS	NS	NS
Income Wave 3 → FHD Wave 3	NS	NS	NS
Income Wave 4 → FHD Wave 4	NS	NS	NS
Income Wave 1 → PRV Wave 1	-0.06	0.94	.003
Income Wave 2 → PRV Wave 2	-0.08	0.93	.001
Income Wave 3 → PRV Wave 3	NS	NS	NS
Income Wave 4 → PRV Wave 4	-0.09	0.91	.002
Indirect Effects			
CM → FHD Wave 1*FHD Wave 1→ PRV Wave 1	0.01	1.01	.025
CM → FHD Wave 2*FHD Wave 2→ PRV Wave 2	NS	NS	NS
CM → FHD Wave 3*FHD Wave 3→ PRV Wave 3	NS	NS	NS
CM → FHD Wave 4*FHD Wave 4→ PRV Wave 4	NS	NS	NS
Intercepts			
FHD Wave 1	1.53	4.62	.000
FHD Wave 2	2.44	11.47	.000
FHD Wave 3	3.80	44.70	.000
FHD Wave 4	3.72	41.31	.000
PRV Wave 1	-1.23	0.29	.000
PRV Wave 2	-1.53	0.22	.000
PRV Wave 3	-2.11	0.12	.000

PRV Wave 4	-1.52	0.22	.000

Note. Final adjusted model examining the influence of child maltreatment on physical revictimization through contemporaneous mediation by the frequency of heaving drinking. All endogenous variables were specified with a Poisson distribution. Unadjusted parameter estimates are expected differences in log counts. When exponentiated, the intercept represents an expected count and the slope represents a ratio of expected counts, or an incident rate ratio. In addition, all predictors are also interpreted as ratios of expected counts, or incident rate ratios, and, therefore, their influence on the intercept can be seen by looking at the product of the intercept and the value of the predictor. All non-significant paths were set to zero in this model.

AIC = 273839.14

Table 6

Unadjusted Parameter Estimates for Model in Figure 14

Parameter Estimate	Unstandardized	Exp(b)	*P*
Structural Model			
CM → FHD Wave1	0.57	1.76	.000
CM → FHD Wave 2	-0.19	0.83	.080
CM → FHD Wave 3	0.07	1.07	.309
CM → FHD Wave 4	-0.06	0.94	.383
CM → PRV Wave 1	0.37	1.45	.000
CM → PRV Wave 2	0.11	1.12	.280
CM → PRV Wave 3	0.45	1.56	.001
CM → PRV Wave 4	0.42	1.51	.004
FHD Wave 1 → PRV Wave 1	0.02	1.02	.000
FHD Wave 2 → PRV Wave 2	0.01	1.01	.000
FHD Wave 3 → PRV Wave 3	0.01	1.01	.000
FHD Wave 4 → PRV Wave 4	0.00	1.00	.872
FHD Wave 1 → FHD Wave 2	0.03	1.03	.000
FHD Wave 2 → FHD Wave 3	0.01	1.01	.000

FHD Wave 3 → FHD Wave 4	0.01	1.01	.000
PRV Wave 1 → PRV Wave 2	0.71	2.03	.000
PRV Wave 2 → PRV Wave 3	0.57	1.76	.000
PRV Wave 3 → PRV Wave 4	0.45	1.57	.000
Covariates			
Age Wave 1 → FHD Wave 1	0.33	1.39	.000
Age Wave 2 → FHD Wave 2	0.15	1.17	.000
Age Wave 3 → FHD Wave 3	-0.02	0.98	.150
Age Wave 4 → FHD Wave 4	-0.04	0.96	.071
Indirect Effects			
CM → FHD Wave 1*FHD Wave 1→ PRV Wave 1	0.01	1.01	.000
CM → FHD Wave 2*FHD Wave 2→ PRV Wave 2	-0.00	1.00	.094
CM → FHD Wave 3*FHD Wave 3→ PRV Wave 3	0.00	1.00	.325
CM → FHD Wave 4*FHD Wave 4→ PRV Wave 4	0.00	1.00	.875
Intercepts			
FHD Wave 1	1.64	5.16	.000
FHD Wave 2	1.99	7.28	.000
FHD Wave 3	3.43	30.81	.000
FHD Wave 4	2.82	16.84	.000
PRV Wave 1	-1.30	0.28	.000

PRV Wave 2	-1.98	0.14	.000
PRV Wave 3	-2.38	0.09	.000
PRV Wave 4	-1.88	0.15	.000

Note. Note. Unadjusted, autoregressive model examining the influence of child maltreatment on physical revictimization through contemporaneous mediation by the frequency of heaving drinking. All endogenous variables were specified with a Poisson distribution. Unadjusted parameter estimates are expected differences in log counts. When exponentiated, the intercept represents an expected count and the slope represents a ratio of expected counts, or an incident rate ratio. In addition, all predictors are also interpreted as ratios of expected counts, or incident rate ratios, and, therefore, their influence on the intercept can be seen by looking at the product of the intercept and the value of the predictor.

AIC = 419767.24

Table 7

Adjusted Parameter Estimates for Model in Figure 15

Parameter Estimate	Unstandardized	Exp(b)	*p*
Structural Model			
CM → FHD Wave1	0.33	1.39	.026
CM → FHD Wave 2	NS	NS	NS
CM → FHD Wave 3	NS	NS	NS
CM → FHD Wave 4	NS	NS	NS
CM → PRV Wave 1	0.42	1.52	.000
CM → PRV Wave 2	NS	NS	NS
CM → PRV Wave 3	0.45	1.57	.017
CM → PRV Wave 4	0.46	1.58	.013
FHD Wave 1 → PRV Wave 1	0.02	1.02	.000
FHD Wave 2 → PRV Wave 2	0.01	1.01	.000
FHD Wave 3 → PRV Wave 3	0.01	1.01	.001
FHD Wave 4 → PRV Wave 4	NS	NS	NS
FHD Wave 1 → FHD Wave 2	0.03	1.03	.000
FHD Wave 2 → FHD Wave 3	0.01	1.01	.000

FHD Wave 3 → FHD Wave 4	0.01	1.01	.000
PRV Wave 1 → PRV Wave 2	0.67	1.95	.000
PRV Wave 2 → PRV Wave 3	0.44	1.56	.000
PRV Wave 3 → PRV Wave 4	0.23	1.25	.015
Covariates			
Sex → FHD Wave 1	NS	NS	NS
Sex → FHD Wave 2	-0.28	0.76	.010
Sex → FHD Wave 3	-0.87	0.42	.000
Sex → FHD Wave 4	-0.45	0.64	.000
Sex → PRV Wave 1	-0.74	0.48	.000
Sex → PRV Wave 2	-0.43	0.65	.001
Sex → PRV Wave 3	-0.87	0.42	.000
Sex → PRV Wave 4	-0.91	0.40	.000
Parental Alcoholism → FHD Wave 1	0.38	1.46	.003
Parental Alcoholism → FHD Wave 2	NS	NS	NS
Parental Alcoholism → FHD Wave 3	NS	NS	NS
Parental Alcoholism → FHD Wave 4	0.20	1.22	.045
Parental Alcoholism → PRV Wave 1	0.26	1.29	.017
Parental Alcoholism → PRV Wave 2	NS	NS	NS
Parental Alcoholism → PRV Wave 3	NS	NS	NS

Parental Alcoholism → PRV Wave 4	NS	NS	NS
PPVT → FHD Wave 1	NS	NS	NS
PPVT → FHD Wave 2	NS	NS	NS
PPVT → FHD Wave 3	0.01	1.01	.010
PPVT → FHD Wave 4	NS	NS	NS
PPVT → PRV Wave 1	NS	NS	NS
PPVT → PRV Wave 2	NS	NS	NS
PPVT → PRV Wave 3	NS	NS	NS
PPVT → PRV Wave 4	-0.02	0.98	.005
Highest Education → FHD Wave 1	-0.16	0.85	.000
Highest Education → FHD Wave 2	-0.08	0.93	.019
Highest Education → FHD Wave 3	0.06	1.06	.008
Highest Education → FHD Wave 4	NS	NS	NS
Highest Education → PRV Wave 1	-0.18	0.83	.000
Highest Education → PRV Wave 2	-0.11	0.89	.004
Highest Education → PRV Wave 3	-0.25	0.78	.000
Highest Education → PRV Wave 4	NS	NS	NS
Age Wave 1 → FHD Wave 1	0.33	1.39	.000
Age Wave 2 → FHD Wave 2	0.15	1.16	.000
Age Wave 3 → FHD Wave 3	-0.05	0.95	.026

Age Wave 4 → FHD Wave 4	NS	NS	NS
Age Wave 1 → PRV Wave 1	NS	NS	NS
Age Wave 2 → PRV Wave 2	NS	NS	NS
Age Wave 3 → PRV Wave 3	-0.15	0.86	.003
Age Wave 4 → PRV Wave 4	NS	NS	NS
Income Wave 1 → FHD Wave 1	NS	NS	NS
Income Wave 1 → FHD Wave 2	NS	NS	NS
Income Wave 3 → FHD Wave 3	NS	NS	NS
Income Wave 4 → FHD Wave 4	NS	NS	NS
Income Wave 1 → PRV Wave 1	-0.06	0.94	.002
Income Wave 2 → PRV Wave 2	-0.06	0.94	.004
Income Wave 3 → PRV Wave 3	NS	NS	NS
Income Wave 4 → PRV Wave 4	-0.08	0.92	.005
Indirect Effects			
CM → FHD Wave 1*FHD Wave 1→ PRV Wave 1	0.01	1.01	.025
CM → FHD Wave 2*FHD Wave 2→ PRV Wave 2	NS	NS	NS
CM → FHD Wave 3*FHD Wave 3→ PRV Wave 3	NS	NS	NS
CM → FHD Wave 4*FHD Wave 4→ PRV Wave 4	NS	NS	NS
Intercepts			
FHD Wave 1	1.53	4.62	.000

FHD Wave 2	2.08	8.03	.000
FHD Wave 3	3.67	39.13	.000
FHD Wave 4	3.07	21.61	.000
PRV Wave 1	-1.23	0.29	.000
PRV Wave 2	-1.93	0.15	.000
PRV Wave 3	-2.33	0.10	.000
PRV Wave 4	-1.58	0.21	.000

Note. Final adjusted, autoregressive model examining the influence of child maltreatment on physical revictimization through contemporaneous mediation by the frequency of heaving drinking. All endogenous variables were specified with a Poisson distribution. Unadjusted parameter estimates are expected differences in log counts. When exponentiated, the intercept represents an expected count and the slope represents a ratio of expected counts, or an incident rate ratio. In addition, all predictors are also interpreted as ratios of expected counts, or incident rate ratios, and, therefore, their influence on the intercept can be seen by looking at the product of the intercept and the value of the predictor. All non-significant paths were set to zero in this model.

AIC = 252462.44

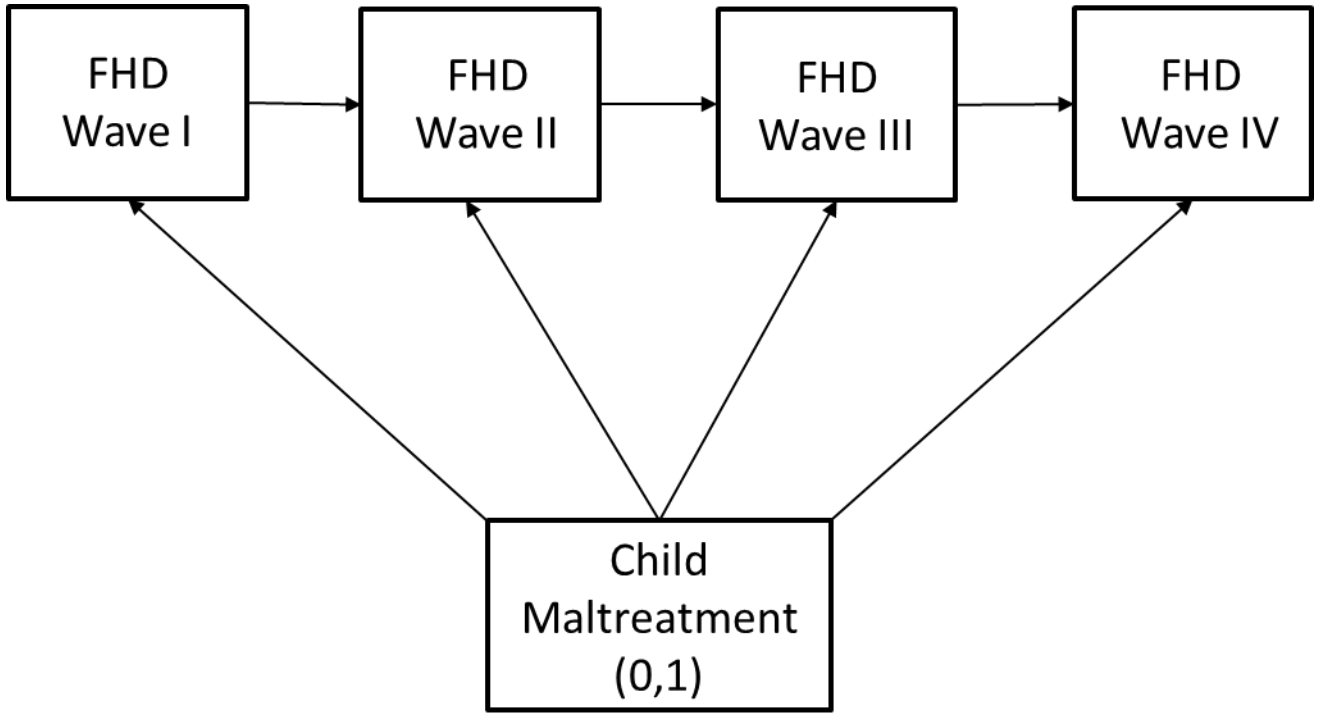


Figure 1. A conceptual model showing the effect of child maltreatment on growth of FHD (Frequency of Heavy Drinking).

