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The Impact of Child Maltreatment on Suicidal Ideation, Polysubstance Use, and Sexual Risk Behaviors

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ABSTRACT

THE IMPACT OF CHILD MALTREATMENT ON SUICIDAL IDEATION, POLYSUBSTANCE USE, AND SEXUAL RISK BEHAVIORS

By

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Child maltreatment is a global public health and human rights issue, with severe lifelong consequences. Previous research has linked experiences of child maltreatment with suicidality, sexual risk behaviors, and polysubstance use. However, little is known about these associations with child maltreatment longitudinally, collectively, and in specific regions of the world. Few studies have examined suicidality among youth in sub-Saharan Africa, and youth living in the slums of Kampala, Uganda are a vulnerable population that is drastically understudied and at risk for suicidal ideation. Additionally, research in the U.S. has been conducted on child maltreatment, sexual risk behaviors, and polysubstance use; however, few studies have examined these associations longitudinally across adolescence into adulthood. These studies seek to expand on previous research on the associations between child maltreatment and 1) suicidality, 2) polysubstance use, and 3) sexual behaviors. Using data from Kampala, Uganda, the impact of child maltreatment on suicidal ideation was examined in the context of current and problematic alcohol use as well as negative future expectations using structural equation mixture modeling. Child maltreatment had a direct effect on suicidal ideation, after accounting for negative future expectations and alcohol use. Using data from the U.S., the association between child maltreatment and polysubstance use was examined using both latent class and latent transition analyses. Lastly, the association between child maltreatment and sexual behaviors was examined a similar analytic approach. The second and third studies aimed to determine if changes between substance use profiles and sexual behaviors differed by child maltreatment patterns. Child maltreatment impacted profiles of substance use and sexual behaviors at specific time points, and previous substance use and sexual behavior profiles influenced profiles at later waves. While there was no interaction between maltreatment and previous profiles of substance use and sexual behaviors, there was an indirect effect of maltreatment on subsequent profiles through the elevated uniform impact of maltreatment in previous waves. Future studies should incorporate additional types of child maltreatment and contextual information on timing, severity, and perpetration.

The Impact of Child Maltreatment Patterns on Suicidal Ideation, Risky Sexual Behaviors, and Polysubstance Use

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CHAPTER 1.

1.1 *Child maltreatment overview*

Child maltreatment is a global public health and human rights issue, with severe lifelong consequences. The World Health Organization (WHO) defines child maltreatment as physical abuse, emotional abuse, sexual abuse, and neglect, all of which yield serious consequences on the child's physical and mental health (World Health Organization, 2016). Globally, minimum prevalence estimates for past-year violence against children (ages 2-17) are at least 50% across Asia, North America, and Africa (Hillis, Mercy, Amobi, & Kress, 2016). This estimate translates to one billion children who are affected by this type of violence (Hillis et al., 2016). Other global estimates include nearly 25% of all adults reporting a history of child physical abuse (World Health Organization, 2016). A history of child sexual abuse is also highly prevalent with estimates of 20% among women and 8% among men (World Health Organization, 2016).

1.2 *Child maltreatment and associated consequences*

Child maltreatment is associated with lifelong consequences. Some of the most problematic and costly consequences of child maltreatment include alcohol and drug use (Charak, Koot, Dvorak, Elklit, & Elhai, 2015; Shin, Edwards, & Heeren, 2009; Shin, Miller, & Teicher, 2013a), sexual risk behaviors (Arata, Langhinrichsen-Rohling, Bowers, & O'Brien, 2007; Hahm, Lee, Ozonoff, & Van Wert, 2010; Lacelle, Hébert, Lavoie, Vitaro, & Tremblay, 2012; Thibodeau, Lavoie, Hébert, & Blais, 2017; Wilsnack, Vogeltanz, Klassen, & Harris, 1997; Wilsnack & Wilsnack, 1995), and negative mental health outcomes, including suicidality (Norman et al., 2012). Additionally, child maltreatment has been linked to acquisition of sexually transmitted infections (STIs) and HIV (Norman et al., 2012), chronic diseases (Norman et al., 2012), and obesity (Gilbert et al., 2009).

1.3 *Statement of purpose and summaries of studies*

This dissertation focuses on the association between child maltreatment and suicidality, polysubstance use, and sexual behaviors. Additionally, this dissertation examines the differential impact of child maltreatment on these health outcomes. These studies aim to further expand the child maltreatment and associated health outcomes literature by incorporating more advanced latent class and latent transition analyses to this area of research. These methods present a flexible approach to modeling patterns and profiles of health behaviors both in a cross-sectional and longitudinal framework. More research is needed to dissect mechanisms of association between child maltreatment and these associated outcomes, in addition to moderators of these associations. The limitations in current research related to these specific outcomes are detailed in the corresponding chapters.

Study 1.

This paper analyzes the impact of child maltreatment on alcohol use, negative future expectations, and suicidal ideation among youth living in the slums of Kampala, Uganda through a latent variable framework. The research question that informs this study is: 1) Does maltreatment have a direct effect on suicidal ideation once accounting for alcohol use and negative future expectations? 2) What are the simultaneous effects of child maltreatment, drinking status, problematic alcohol use and negative future expectations on suicidal ideation?

Study 2.

The second study seeks to determine the profiles of alcohol, drug use, and tobacco use and the association with the types of child maltreatment over the course of adolescence to adulthood. The research questions that inform this study are: 1) What is the association between

child maltreatment patterns and polysubstance use in adolescence and adulthood?; 2) What is the association between child maltreatment patterns and longitudinal patterns of polysubstance use?