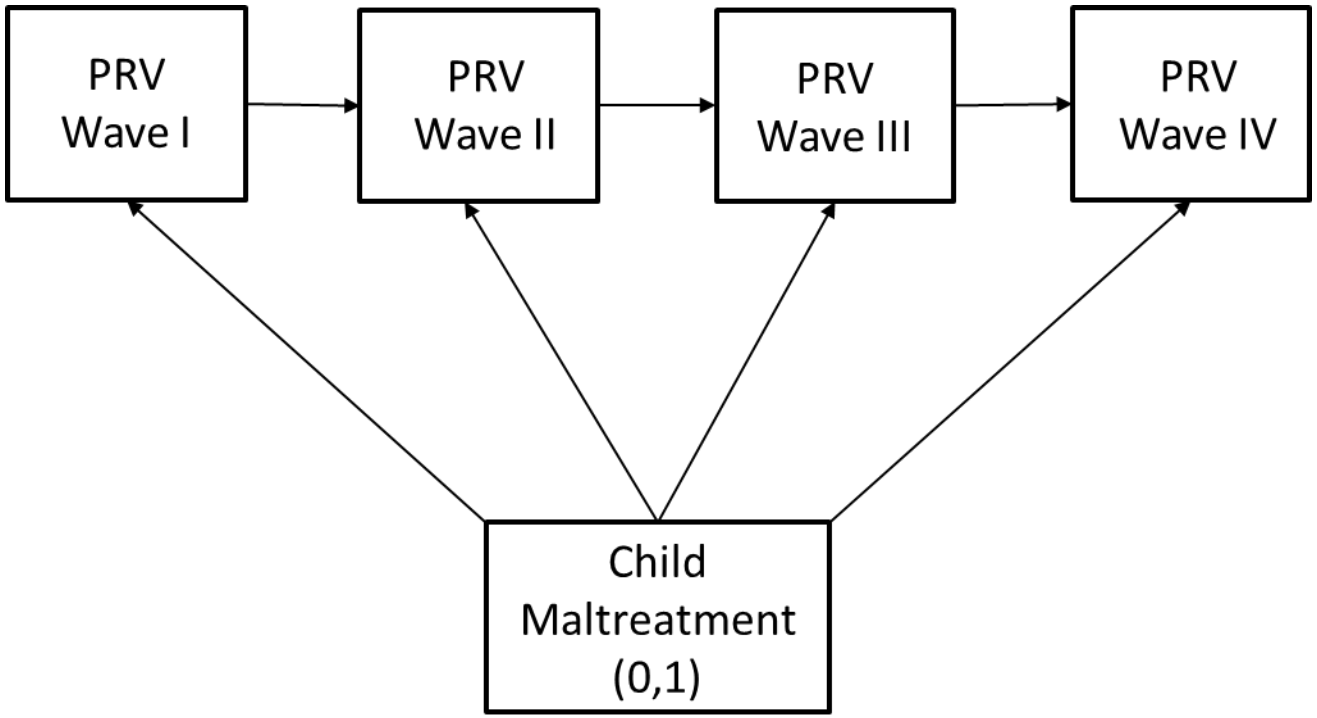


Figure 2. A conceptual model showing the effect of child maltreatment on growth of PRV (Physical Revictimization).

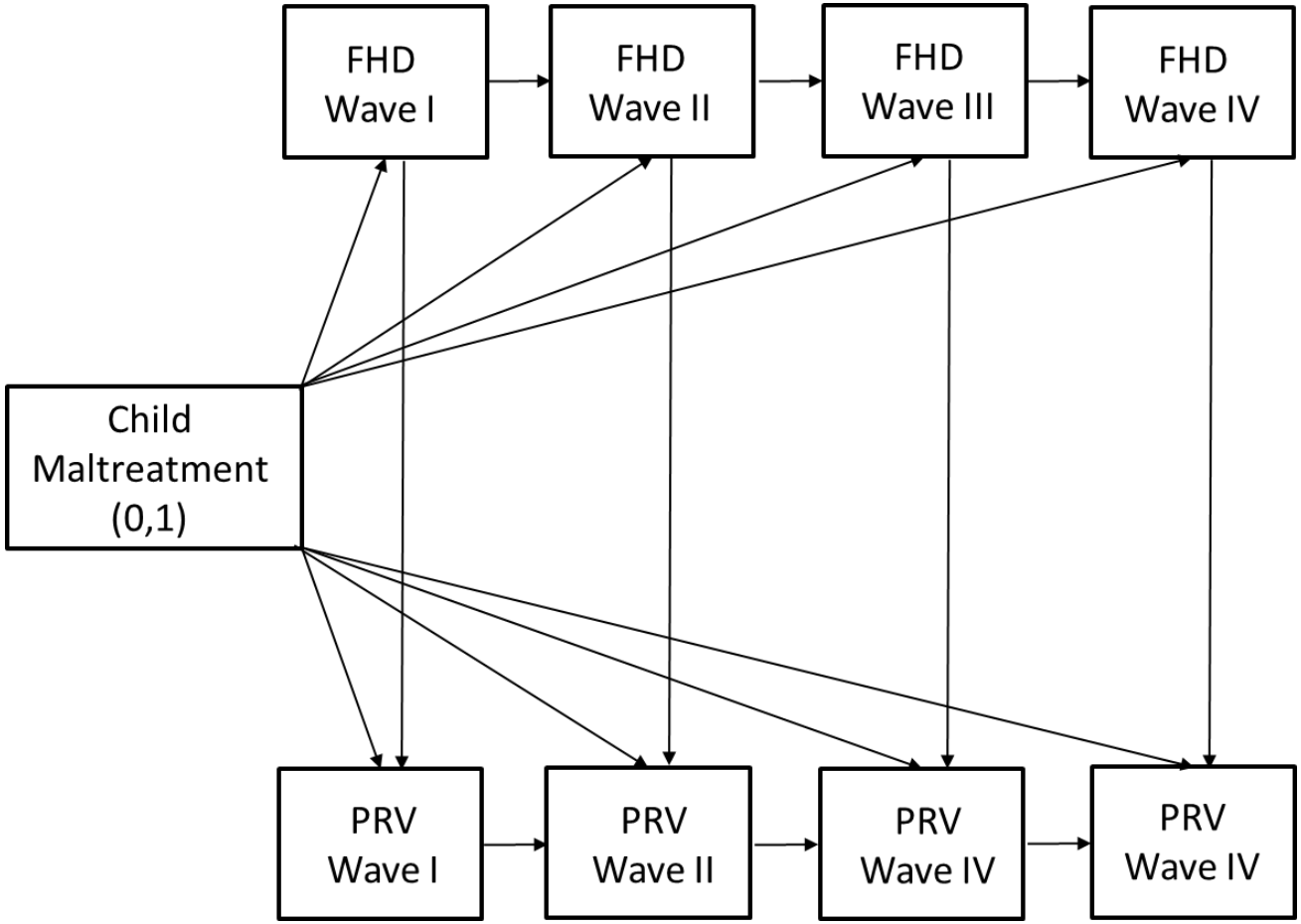


Figure 3. A conceptual autoregressive model with contemporaneous mediation showing the effect of child maltreatment on PRV (Physical Revictimization) through FHD (Frequency of Heavy Drinking).

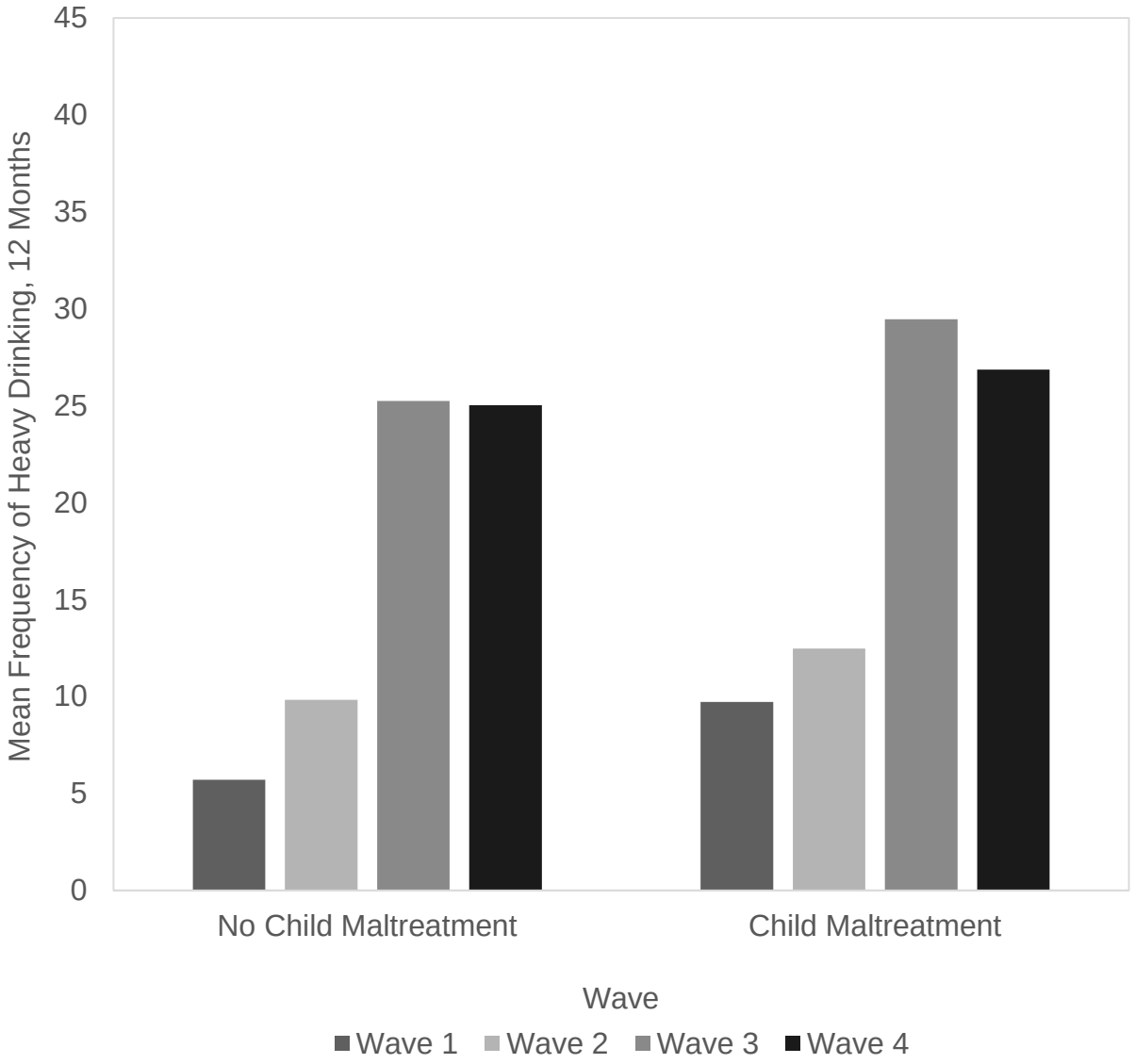


Figure 4. Mean frequency of heavy drinking across Waves I-IV, comparing those with and without child maltreatment. All means are weighted and account for the complex survey design.

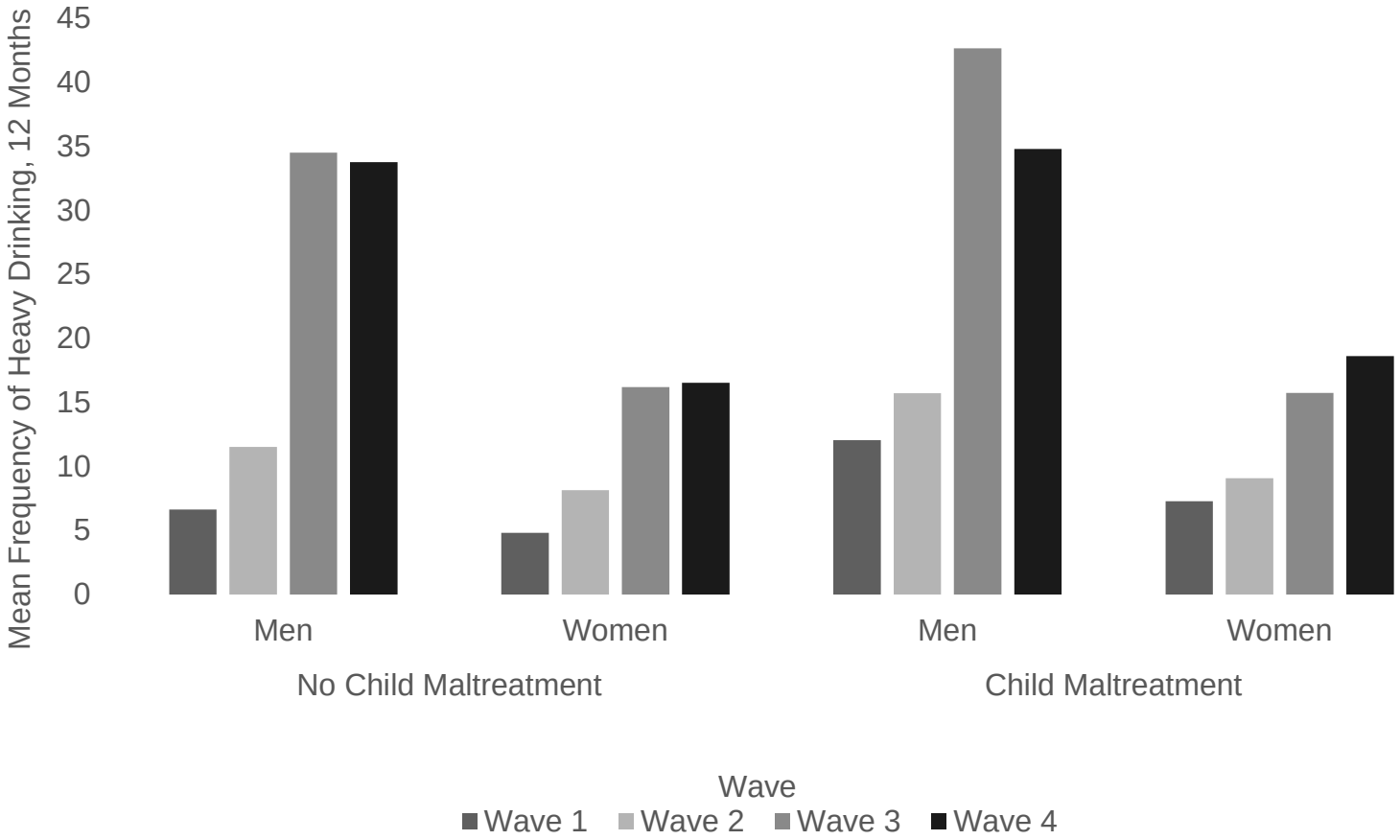


Figure 5. Mean frequency of heavy drinking for men and women across Waves I-IV, comparing those with and without child maltreatment. All means are weighted and account for the complex survey design.

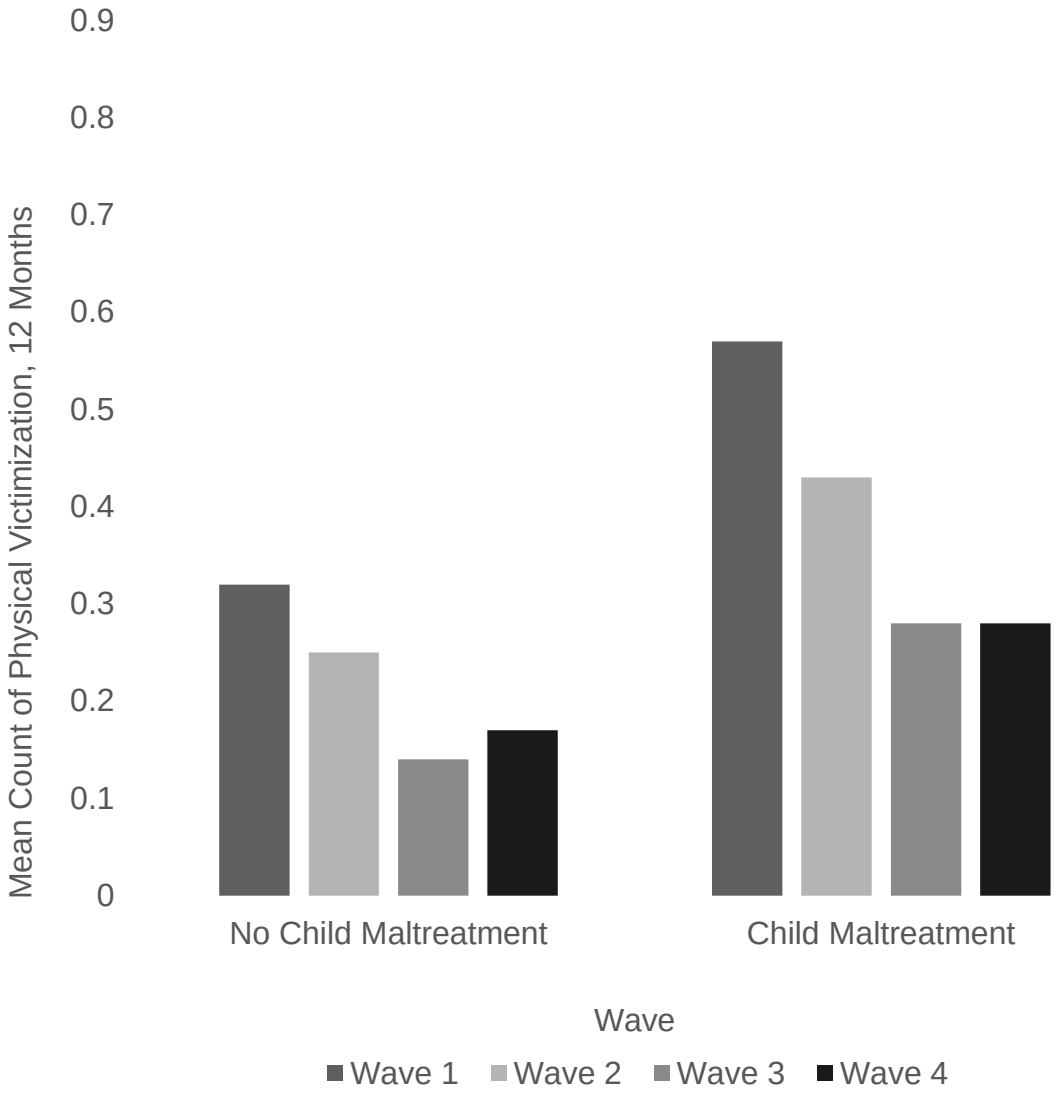


Figure 6. Mean count of physical (re)victimization types across Waves I-IV, comparing those with and without child maltreatment. All means are weighted and account for the complex survey design.

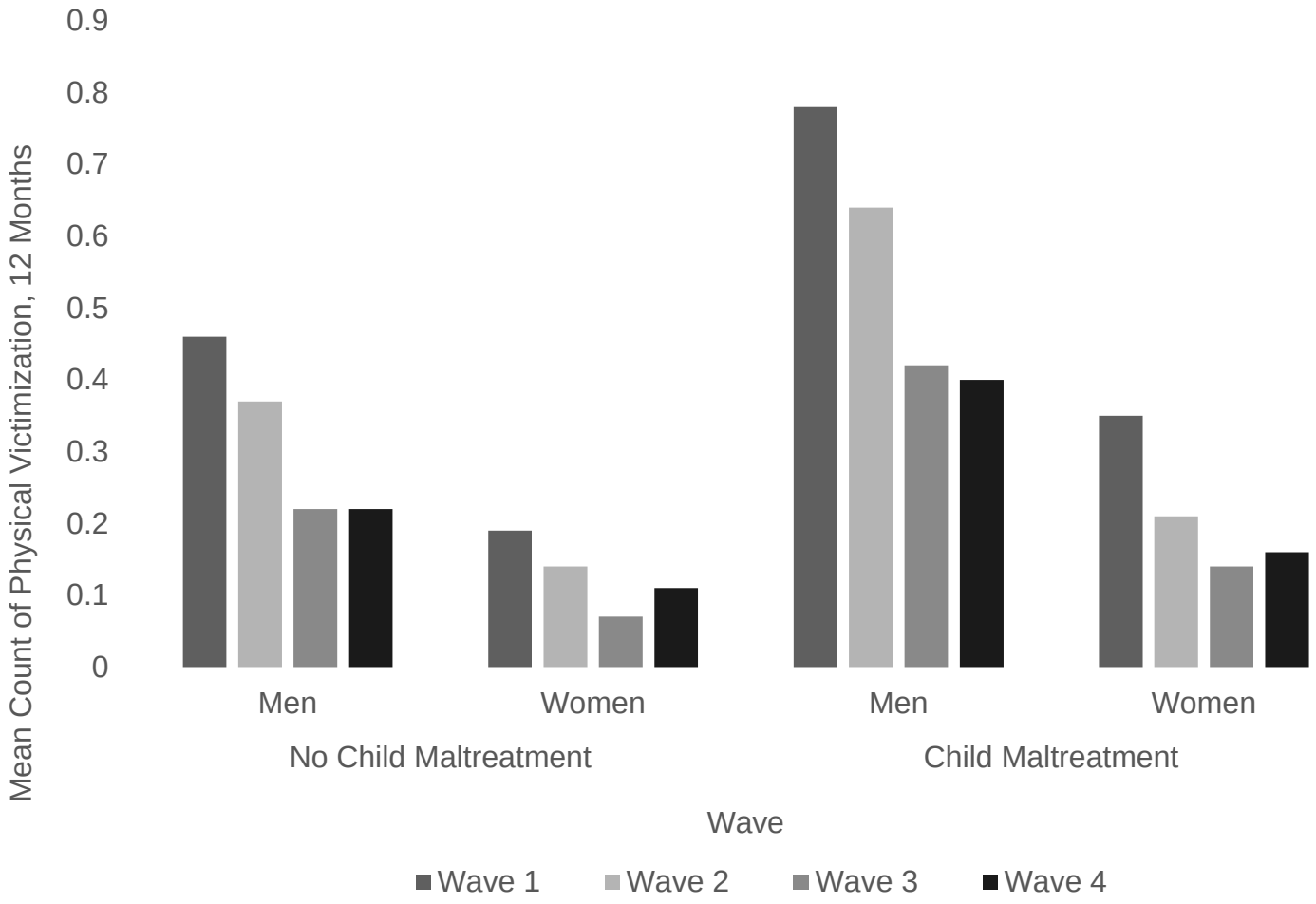


Figure 7. Mean count of physical (re)victimization types across Waves I-IV for men and women, comparing those with and without child maltreatment. All means are weighted and account for the complex survey design