Study 3.

The third paper seeks to analyze the associations of child maltreatment and longitudinal patterns of sexual risk behaviors over the course of adolescence to adulthood. The research questions that inform this study are: 1) What is the association between child maltreatment patterns and sexual risk behavior profiles in adolescence and adulthood?; 2) What is the longitudinal association between child maltreatment patterns and sexual risk behavior profiles over time?

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CHAPTER 2.

The interrelationships of child maltreatment, alcohol use, and suicidal ideation among youth living in the slums of Kampala, Uganda

Globally, suicide is the third leading cause of death for adolescents ages 15-19 (World Health Organization, 2016). Suicide rates have risen nearly 60% in the last half century worldwide (Wasserman, 2009). In sub-Saharan Africa, adolescent suicide is starting to emerge as an important public health problem, but studies examining suicidality among adolescents are limited in sub-Saharan Africa (Page & West, 2011). Reports of suicidal ideation among adolescents vary across countries in sub-Saharan Africa. An estimated 13% of youth report suicidal ideation among school-attending youth in Malawi (Shaikh, Lloyd, Acquah, Celedonia, & Wilson, 2016). Additionally, the prevalence of suicidal ideation among adolescents in Uganda and Kenya is estimated to be 20% and 28%, respectively (Swahn, Bossarte, Eliman, Gaylor, & Jayaraman, 2010). Youth living in very economically distressed areas may be at a higher risk of suicide (Cheng et al., 2014). Youth living in the slums of Kampala have reported higher rates of suicidal ideation (Culbreth, Swahn, Ndetei, Ametewee, & Kasirye, 2018; Swahn, Palmier, Kasirye, & Yao, 2012) compared to population-based studies examining suicidal behaviors in Uganda (Swahn et al., 2010). Additionally, youth living in the slums or streets in Kampala live in a disadvantaged environment, often characterized by extreme poverty and lack of government infrastructure, which may contribute to the high rates of suicidal ideation among these youth (Mufune, 2000; Swahn, Palmier, et al., 2012; Swahn, Gressard, et al., 2012; Swahn, Dill, Palmier, & Kasirye, 2015; Swahn, Haberlen, & Palmier, 2014).

Predictors for suicidal ideation include substance use (Jones, 1997; King & Merchant, 2008; Sher, Sperling, Zalsman, Vardi, & Merrick, 2006; Sher & Zalsman, 2005; Page & West, 2011; Reifman & Windle, 1995; Schilling, Aseltine, Glanovsky, James, & Jacobs, 2009; Swahn, Palmier, et al., 2012), child maltreatment (Brown, Cohen, Johnson, & Smailes, 1999; Cluver, Orkin, Boyes, & Sherr, 2015; King & Merchant, 2008; Ng et al., 2015), depression and mental illness (Cluver et al., 2015), and negative future expectations (Abramson et al., 1998; Ballard, Patel, Ward, & Lamis, 2015). Several models and theoretical frameworks help explain the associations between these risk factors and suicidal ideation. The Problem Behavior Theory (PBT) states that youth who engage in substance use, such as alcohol, are at an increased risk for the development of depression, which in turn increases risk of suicidal ideation and suicidal behaviors (Jessor & Jessor, 1977). Additionally, the Secondary Mental Disorder Model states that victimization, including child maltreatment victimization, may lead to alcohol use, which in turn may lead to suicidal ideations (Pompili et al., 2010; Marschall-Lévesque et al., 2016). Several longitudinal studies have demonstrated that alcohol use in adolescence is associated with higher suicidal ideation in early adulthood (Borowsky, Ireland, & Resnick, 2001; Duncan, Alpert, Duncan, & Hops, 1997; Fergusson, Woodward, & Horwood, 2000; Reifman & Windle, 1995). This is also consistent with the Stress-Coping Theory, which states that individuals engage in substance use and alcohol use to cope with previous stressful events in life, such as child maltreatment experiences, which then exacerbates risk for suicidal ideation (Kandel, Raveis, & Davies, 1991). However, several studies have reported conflicting directionality results where suicidal ideations and behaviors predict alcohol use and substance use later in life (Fergusson et al., 2000; Steinhausen, Bösiger, & Metzke, 2006).

Other theories have emphasized the importance of negative cognitions and the association with suicidal ideation. The hopeless theory of suicide states that hopeless cognitions and negative future outlooks are directly related to suicidal ideation, specifically when prefaced with adverse events (Abramson et al., 1998; Ballard, Patel, Ward, & Lamis, 2015). Negative future expectations may increase suicidal ideations later in life through the perceptions that negative events are unavoidable, therefore lowering resilience to suicidal thoughts and behaviors (Jamieson & Romer, 2008; Nguyen et al., 2012). Additionally, perceptions of negative future expectations may lead to substance use as a coping mechanism (Jamieson & Romer, 2008; Nguyen et al., 2012). A conceptual model which informs this study is presented in Figure 2.1.