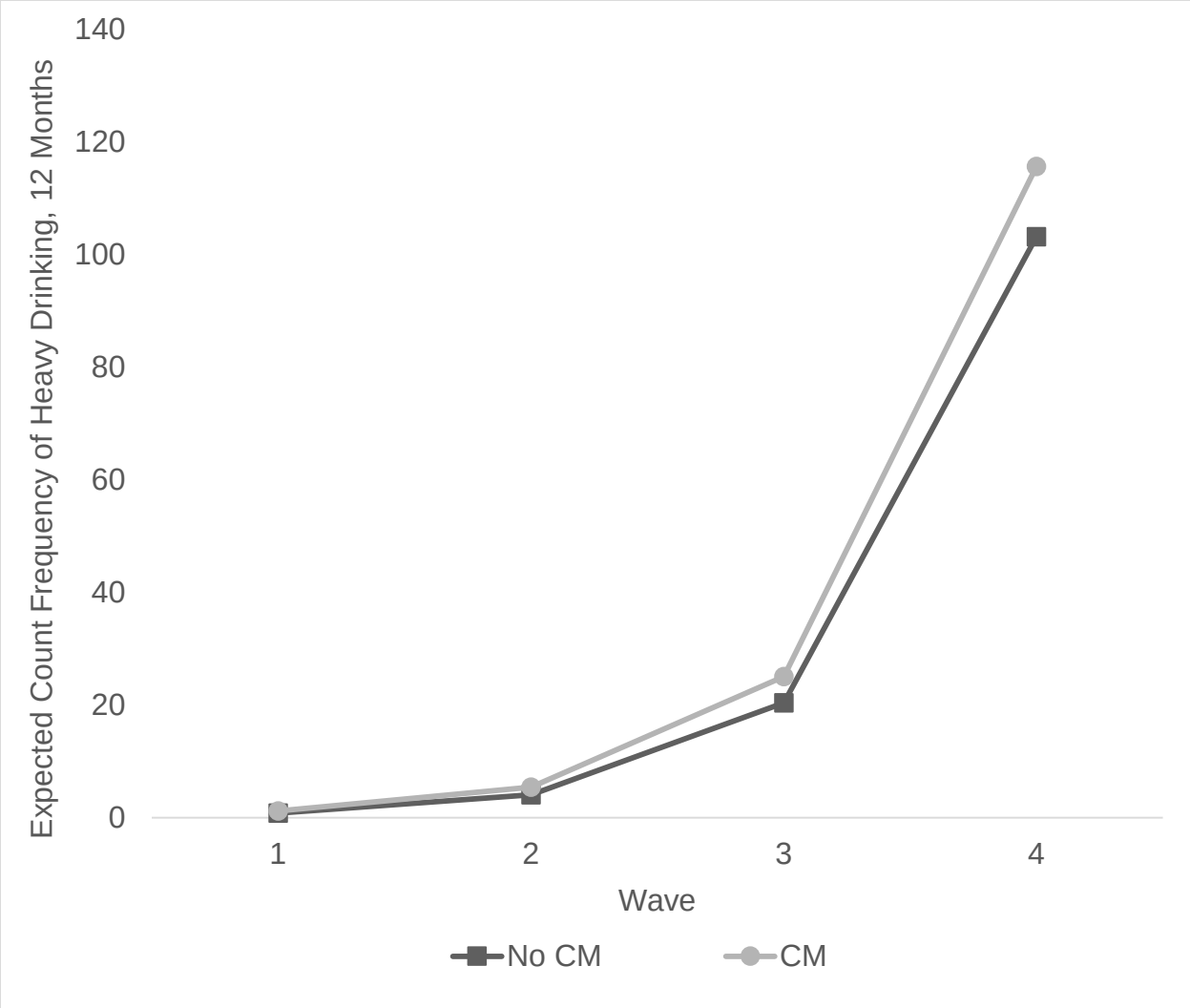


Figure 8. Estimated prototypical heavy drinking trajectories for those with and without child maltreatment. All estimates account for the complex survey design and all significant covariates (non-significant covariates were dropped for model parsimony). Based on the depicted trajectories, the expected count for heavy drinking at Wave I was 47% higher for those with child maltreatment than for those without. In addition, there was a difference in slope, such that those with child maltreatment had a slower growth in heavy drinking than those without. Ultimately, this meant that at Wave IV, those with child maltreatment had an expected count for heavy drinking that was approximately 12% higher than the expected count for those without child maltreatment.

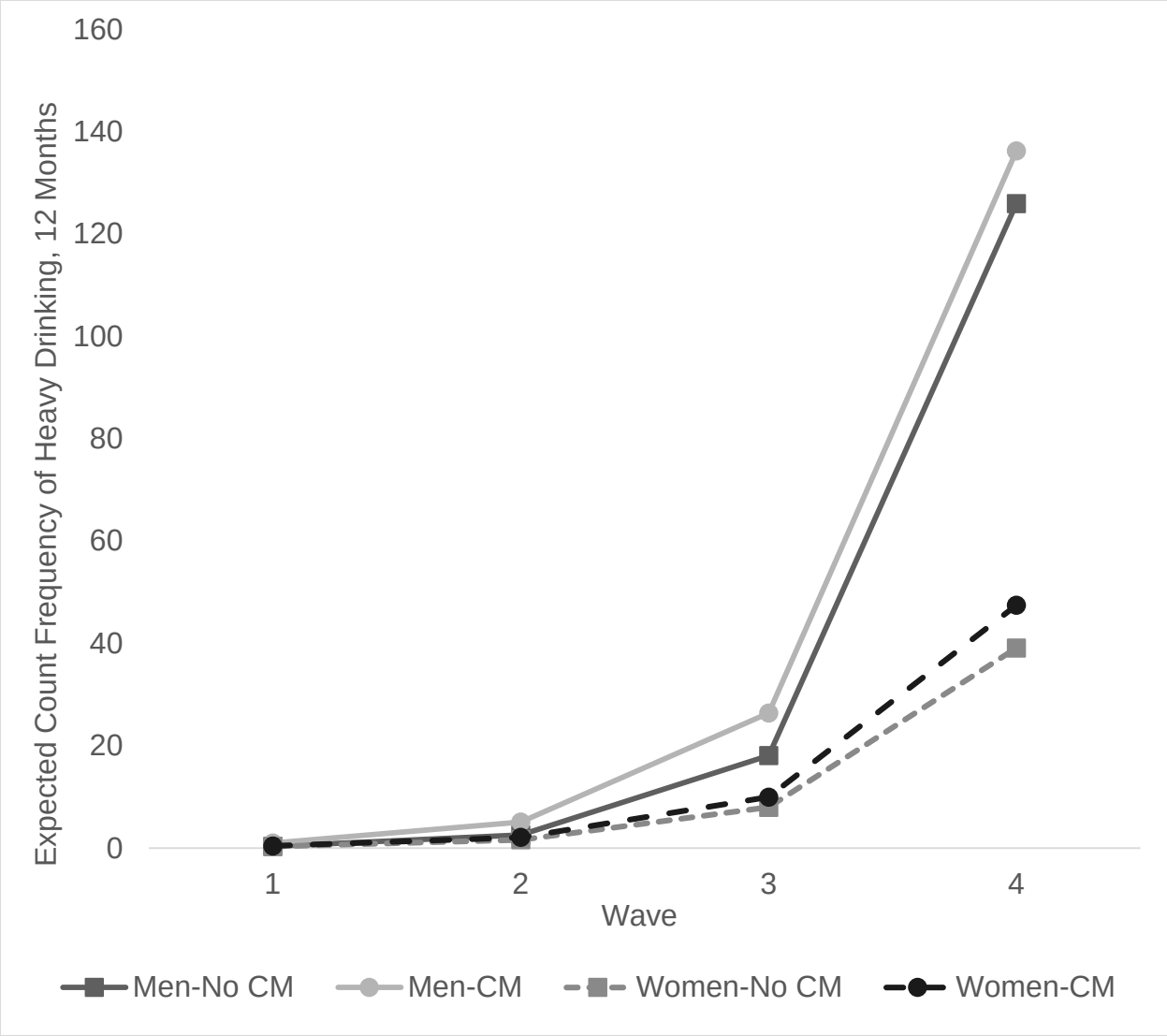


Figure 9. Estimated prototypical heavy drinking trajectories for men and women with and without child maltreatment. All estimates account for the complex survey design and all significant covariates (non-significant covariates were dropped for model parsimony). Overall, the depicted trajectories show that the expected count for heavy drinking for men was higher than it was for women. Within sex differences indicated the impact of child maltreatment on heavy drinking was different for men and women. Specifically, at Wave I, child maltreatment was associated with a 167% increase in the expected count of heavy drinking for men, and a 32% increase for women. However, given that the three-way

interaction between time, sex, and child maltreatment indicated that the slope for men with child maltreatment was significantly less steep than the slope for men without child maltreatment, while the slopes for women with and without child maltreatment were more similar. These differences in slope meant that the relative differences in heavy drinking due to child maltreatment were greater for women than men by Wave IV. Specifically, at Wave IV, men with child maltreatment had an expected count for heavy drinking that was 8% higher than the expected count for men without child maltreatment. For women, the expected count for heavy drinking was 21% higher for women with child maltreatment, than for women without.

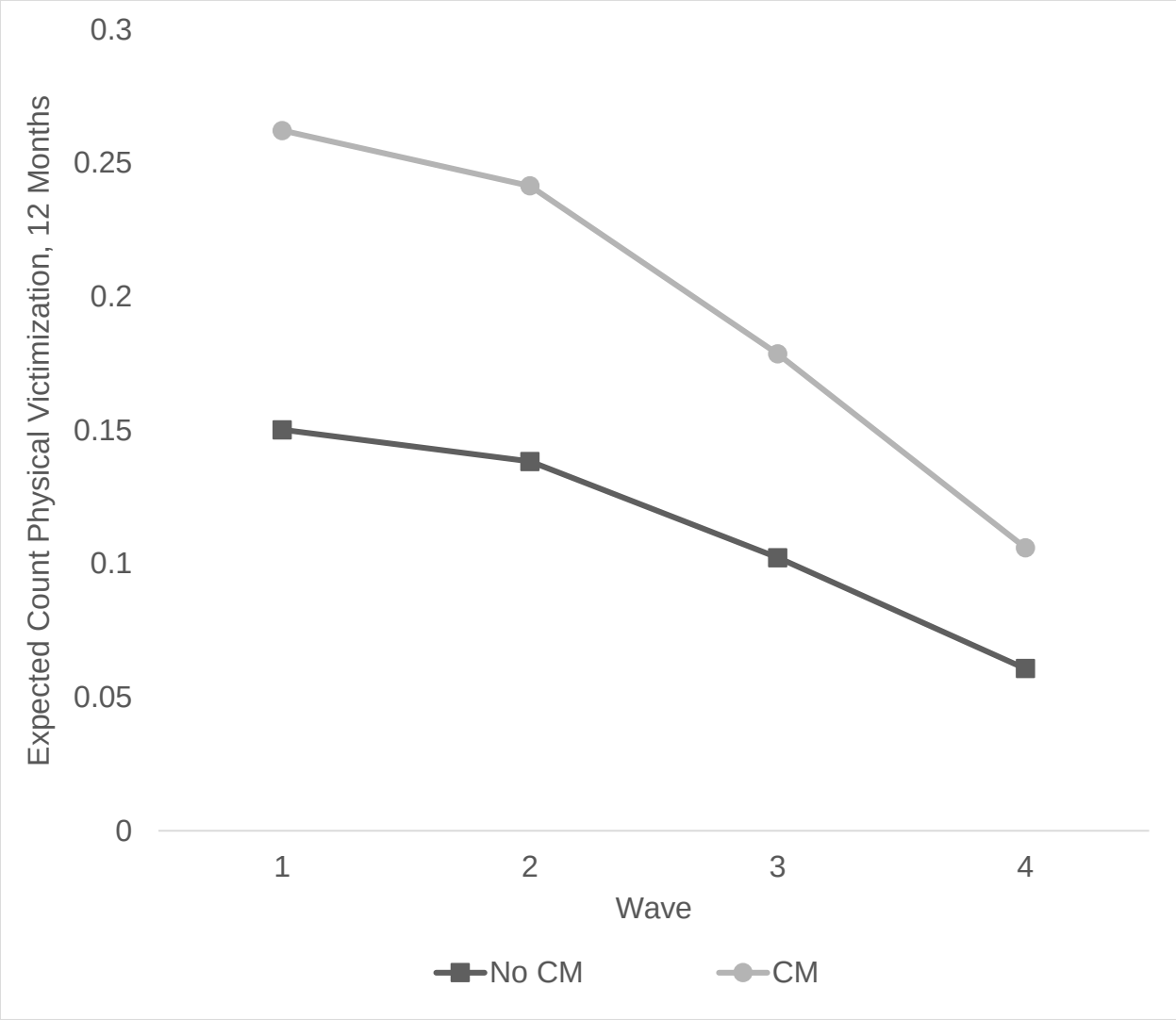


Figure 10. Estimated prototypical physical (re)victimization trajectories for those with and without child maltreatment. All estimates account for the complex survey design and all significant covariates (non-significant covariates were dropped for model parsimony). Based on the depicted trajectories, the expected count for physical (re)victimization was 74% higher for those with child maltreatment than for those without. There were no differences in slope between the two groups, and so both groups experienced an overall reduction in physical (re)victimization across the four waves.

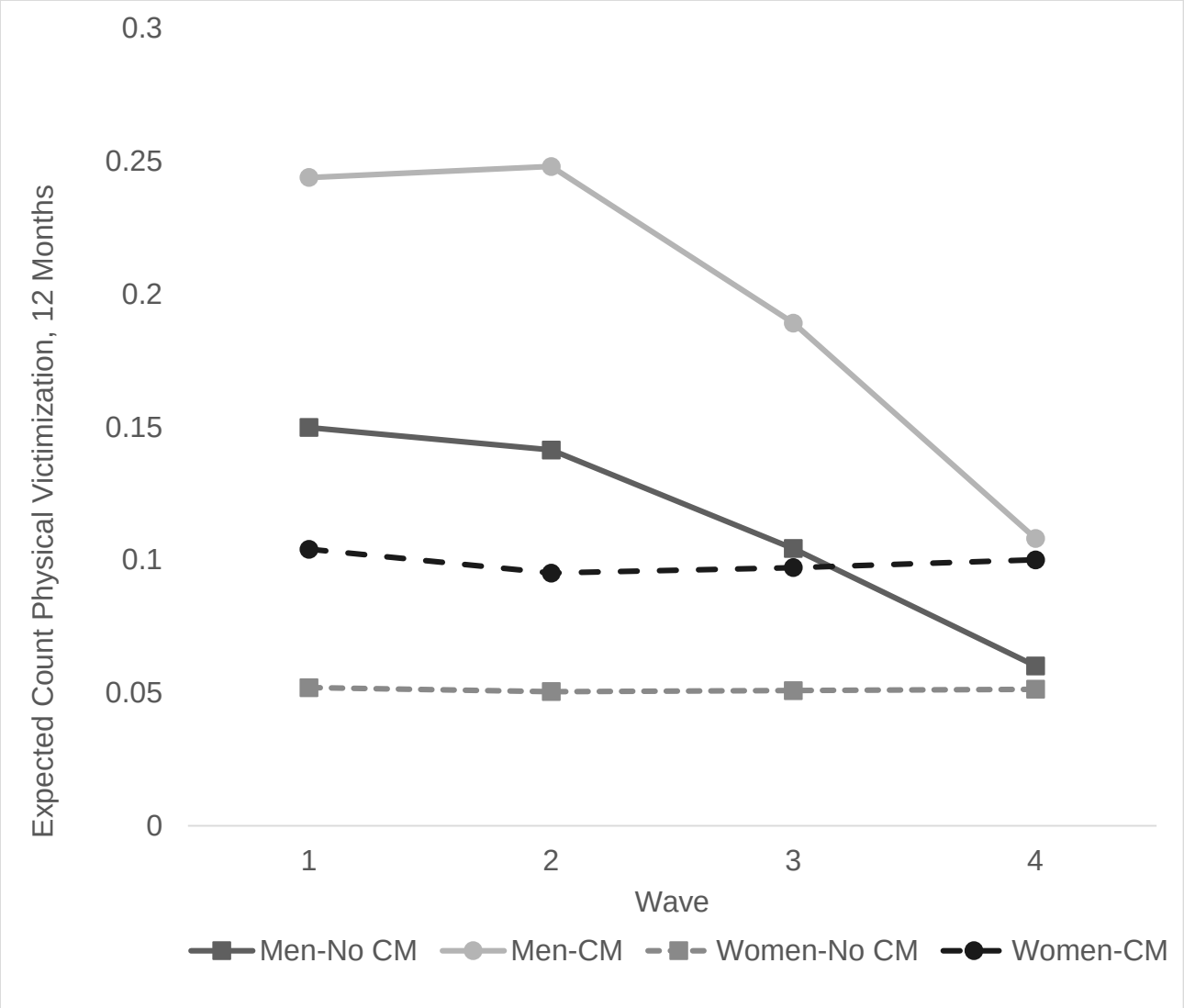


Figure 11. Estimated prototypical physical (re)victimization trajectories for men and women with and without child maltreatment. All estimates account for the complex survey design and all significant covariates (non-significant covariates were dropped for model parsimony). Overall, the depicted trajectories show that men experienced more physical (re)victimization than women. For both men and women, child maltreatment was associated with increased risk of physical (re)victimization. The plotted trajectories make it appear that women's risk of physical (re)victimization was stable across time; however, it is important to note that all two-way and three-way interactions were non-

significant; and, therefore, great caution is needed when interpreting these apparent differences in slope between men and women.

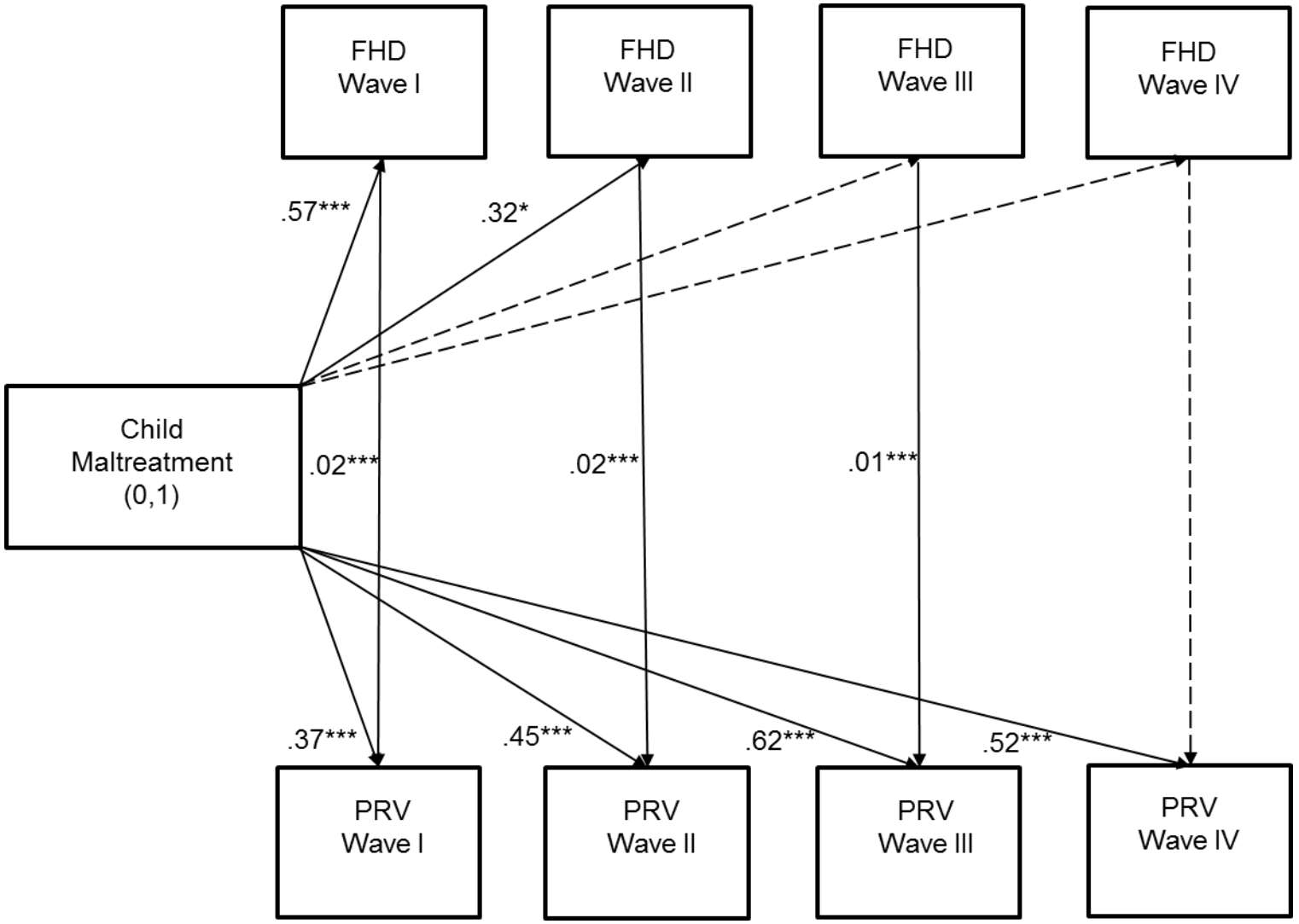


Figure 12. Unadjusted path model with contemporaneous mediation. All estimates are ratios of expected counts and account for the complex survey design. This path model indicates that child maltreatment was significantly associated with

frequency of heavy drinking (FHD) at Wave I and Wave II, while it evidenced a strong, significant relationship with physical revictimization (PRV) across all four waves. The paths between heavy drinking and physical revictimization were significant, but small, for Waves I-III, but the path was non-significant at Wave IV. The indirect path from child maltreatment to physical revictimization was tested at Waves I and II. The paths were significant at Waves I (exp(b) = 1.01, p <.001) and II (exp(b) = 1.01, p = .018), both accounting for a 1% increase in the expected count.

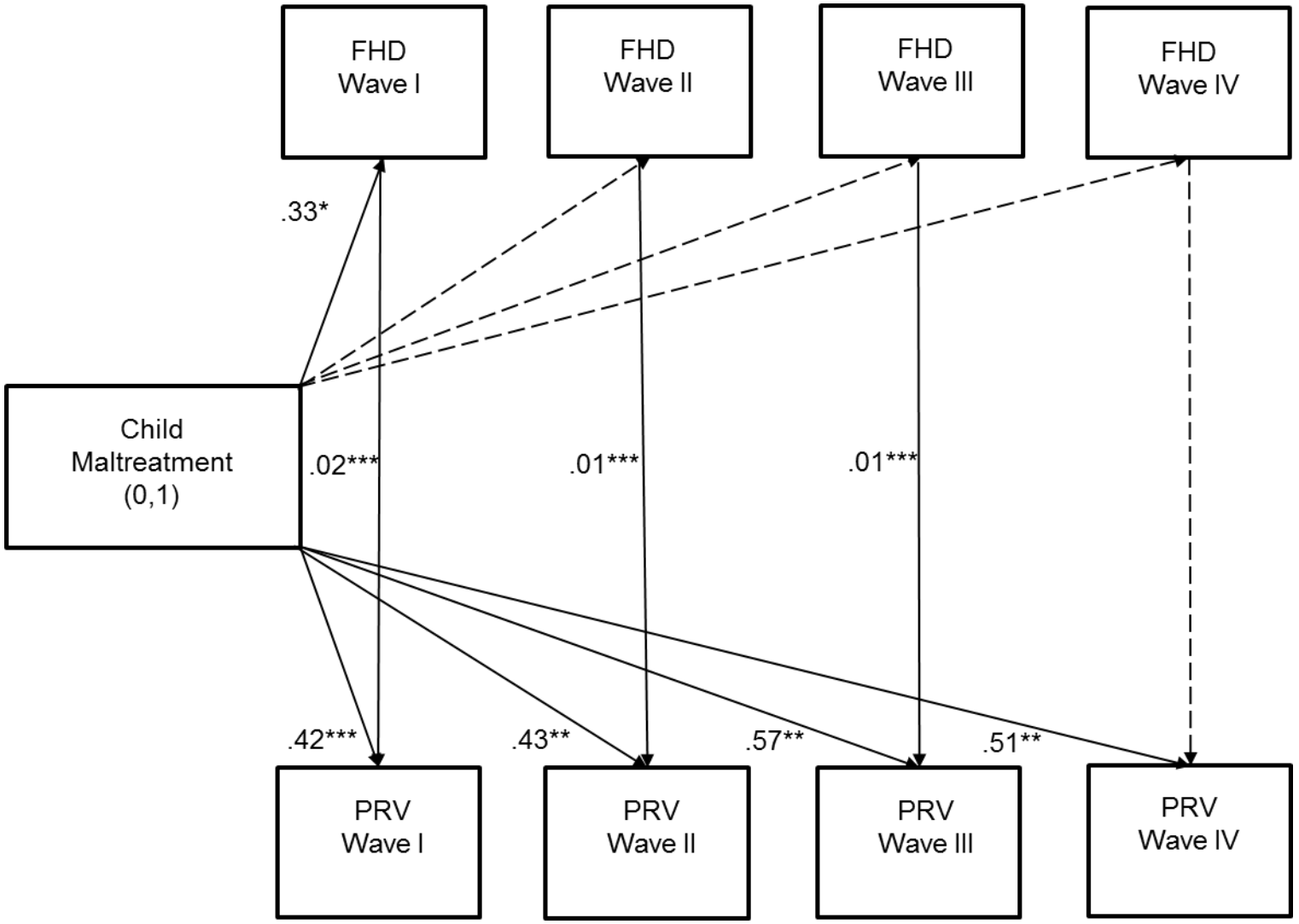


Figure 13. Adjusted path model with contemporaneous mediation. All estimates are ratios of expected counts and account for the complex survey design, as well as all significant covariates (all paths from non-significant covariates were fixed at

zero to preserve model parsimony). This path model indicates that child maltreatment was significantly associated with frequency of heavy drinking (FHD) at Wave I, while it evidenced a strong, significant relationship with physical revictimization (PRV) across all four waves. The paths between heavy drinking and physical revictimization were significant, but small, for Waves I-III, but the path was non-significant at Wave IV. The indirect path from child maltreatment to physical revictimization was tested at Wave I and was significant (exp(b) = 1.01, p = .025), accounting for a 1% increase in the expected count.