Additionally, biological mechanisms may partially explain predictors of suicidal ideation, specifically the link of child maltreatment and suicidal ideation. Experiencing child maltreatment may cause repeated stress, which may negatively impact brain development, leading to a higher risk for stress-related diseases such as depression and cognitive impairment (American Academy of Pediatrics, 2014). The traumatic residual effects linked to child maltreatment have been linked to an increase risk of suicidal ideation and suicidal behavior (Brown et al., 1999; King & Merchant, 2008; Ng et al., 2015). Brown and colleagues found that adults who reported child maltreatment were three times more likely to also report suicidal behaviors (1999). A meta-analysis recently reported there is robust evidence for the link between physical abuse, emotional abuse, and childhood neglect with depressive disorders and suicide attempts (Norman et al., 2012).

In addition to the links between child maltreatment and suicidal ideation, studies have found an association with child sexual abuse (Smith, Smith, & Grekin, 2014; Meyers et al., 2018), emotional abuse (Mills, Alati, Strathearn, & Najman, 2014; Shin, Edwards, & Heeren,

2009; Shin, Miller, & Teicher, 2013), physical abuse, and neglect (Norman et al., 2012) with problematic alcohol use among adolescents. Experiencing multiple types of child maltreatment was associated with a faster progression to heavy episodic drinking, which persisted across young adulthood (Shin et al., 2013). Additionally, overuse of alcohol and binge drinking are known to cause disinhibition, impaired judgment and impulsivity, and these are the mechanisms which may link alcohol use to suicidal behavior (Pompili et al., 2010; Wilsnack, Wilsnack, Kristjanson, Vogeltanz-Holm, & Windle, 2004).

While an expanding body of literature exists examining biological, psychosocial, and environmental risk factors for suicide and suicidal ideation in developed countries, few studies have examined predictors for suicidal ideation in sub-Saharan Africa. Page and West conducted a review which examined suicidal behaviors and ideation among adolescents in sub-Saharan Africa and reported that 25% of boys and 26% of girls reported suicidal ideation in the past 12 months (2011). Among a sample of adolescents living in southwest Nigeria, suicidal behaviors were statistically significantly associated with childhood sexual abuse (Omigbodun, Dogra, Esan, & Adedokun, 2008). In Uganda, child maltreatment was statistically significantly associated with suicidal behaviors among adolescents in Northern Uganda (Olema, Catani, Ertl, Saile, & Neuner, 2014), while child neglect was associated with suicidal ideation among youth living in the slums of Kampala, Uganda (Swahn, Palmier, et al., 2012). Understanding the mechanisms of suicidal ideation predictors among youth living in the slums of Kampala, Uganda is urgently warranted. These youth may face unique risk factors, and known risk factors may operate differently. For example, this population may have a stronger association between child maltreatment, alcohol use, negative future expectations, and suicidal ideation compared to other populations. These associations may be exacerbated by the dire environmental living conditions

these youth face, including poverty, food scarcity, exposure to violence, and a lack of government infrastructure (Culbreth et al., 2018; Swahn, Culbreth, Salazar, Kasirye, & Seeley, 2016; Swahn et al., 2014; Swahn et al., 2015; Swahn, Culbreth, Staton, Self-Brown, & Kasirye, 2017). Additionally, this population has a high prevalence of commercial sex work (13%), which has been previously linked with alcohol use (Swahn et al., 2016) and poor mental health outcomes (Hong, Li, Fang, & Zhao, 2007).

While several studies have examined suicidal attempts and ideation among youth living in the slums of Kampala (Culbreth et al., 2018; Swahn, Palmier, et al., 2012), the current study seeks to examine suicidal ideation in a larger, latent variable framework. No study, to our knowledge, has examined the mechanisms of suicidal ideation predictors among adolescents in Uganda, and more broadly, sub-Saharan Africa. Using the conceptual model, we aim to understand the impact of child maltreatment, drinking status, and negative future expectations simultaneously on suicidal ideation. Additionally, since this study is cross-sectional, we plan to examine the effects of drinking status on suicidal ideation, rather than examining bidirectional effects of suicidal ideation on drinking status. Moreover, this study seeks to determine the specific associations between child maltreatment, problem drinking, and negative future expectations on alcohol use among current drinkers, in addition to the impact of drinking status on suicidal ideation. Understanding the heterogeneity of suicidal ideation predictors among adolescents is critical in creating culturally relevant and effective suicidal interventions (Kinyanda, Wamala, Musisi, & Hjelmeland, 2011).

Methods

Study Design and Participants

The current analysis is based on data collected in Kampala, Uganda, as part of a study known as the "Kampala Youth Survey 2014." This was a cross-sectional study conducted in 2014 on youth ages 12-18 years of age who live in the streets and the slums of Kampala. The youth comprised a convenience sample who were attending the Uganda Youth Development Link (UYDEL) drop-in centers, which provide may services to youth, including vocational training, HIV/STI testing, and mental health counselling services. The participation rate among youth who were approached to participate was 92%, yielding 1,497 youth. Due to technical issues, 320 surveys were lost, which resulted in 1,134 surveys for the final sample.

The survey was administered face-to-face by social workers and peer educators who were trained in the study methodology and survey administration. All participants provided verbal informed consent to participate in the study. Youth under 18 who "cater to their own livelihood" are considered independent and emancipated in Uganda, enabling them to provide their own informed consent without parental consent. Youth participants were limited to ages 12-18 on the day of the study, and no other exclusion criteria was applied. IRB approvals were obtained from both sites (Georgia State University and the Uganda National Council for Science and Technology).

Measures

Survey questions for the Kampala Youth Survey 2014 were adapted from previously validated measures of youth alcohol use, experiences of violence victimization and perpetration, alcohol marketing exposures and mental health among adolescents. Further details on contents of

the survey are discussed elsewhere (Swahn et al., 2016), and a detailed description of the measures used are listed in Appendix 2.1.

Suicidal ideation. For the current analysis, suicidal ideation was the main outcome of interest. Youth were asked, "In the past year, did you ever think of killing yourself?" Response options were binary (1-Yes, 0-No).

Child maltreatment. Three questions used to measure child maltreatment (lifetime) included parental neglect, parental abuse, and sexual abuse. Parental neglect was attributed to parental alcohol use, and was measured using, "Did your parents/caretakers' alcohol use make them not able to care for you?" Sexual abuse was measured using, "Has someone ever raped you or forced you to have sex with him or her?" Parental physical abuse was measured using, "Did your parents ever beat you so hard that you had bruises/marks?" Responses to all three questions were binary (1-Yes, 0-No).

Negative future expectations. Three questions measured negative future expectations. Participants were asked, "Overall, what do you think about the following statements? I will probably die before I am thirty; I will be unhappy; Bad things happen to people like me." Responses were binary (1-Yes/Agree, 0-No/Disagree).

Current drinking status. Two questions of alcohol use were used to measure current drinking status, and all participants were asked these two questions. The first alcohol use question was, "How old were you when you had your first full drink of alcohol?" Respondents could answer 1-12, 13-14, 15-16, 17-18, and never. The second question was, "Have you had a drink of alcohol in the past year?" Responses were binary (1-Yes, 0-No).

Problematic alcohol use. Youth who reported not drinking in the past year were missing on all of the problematic alcohol questions since a skip pattern was present in the survey. Four

questions were used to measure problematic alcohol use: frequency, amount, and two measures of alcohol use adverse behavior. Alcohol use frequency was measured using, “How often do you have a drink containing alcohol?” The timeframe for this question was not specified. Responses consisted of “Monthly or Less”, “2-4 times a month”, “2-3 times a week”, and “4 or more times a week.” Alcohol use amount was measured using, “How many full drinks containing alcohol do you have in a typical day when you are drinking?” Responses consisted of “1-2 drinks,” “3-4 drinks,” and “5 or more drinks.” Alcohol use adverse behavior was measured using two questions, “Have you been seriously injured or hurt due to your drinking?” and “Has someone else been seriously injured or hurt because of our drinking?” Responses were binary for both questions (1-Yes, 0-No).

Control variables. Control variables included the analysis included gender (female/male) and age (in years).

Data Analysis

Descriptive statistics and bivariate associations were examined among the variables of interest. Factor models for negative future expectations and problematic alcohol use were each constructed separately. Child maltreatment variables were tested using a series of nested model tests to determine the optimal operationalization of these variables.

Once the factor models were built separately, the two factor models, along with the child maltreatment variables, were examined together. Additionally, we chose to estimate problematic alcohol use among current drinkers only, and a fixed latent class variable was constructed for current drinking status: current, non-active, and never drinkers. If youth reported a specific age for initiating alcohol use and responding, “Yes” to having a full drink of alcohol in the past year, they were classified as current drinkers. If youth reported a specific age for initiating alcohol use

but responded “No” to having a full drink of alcohol in the past year, they were classified as non-active drinkers. Lastly, for youth who reported “Never” to initiating alcohol use and “No” to having a full drink of alcohol in the past year, they were classified as never drinkers. Then, the problematic alcohol use factor model was only estimated within the current drinking class. This approach is beneficial compared to just analyzing current drinking status alone or analyzing problematic alcohol use among current drinkers and listwise deleting non-drinkers. Additionally, this approach allows more flexibility in the modeling process of problematic drinking compared to typical practices of setting all problematic drinker indicators to zero for missing values. This method allows for the inclusion of all participants for the analysis of both current drinking status and problematic alcohol use.

In the final model, structural equation mixture modeling was used to determine associations between all latent and observed variables. Our analytic model is presented in Figure 2.2. Direct effects for child maltreatment, negative future expectations, drinking status, and problematic alcohol use on suicidal ideation were all examined. Additionally, direct effects for both child maltreatment and negative future expectations on both drinking status and problematic alcohol use among current drinkers were examined. Finally, direct effects from child maltreatment on negative future expectations were also included. All associations were estimated simultaneously.

Measurement invariance was assessed for all latent factors. Full information maximum likelihood (FIML) estimation was used to estimate the model under the missing-at-random (MAR) assumption. Descriptive and bivariate analyses were conducted in SAS 9.4 (SAS Institute, Cary, NC), and the measurement and structural equation mixture models were

estimated using MPlus 7.4 (Muthén, L. K., & Muthén, B. O. Los Angeles, CA: Muthén & Muthén).

Results

Descriptive statistics among reported suicidal ideation are displayed in Table 2.1. Among all youth participants (n=1,134), the prevalence of suicidal ideation is 23.5% (n=266). A higher percentage of females reported suicidal ideation compared to males (27% vs. 19%, respectively).

Among all youth in the sample, physical abuse was the highest reported type of abuse among youth (34% of total sample), and 36% of youth who experienced physical abuse also reported experiencing suicidal ideation. Among youth who experienced sexual abuse and parental neglect, a high percentage of youth reported suicidal ideation (40% and 42%, respectively). Additionally, higher child maltreatment sum scores corresponded to higher percentages of reported suicidal ideation. For example, approximately half (51%) of youth who reported experiencing all three types of child maltreatment experienced suicidal ideation.