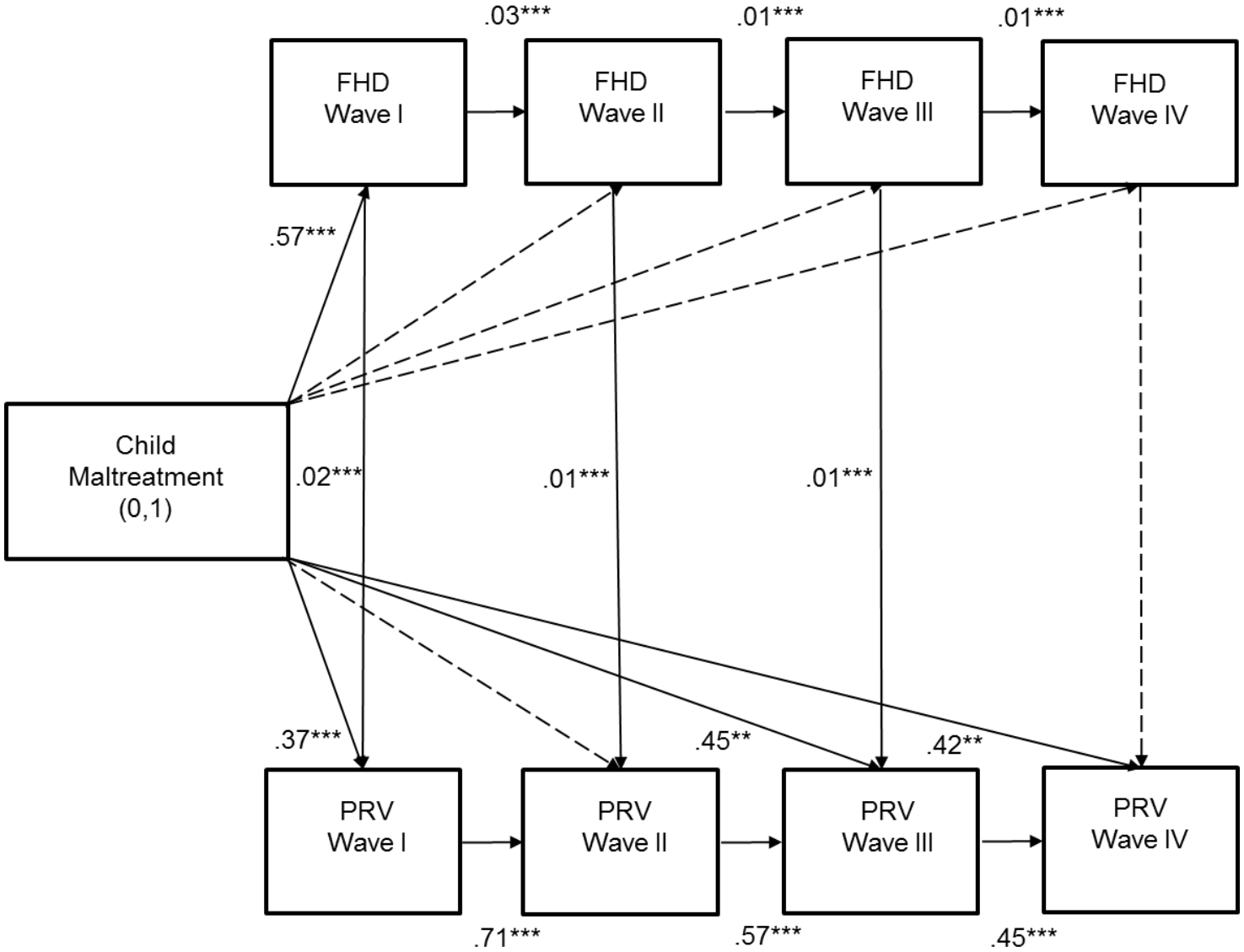


Figure 14. Unadjusted, autoregressive path model with contemporaneous mediation. All estimates are ratios of expected counts and account for the complex survey design. This path model indicates that child maltreatment was significantly

associated with frequency of heavy drinking (FHD) at Wave I while it evidenced a strong, significant relationship with physical revictimization (PRV) across three of the four waves (Waves I, III, & IV). The paths between heavy drinking and physical revictimization were significant, but small, for Waves I-III, but the path was non-significant at Wave IV. The indirect path from child maltreatment to physical revictimization was tested at Wave I and was significant (exp(b) = 1.01, p <.001), accounting for a 1% increase in the expected count.

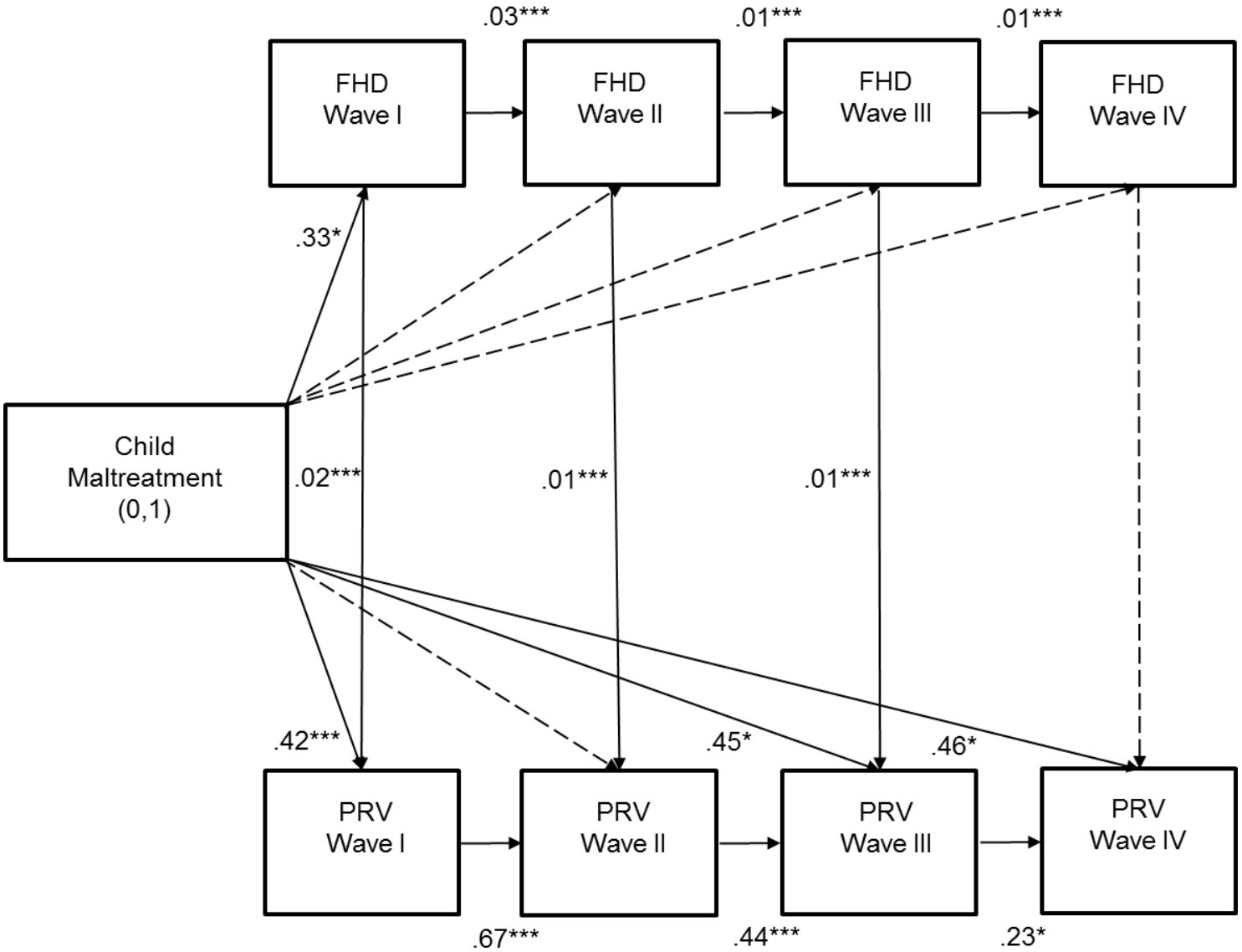


Figure 15. Adjusted, autoregressive path model with contemporaneous mediation. All estimates are ratios of expected counts and account for the complex survey design, as well as all significant covariates (all paths from non-significant

covariates were fixed at zero to preserve model parsimony). This path model indicates that child maltreatment was significantly associated with frequency of heavy drinking (FHD) at Wave I, while it evidenced a strong, significant relationship with physical revictimization (PRV) across three of the four waves (Waves I, III, & IV). The paths between heavy drinking and physical revictimization were significant, but small, for Waves I-III, but the path was non-significant at Wave IV. The indirect path from child maltreatment to physical revictimization was tested at Wave I and was significant (exp(b) = 1.01, p = .025), accounting for a 1% increase in the expected count.

APPENDIX A.

CHILD MALTREATMENT, WAVE III

1. By the time you started 6th grade, how often had your parents or other adult care-givers left you home alone when an adult should have been with you?

One time	Two times	Three to five times	Six to ten times	More than ten times	This never happened
1	2	3	4	5	6

2. How often had your parents or other adult care-givers not taken care of your basic needs, such as keeping you clean or providing food or clothing?

One time	Two times	Three to five times	Six to ten times	More than ten times	This never happened
1	2	3	4	5	6

3. How often had your parents or other adult care-givers slapped, hit, or kicked you?

One time	Two times	Three to five times	Six to ten times	More than ten times	This never happened
1	2	3	4	5	6

4. How often had one of your parents or other adult care-givers touched you in a sexual way, forced you to touch him or her in a sexual way, or forced you to have sexual relations?

One time	Two times	Three to five times	Six to ten times	More than ten times	This never happened
1	2	3	4	5	6

APPENDIX B.

CHILD MALTREATMENT, WAVE IV

These next questions are about how often certain experiences happened while you were growing up, that is, before your 18th birthday.

1. Before your 18th birthday, how often did a parent or adult caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved? (H4MA1)

One time	Two times	Three to five times	Six to ten times	More than ten times	This never happened
1	2	3	4	5	6

   a. How old were you the first time this happened? (H4MA2)

2. Before you 18th birthday, how often did a parent or adult caregiver hit you with a fist, kick you, or throw you down on to the floor, into a wall, or down stairs? (H4MA3)

One time	Two times	Three to five times	Six to ten times	More than ten times	This never happened
1	2	3	4	5	6

   a. How old were you the first time this happened? (H4MA4)

3. Before your 18th birthday, how often did a parent or adult caregiver touch you in a sexual way, force you to touch him or her in a sexual way, or force you to have sexual relations? (H4MA5)

One time	Two times	Three to five times	Six to ten times	More than ten times	This never happened
1	2	3	4	5	6

   a. How old were you the first time this happened? (H4MA6)

APPENDIX C.

PROBLEM ALCOHOL USE, WAVES I-IV

The next question ask about your experiences with tobacco, alcohol, and drugs. Remember, your answers will not be linked to you

1. During the past 12 months, on how many days did you drink alcohol? (H1T015, H2T019, H3TO38, H4T035)

None	1 or 2 days	3 to 12 days	2 or 3 days a month	1 or 2 days a week	3 to 5 days a week	Every day or almost every day
0	1	2	3	4	5	6

2. During the past 12 months, on how many days did you drink [5 or more/4 or more] drinks in a row? (H1T017, H2T021, H3TO40, H4T037)

None	1 or 2 days	3 to 12 days	2 or 3 days a month	1 or 2 days a week	3 to 5 days a week	Every day or almost every day
0	1	2	3	4	5	6

3. During the past 12 months, on how many days have you been drunk or very high on alcohol? (H1T018, H2T022, H3T043, H4T038)

None	1 or 2 days	3 to 12 days	2 or 3 days a month	1 or 2 days a week	3 to 5 days a week	Every day or almost every day
0	1	2	3	4	5	6

APPENDIX D.