The measurement models for problematic alcohol use and negative future expectations are presented in Table 2.2. The model for negative future expectations is just-identified, and the problematic alcohol use measurement model had adequate fit. A residual correlation was added between the two alcohol behavior items due to the high similarity between the two questions. All standardized loadings for both latent variables are above 0.60, except the two alcohol behavior indicators.

Structural associations are presented in Table 2.3. All structural associations were adjusted for gender and age, and measurement invariance held for all latent factors. After testing child maltreatment variable patterns using nested model tests, the model that incorporated a sexual abuse indicator, a child maltreatment sum score for physical abuse and neglect (0, 1, and

2), and an interaction term between sexual abuse and the sum score fit the data better than alternative models. Regarding the sum score, for youth who reported only sexual abuse, they received a "0" for maltreatment sum score (and a "1" for the sexual abuse variable). Participants who experienced either physical abuse alone or neglect alone each received a "1" for the maltreatment sum score, whereas participants who experienced both physical abuse and neglect received a "2" for the maltreatment sum score. Alternative models that were compared included only the child maltreatment sum score (all three types of child maltreatment) as well as a model with each unique child maltreatment experience type separately (physical abuse, sexual abuse, and neglect in the model as separate terms with all possible interactions). Table 2.4 presents the structural associations for the different patterns of child maltreatment.

For the association between maltreatment and negative future expectations, the maltreatment sum score was statistically significantly associated with having negative future expectations (mean difference: 0.99; 95% CI: 0.69, 1.29, $p<0.001$) when sexual abuse was not experienced, after adjusting for other covariates (Table 2.3). Additionally, reporting both physical abuse and neglect corresponded to a 1.98 positive difference in the mean of negative future expectations compared to no maltreatment. Sexual abuse was not statistically significantly associated with experiencing negative future expectations.

Regarding alcohol use, sexual abuse only and the child maltreatment sum score were statistically significantly associated with being in the current drinker class compared to the never drinker class, after adjusting for covariates and negative future expectations. Additionally, experiencing sexual abuse alongside other types of maltreatment was associated with higher odds of being in the current drinking class compared to the never drinking class. For example, the odds ratio for being in the current drinker class (compared to the never drinker class) for youth

reporting sexual abuse only was 2.32, and the odds ratio for being in the current drinker class for youth reporting all three types of abuse was 12.43 (Table 2.4). Sexual abuse only was also associated with being in the non-active drinker class compared to the never drinker class; however, this association was not observed among participants reporting physical abuse and neglect (maltreatment sum score).

Problematic alcohol use among current drinkers was statistically significantly associated with experiencing sexual abuse (Est: 1.91; 95% CI: 1.09, 2.74; $p<0.001$) when the maltreatment sum score is 0 (physical abuse and neglect not present), controlling for covariates and negative future expectations (Table 2.3). However, the association between the sum score and problematic alcohol use was not statistically significant when sexual abuse was not present. Reporting sexual abuse only corresponded with a 1.91 positive difference in means for problematic alcohol use compared to maltreatment (Table 2.4). Furthermore, experiencing sexual abuse and one other type of maltreatment (either physical abuse or neglect alone) corresponded with a 1.22 positive difference in means for problematic alcohol use. Experiencing all three types of maltreatment corresponded with a 0.53 positive difference in means of problematic alcohol use.

Regarding associations with suicidal ideation, negative future expectations (OR: 1.45), current drinking status (OR: 1.80), sexual abuse only (OR: 2.89), and the maltreatment sum score (OR: 1.88) all were statistically significantly associated with suicidal ideation. However, problematic alcohol use was not a statistically significant predictor of suicidal ideation. The highest odds ratio among different patterns of child maltreatment for suicidal ideation was observed among participants reporting both physical abuse and neglect without sexual abuse (Table 2.4).

Discussion

Nearly 25% of youth in our sample reported suicidal ideation in the past year. This estimate was lower than previously reported suicidal ideation among youth living in the slums of Kampala (30%) (Swahn, Palmier, et al., 2012) but higher than the national prevalence of suicidal ideation among youth in Uganda (Swahn et al., 2010). Consistent with previous studies, negative future expectations had a direct effect on suicidal ideation (Abramson et al., 1998; Ballard, Patel, Ward, & Lamis, 2015), however, these effects were not observed via alcohol use.

Current drinking status (vs. never) was associated with suicidal ideation. However, problematic alcohol use was not associated with suicidal ideation. Our study presented a unique approach of estimating problematic alcohol use within classes of drinking behavior, without listwise deleting non-drinkers when examining problematic drinking behaviors. This analytic method is more flexible than restricting the analysis to only drinkers, analyzing only current drinking status among all participants, or coding all missing values on problematic alcohol use indicators to zero. Our finding of *any* alcohol use and suicidal ideation is consistent with the literature (Duncan et al., 1997; Borowsky et al., 2001) but inconsistent with the literature that demonstrates the association between problematic alcohol use and suicidal ideation (Fergusson et al., 2000; Reifman & Windle, 1995). However, this inconsistency might be due to a difference in populations assessed. Additionally, the inconsistency may also be due to the previous studies including all non-drinkers as a "0" on their problematic alcohol use measure, rather than including both current drinking status and problematic alcohol use together. Including all non-drinkers as "0" violates a crucial assumption in the model because problematic drinking cannot be assessed among non-drinkers who do not consume alcohol, in addition to violating the distributional assumption. Furthermore, our analytic method allowed us to examine the unique

direct pathways of variables on the different aspects of the drinking process, further contributing to literature by utilizing this approach.

Regarding child maltreatment and problematic alcohol use, reporting sexual abuse only and sexual abuse alongside other types of abuse was statistically significantly associated with problematic alcohol use. Thus, the effects of child maltreatment on problematic alcohol use were only statistically significant when sexual abuse was present, and the effects of sexual abuse depended on the other types of maltreatment experienced alongside sexual abuse. The strong association between sexual abuse and problematic alcohol use has previously been demonstrated in the literature (Smith, Smith, & Grekin, 2014; Meyers et al., 2018). However, the interaction term between sexual abuse and the maltreatment sum score was in the opposite direction than expected (Shin et al., 2013). Youth who experienced sexual abuse alongside other types of abuse had a slightly lower association with problematic alcohol use compared to youth who only experienced sexual abuse; however, all combinations of sexual abuse alongside other types of maltreatment were associated with positive mean differences for problematic alcohol use. It should be noted that the context of the sexual abuse measure in this study involves any perpetrator, while the context of the physical abuse and neglect questions involve familial perpetrators. Additionally, the neglect measure incorporated neglect due to parental alcohol use. Also, the strong association between experiencing sexual abuse only with problematic alcohol use in this study might be partially explained by youth engaging in commercial sex work. The prevalence of commercial sex work in this sample among sexually active youth is 14%, and the majority of sex workers (90%) report previously being sexually abused (68%) (Swahn et al., 2016). While this study did not assess the prevalence of engaging in commercial sex work among youth who only report sexual abuse, commercial sex work may be one underlying

mechanism driving the strong association between experiencing only sexual abuse with problematic alcohol use. Future research is needed to investigate the differences in outcomes related to child maltreatment patterns in this population. Moreover, it would be beneficial to determine the source of the maltreatment (familial vs. other) and other contextual information around the maltreatment experiences and long-term consequences in this population.

Additionally, the child maltreatment sum score (experiencing physical abuse and/or neglect without sexual abuse) was statistically significantly associated with negative future expectations. Sexual abuse was not statistically significantly associated with negative future expectations. While previous research has found an association with early adverse events and negative future expectations, the specific type of adverse event has not been extensively examined (Abramson et al., 1998; Ballard et al., 2015). A further examination into internalizing behaviors may shed light on these findings. Neglect has been linked to primarily internalizing behaviors (English et al., 2005; Manly, Kim, Rogosch, & Cicchetti, 2001) such as unhappiness, loneliness, and depression, whereas physical abuse has been mostly linked to externalizing behaviors (Villodas et al., 2015). Sexual abuse has been linked to both internalizing and externalizing behaviors (Manly et al., 2001; Villodas et al., 2015). If negative future expectations could be classified into the broad category of internalizing behaviors, then our findings would be similar to previous studies in terms of neglect. However, our results also show that physical abuse might be associated with internalizing behaviors in addition to the previous research showing the link to externalizing behaviors. Again, the physical abuse and neglect measures in our study both involved familial perpetrators, whereas the sexual abuse measure involved any perpetrator. There may be an underlying mechanism where the familial perpetration is driving

the association with negative future expectations, compared to the sexual abuse measure where the perpetrator is not specified.

Our results also showed a statistically significant association between all patterns of child maltreatment and suicidal ideation. For youth who experienced both physical abuse and neglect, without sexual abuse, the suicidal ideation odds ratio was the highest. A previous meta-analysis showed robust evidence for the association for physical abuse and neglect with suicidal ideation (Norman et al., 2012). Youth who reported only sexual abuse experienced the second highest odds ratio for suicidal ideation. Youth who experienced sexual abuse in addition to another type of abuse only had a slightly lower odds ratio for suicidal ideation compared to youth who experienced only sexual abuse. These differences in child maltreatment patterns may be partially explained by the differences in perpetrators (familial perpetrators in physical abuse and neglect and non-specific perpetrator in sexual abuse). However, all types of child maltreatment were associated with an increased odds of suicidal ideation, consistent with previous literature (Brown et al., 1999; King & Merchant, 2008; Ng et al., 2015). As mentioned previously, identifying the context of child maltreatment would be beneficial for future studies.

Limitations

While this is the first study to our knowledge to document the associations between child maltreatment, alcohol use, negative future expectations, and suicidal ideation among youth living in the slums of Kampala, this study has several limitations. First, the sample is a convenience sample of youth, which may limit generalizability to service-seeking youth living in the slums who are attending UYDEL drop-in centers. Second, the survey is cross-sectional, and directionality of effects cannot be determined using this data alone. Future research would greatly benefit from longitudinal studies of this population. Caution should be used in evaluating

the results of this study as to not infer causality from this data. One alternative model includes the possible reciprocal effect of alcohol use on negative future expectations. Instead of negative future expectations predicting alcohol use, alcohol use could also predict negative future expectations (Pompili et al., 2010). Additionally, suicidal ideation could also predict alcohol use, and this study did not examine those reciprocal effects. As mentioned previously, the timeline and context of the abuse variables cannot be ascertained from this data. For example, this study cannot determine whether abuse happened before or after alcohol use behaviors, negative future expectations, and suicidal ideations. Future studies should also seek to tease apart the timing of abuse, effects of different types of abuse, and incorporating the perpetrator source along with the frequency and severity of abuse.