PHYSICAL (RE)VICTIMIZATION, WAVES I-II

During the past 12 months, how often did each of the following things happen?

1. You saw someone shoot or stab another person? (H1FV1, H2FV1)

Never	Once	More than once
0	1	2

2. Someone pulled a knife or gun on you? (H1FV2, H2FV2)

Never	Once	More than once
0	1	2

3. Someone shot you? (H1FV3, H2FV3)

Never	Once	More than once
0	1	2

4. Someone stabbed you? (H1FV4, H2FV4)

Never	Once	More than once
0	1	2

5. You were jumped? (H1FV6, H2FV5)

Never	Once	More than once
0	1	2

Note. Responses will be coded dichotomously. In Wave IV, questions 3 and 4 were asked as one question (i.e., “Someone shot or stabbed you?”). Therefore, these two questions will be combined and responses will be coded positively if someone answered ‘yes’ to either question 3 or 4.

APPENDIX E.

PHYSICAL (RE)VICTIMIZATION, WAVES III-IV

Which of the following things happened in the past 12 months:

1. You saw someone shoot or stab another person? (H3DS18A, H4DS14)

No	Yes
0	1

2. Someone pulled a knife or gun on you? (H3DS18B, H3DS18C, H4DS15)

No	Yes
0	1

3. Someone shot or stabbed you? (H3DS18D, H3DS18E, H4DS16)

No	Yes
0	1

4. You were beaten up? (H3DS18F, H3DS18G, H4DS18)

No	Yes
0	1

Note. In Wave III, questions 2 and 3 were asked as two separate questions (e. g., “Someone pulled a knife on you?” and “Someone pulled a gun on you?”). Responses will be coded positively for questions 2 and 3 if someone answered ‘yes’ to either of the questions at Wave III.

APPENDIX F.

PARENTAL PROBLEM ALCOHOL USE, WAVE I

The following questions were asked to a parent in the household, preferably the [resident] mother.

1. [His/her] biological mother have alcoholism? (PC49_2)

No	Yes
0	1

1. [His/her] biological mother have alcoholism? (PC49_3)

No	Yes
0	1

APPENDIX G.

SOCIOECONOMIC STATUS, WAVE I, III & IV

Income

Wave I

1. About how much total income, did your family receive in 1994? (PA55)

Wave III

2. Including all the income sources you reported above, what was your total personal income before taxes in (2000/2001)? (H3EC2)
3. Thinking about your income and the income of everyone who lives in your household and contributes to the household budget, what was the total household income before taxes in (2000/2001)? Include all sources of income received by these household members. (H3EC6)
4. Thinking about your income and the income of your spouse or partner, and all types of income sources, what was your total household income before taxes in (2000/2001)? (H3EC8)

Wave IV

5. Thinking about your income and the income of everyone who lives in your household and contributes to the household budget, what was the total household income before taxes and deductions in (2006/2007/2008)? Include all sources of income, including non-legal sources. (H4EC1).

APPENDIX H.

SOCIOECONOMIC STATUS, WAVES III-IV

Highest Level of Education

1. What is the highest level of education that you have achieved to date? (H3ED1-H3ED8, H4ED1)

APPENDIX I.

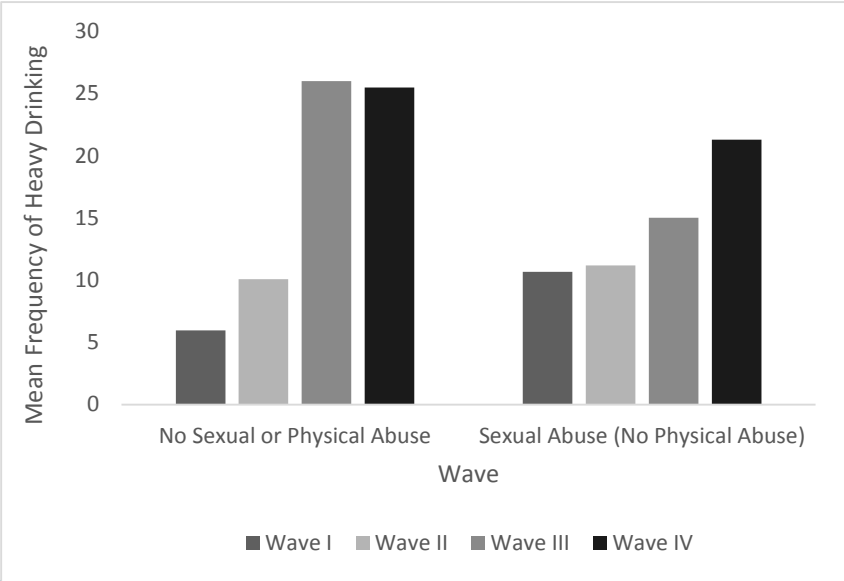
MEAN HEAVING DRINKING ACROSS THE FOUR WAVES

BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT:

SEXUAL ABUSE WITHOUT PHYSICAL ABUSE

	No Physical or Sexual Abuse (n = 2752)		Sexual Abuse (No Physical Abuse) (n=154)	
	M	(*SD*)	*M*	(*SD*)
Wave I	5.98	(14.05)	10.68	(23.77)
Wave II	10.09	(21.96)	11.2	(26.54)
Wave III	26.01	(36.59)	15.03	(29.84)
Wave IV	25.49	(35.88)	21.29	(21.29)

Note. All means and standard deviations are weighted and account for the complex survey design.



APPENDIX J.

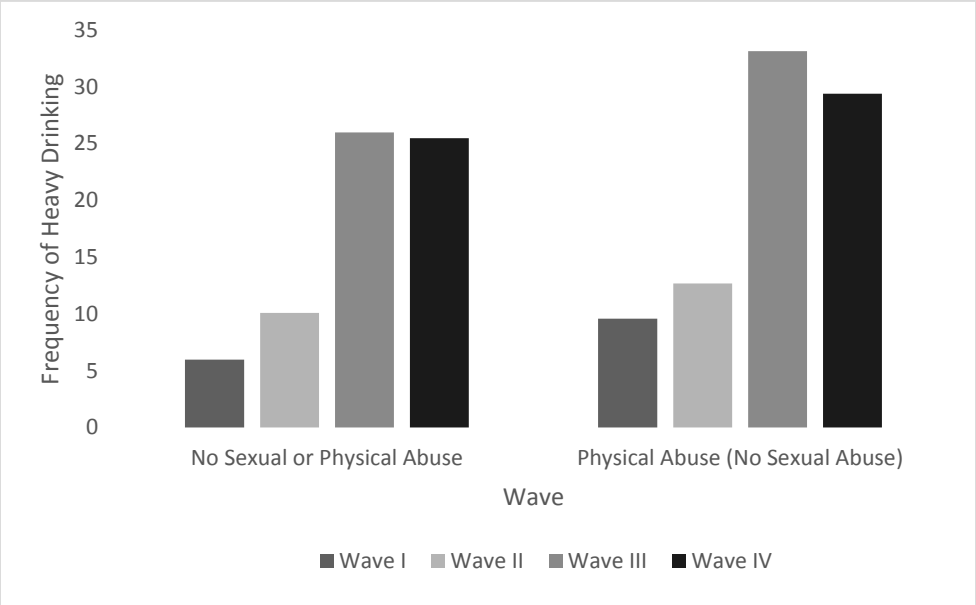
MEAN HEAVING DRINKING ACROSS THE FOUR WAVES

BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT:

PHYSICAL ABUSE WITHOUT SEXUAL ABUSE

	No Physical or Sexual Abuse (n = 2752)		Physical Abuse (No Sexual Abuse) (n=353)	
	M	(*SD*)	*M*	(*SD*)
Wave I	5.98	(14.05)	9.58	(20.87)
Wave II	10.09	(21.96)	12.70	(26.37)
Wave III	26.01	(36.59)	33.16	(42.63)
Wave IV	25.49	(35.88)	29.40	(39.20)

Note. All means and standard deviations are weighted and account for the complex survey design.



APPENDIX K.

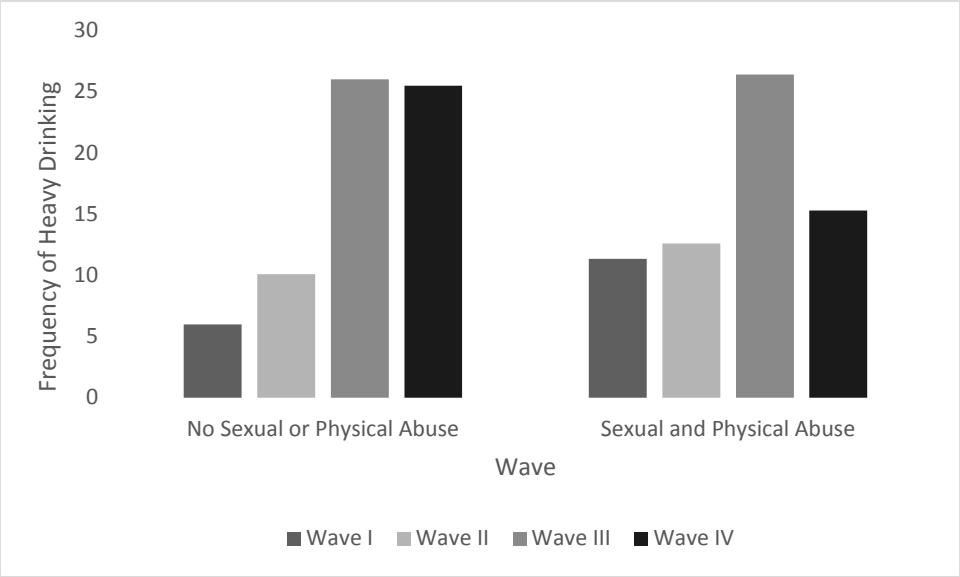
MEAN HEAVY DRINKING ACROSS THE FOUR WAVES

BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT:

SEXUAL AND PHYSICAL ABUSE

	No Physical or Sexual Abuse (n = 2752)		Sexual and Physical Abuse (n=73)	
	M	(*SD*)	*M*	(*SD*)
Wave I	5.98	(14.05)	11.34	(24.78)
Wave II	10.09	(21.96)	12.6	(26.22)
Wave III	26.01	(36.59)	26.39	(40.11)
Wave IV	25.49	(35.88)	15.28	(25.51)

Note. All means and standard deviations are weighted and account for the complex survey design.



APPENDIX L.

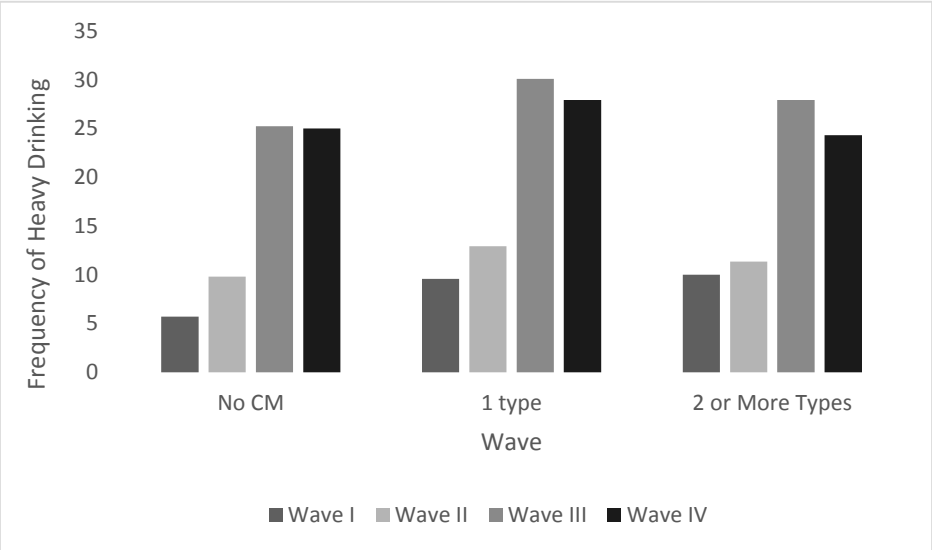
MEAN HEAVY DRINKING ACROSS THE FOUR WAVES

BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT:

COUNT OF TYPES OF MALTREATMENT

	No Maltreatment (n = 2408)		One Type (n=554)		Two or More Types (n=236)	
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)
Wave I	5.71	(13.32)	9.59	(21.21)	10.02	(22.37)
Wave II	9.82	(21.37)	12.94	(27.14)	11.35	(25.32)
Wave III	25.24	(35.49)	30.09	(43.70)	27.94	(37.28)
Wave IV	25.03	(35.34)	27.93	(39.25)	24.33	(34.78)

Note. All means and standard deviations are weighted and account for the complex survey design.