Implications

Despite the limitations, this study contributes to the growing body of literature on suicidality among youth living in sub-Saharan Africa. Nearly 25% of our sample reported experiencing suicidal ideation, and suicide prevention programs should be tailored to this population. Multi-level suicide prevention campaigns have demonstrated efficacy in decreasing suicide attempts among youth (Harris et al., 2016; Hegerl, Althaus, Schmidtke, & Niklewski, 2006). Multi-level suicide prevention programs focus on high-risk adolescents and training youth about coping and self-help skills, equipping community leaders on suicide prevention tools, and implementing a widespread media awareness campaign on suicide prevention (Harris et al., 2016; Hegerl et al., 2006). Additionally, best practice recommendations to reduce suicide attempts at the population level in low- and middle-income countries include restricting access to lethal weapons and substances used in suicide for that particular region (Petersen et al., 2016). Also at the population level, best practices recommend reducing and enforcing alcohol restriction

among youth due to the strong connection between alcohol use, depression, and suicidality (Petersen et al., 2016). Since child maltreatment is also strongly associated with alcohol use and suicidality, some research from low- and middle-income countries on mental health support the implementation of child protection laws to protect children at high risk for child maltreatment (Fluke et al., 2012; Petersen et al., 2016).

Additionally, this study provided a unique approach to modeling alcohol use that allowed inclusion of all participants to examine both current drinking status as well as problematic alcohol use among current drinkers. This approach provides flexibility over previously utilized methods. Furthermore, this study found that current drinking status and not problematic alcohol use was associated with suicidal ideation. Interventions which delay alcohol use or target the initiation of alcohol use may be useful to incorporate in suicide prevention programs for this population.

Currently, Uganda Youth Development Link (UYDEL) provides child protection services, substance use counseling and rehabilitation, mental health counseling, HIV and sexually transmitted infection testing and counseling, and vocational training to youth living in the slums of Kampala. Future research should evaluate the feasibility and efficacy of implementing a tailored suicide prevention and mental health program in this population alongside current services offered at UYDEL. Additionally, the associations between child maltreatment, alcohol use, and suicidal ideation in this study should be evaluated in a longitudinal framework for future studies.

Figure 2.1. Conceptual model of suicidal ideation predictors

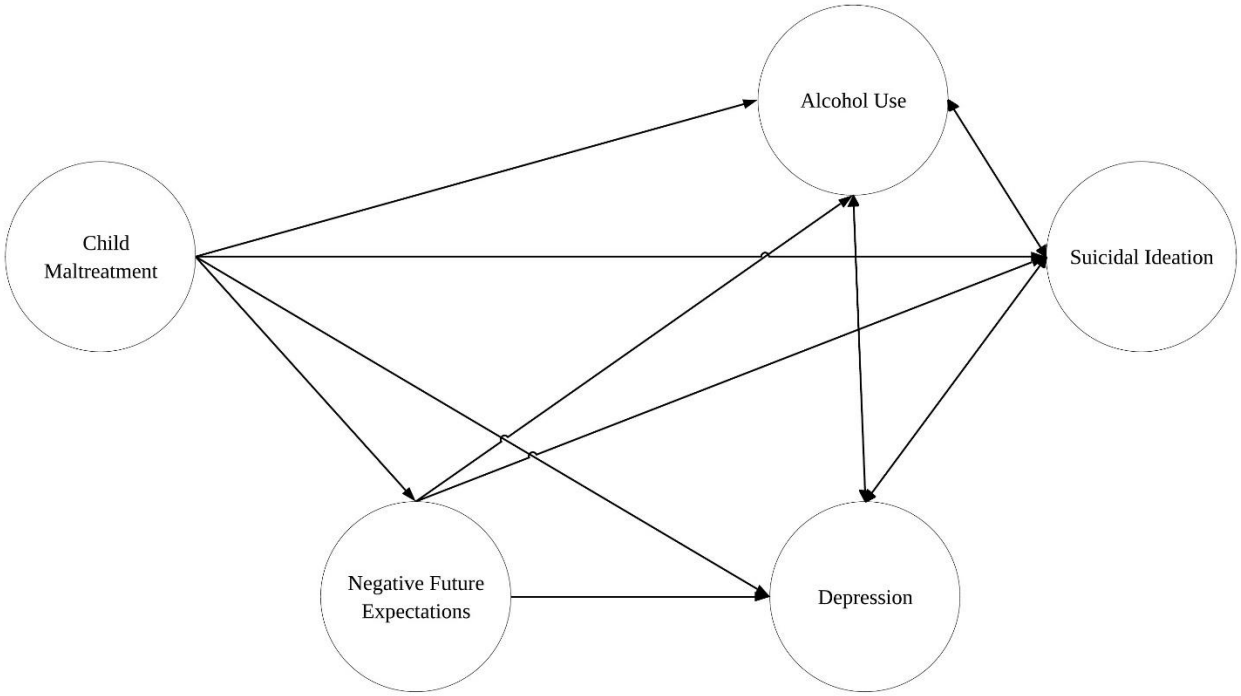

Figure 2.2. Analytic model for the impact of child maltreatment, negative future expectations, alcohol use, and suicidal ideation among youth living in the slums of Kampala, Uganda