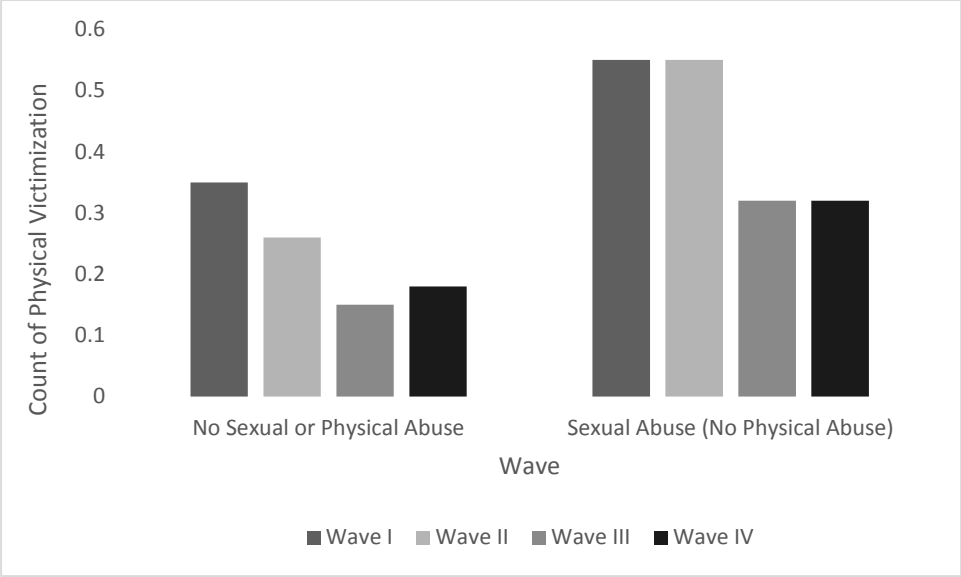


APPENDIX M.

MEAN PHYSICAL (RE)VICTIMIZATION ACROSS THE FOUR WAVES BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT: SEXUAL ABUSE WITHOUT PHYSICAL ABUSE

	No Physical or Sexual Abuse (n = 2752)		Sexual Abuse (No Physical Abuse) (n=154)	
	M	(*SD*)	*M*	(*SD*)
Wave I	0.35	(0.79)	0.55	(0.97)
Wave II	0.26	(0.68)	0.55	(1.00)
Wave III	0.15	(0.50)	0.32	(0.84)
Wave IV	0.18	(0.63)	0.32	(0.90)

Note. All means and standard deviations are weighted and account for the complex survey design.

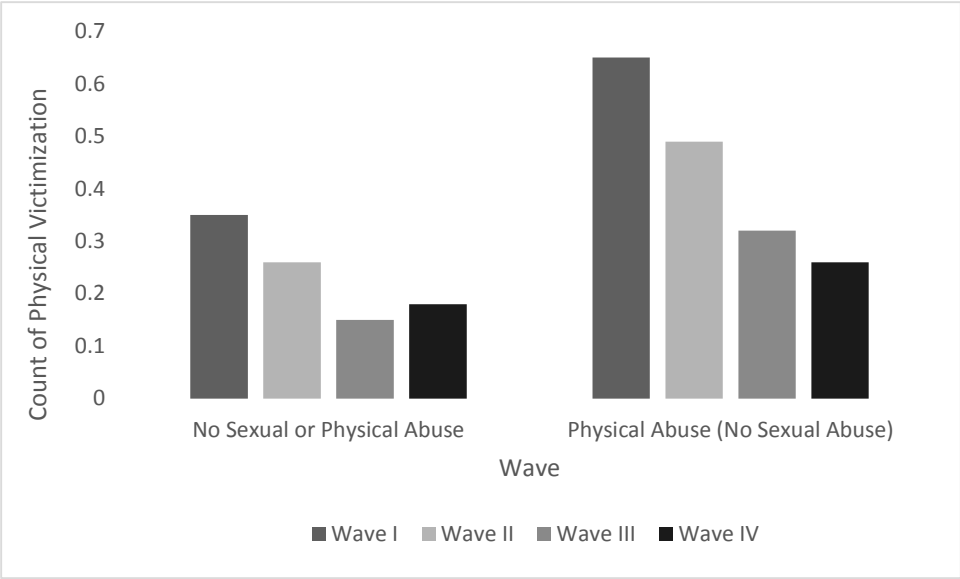


APPENDIX N.

MEAN PHYSICAL (RE)VICTIMIZATION ACROSS THE FOUR WAVES BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT: PHYSICAL ABUSE WITHOUT SEXUAL ABUSE

	No Physical or Sexual Abuse (n = 2752)		Physical Abuse (No Sexual Abuse) (n=353)	
	M	(*SD*)	*M*	(*SD*)
Wave I	0.35	(0.79)	0.65	(1.09)
Wave II	0.26	(0.68)	0.49	(0.98)
Wave III	0.15	(0.50)	0.32	(0.79)
Wave IV	0.18	(0.63)	0.26	(0.78)

Note. All means and standard deviations are weighted and account for the complex survey design.

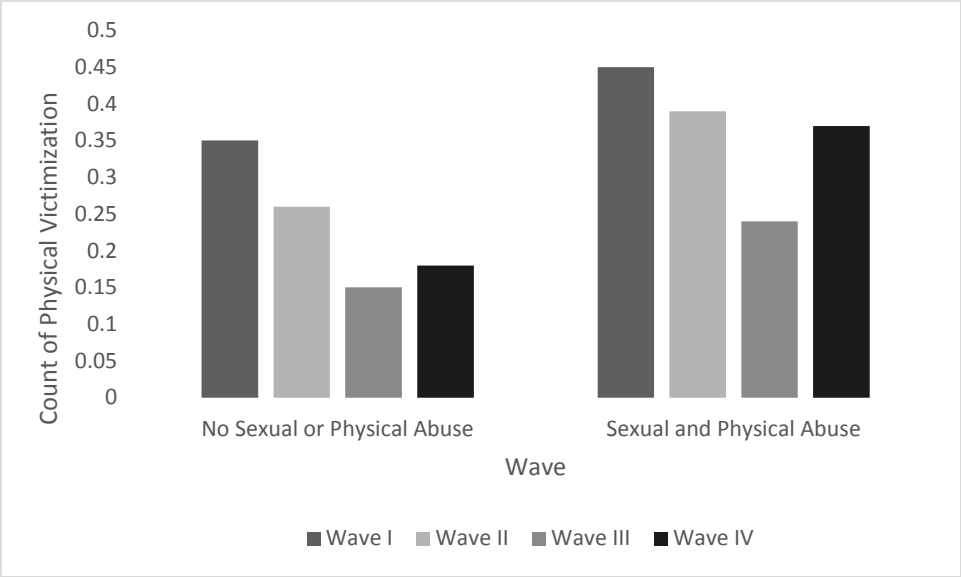


APPENDIX O.

MEAN PHYSICAL (RE)VICTIMIZATION ACROSS THE FOUR WAVES BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT: SEXUAL AND PHYSICAL ABUSE

	No Physical or Sexual Abuse (n = 2752)		Sexual and Physical Abuse (n=73)	
	M	(*SD*)	*M*	(*SD*)
Wave I	0.35	(0.79)	0.45	(0.83)
Wave II	0.26	(0.68)	0.39	(0.87)
Wave III	0.15	(0.50)	0.24	(0.66)
Wave IV	0.18	(0.63)	0.37	(0.91)

Note. All means and standard deviations are weighted and account for the complex survey design.

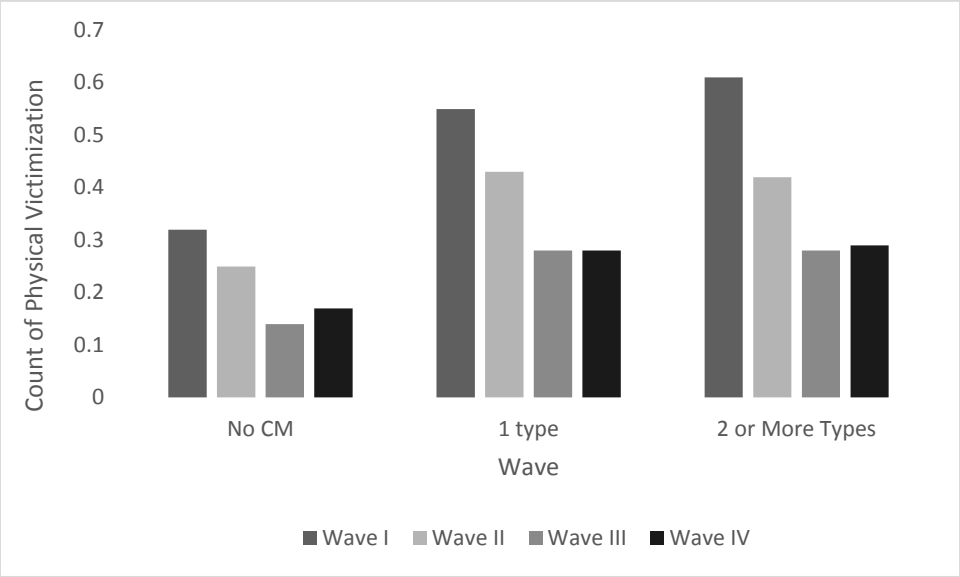


APPENDIX P.

MEAN PHYSICAL (RE)VICTIMIZATION ACROSS THE FOUR WAVES BASED ON ALTERNATIVE DEFINITIONS OF CHILD MALTREATMENT: COUNT OF TYPES OF MALTREATMENT

	No Maltreatment (n = 2408)		One Type (n=554)		Two or More Types (n=236)	
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)
Wave I	0.32	(0.75)	0.55	(1.04)	0.61	(0.61)
Wave II	0.25	(0.68)	0.43	(0.90)	0.42	(0.89)
Wave III	0.14	(0.48)	0.28	(0.73)	0.28	(0.78)
Wave IV	0.17	(0.61)	0.28	(0.80)	0.29	(0.80)

Note. All means and standard deviations are weighted and account for the complex survey design.



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ABSTRACT

CHILD MALTREATMENT, PROBLEM ALCOHOL USE AND PHYSICAL REVICTIMIZATION: EXAMINING LONGITUDINAL TRAJECTORIES IN A NATIONALLY REPRESENTATIVE SAMPLE

by

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Major: Psychology (clinical)

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Past investigations examining the relationships between child maltreatment, alcohol use and physical revictimization have been limited by their use of cross-sectional designs and their focus on childhood sexual abuse and sexual revictimization. In addition, there is a paucity of epidemiological studies examining child maltreatment, alcohol use, and physical revictimization. The present study sought to address these limitations by examining relationships between child maltreatment, problem alcohol use, and physical revictimization in a nationally representative sample. Data were analyzed from the public-use data set of the National Longitudinal Study of Adolescent to Adult Health (Add health; Harris & Udry, 2014), waves I-IV. Results of the present study add to a growing body of literature demonstrating that child maltreatment engenders numerous risks, years after the abuse has occurred. Indeed, in a nationally representative sample, we found that child maltreatment was associated with a higher risk of physical revictimization across four waves of data. Further, results also suggest that the relationship between early child maltreatment and problem alcohol use is complex, with differences based on (1)

developmental stage and (2) sex. Finally, results underscore the importance of continuing to identify mechanisms of the child maltreatment/physical revictimization pathway.

AUTOBIOGRAPHICAL STATEMENT

I began my doctoral education at Wayne State University in 2007. Prior to beginning my graduate education, I earned a bachelor's degree in psychology, with highest honors, from the University of Michigan. While attending Wayne State University, I worked closely with Dr. Emily Grekin. With Dr. Grekin's support and mentorship, I completed an honor's thesis in January of 2011 examining problem alcohol use, personality, and problem solving.

I completed an APA-accredited internship in Psychology at Yale University, School of Medicine, at the Forensic Drug Diversion Clinic (ForDD) in June of 2014, under the mentorship of Dr. Sherry McKee. Following the internship year, I worked as a postgraduate associate in Dr. McKee's behavioral psychopharmacology lab. My research interests focus on understanding the relationships between trauma, substance use, and later victimization and perpetration of violence.