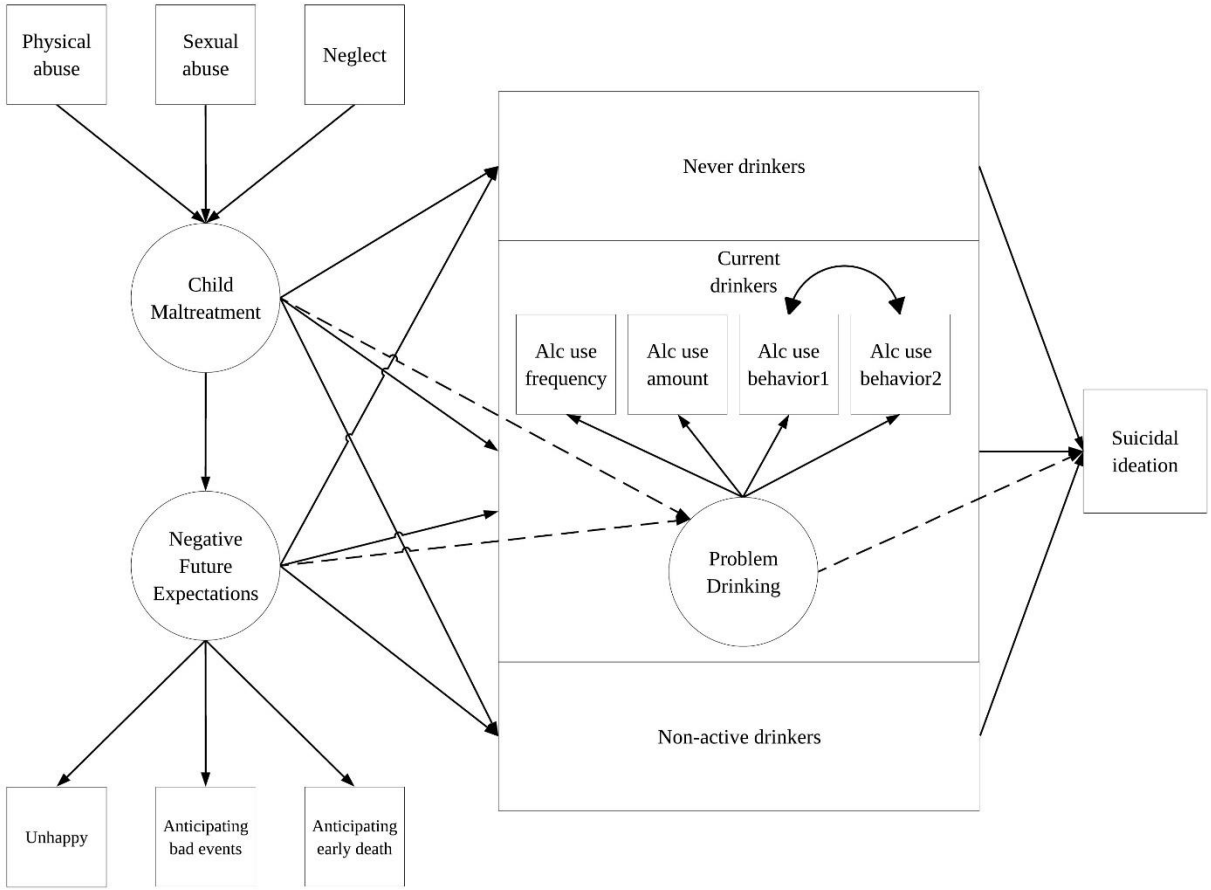

Table 2.1. Demographics and Predictors of Suicidal Ideation among Youth Living in the Slums of Kampala

		Suicidal Ideation	
	Total n=1130	Yes n=266 (24%)	No n=864 (76%)
Demographic variables, n (%)			
Age, mean (SD)	16.15 (1.79)	16.41 (1.69)	16.07 (1.81)
Gender			
Female	635 (56%)	172 (27%)	463 (73%)
Male	494 (44%)	94 (19%)	400 (81%)
Child maltreatment experiences, n (%)			
Physical abuse	380 (34%)	137 (36%)	243 (64%)
Sexual abuse	191 (17%)	77 (40%)	114 (60%)
Parental neglect	212 (20%)	89 (42%)	123 (58%)
Child maltreatment sum score			
0	595 (53%)	69 (12%)	526 (88%)
1	349 (31%)	117 (34%)	232 (67%)
2	151 (13%)	62 (41%)	89 (59%)
3	35 (3%)	18 (51%)	17 (49%)
Alcohol use, n (%)			
Age at first alcohol consumption			
Never	718 (64%)	120 (17%)	598 (83%)
1-12	58 (5%)	25 (43%)	33 (57%)
13-14	116 (10%)	42 (36%)	74 (64%)
15-16	165 (15%)	57 (35%)	108 (65%)
17-18	66 (6%)	19 (29%)	47 (71%)
Alcohol use in past year			
Yes	346 (31%)	129 (37%)	217 (63%)
No	784 (69%)	137 (17%)	647 (83%)
Alcohol frequency			
Monthly or less	70 (20%)	26 (37%)	44 (63%)
2-4 times a month	104 (30%)	35 (34%)	69 (66%)
2-3 times a week	128 (37%)	53 (41%)	75 (59%)
4 or more times a week	44 (13%)	15 (34%)	29 (66%)
Amount of alcohol consumed			
1-2 drinks	195 (57%)	65 (33%)	130 (67%)
3-4 drinks	118 (24%)	49 (42%)	69 (59%)
5 or more drinks	32 (9%)	15 (47%)	17 (63%)
Ever hurt yourself due to drinking	132 (38%)	64 (49%)	68 (52%)
Ever hurt someone else due to drinking	95 (28%)	45 (47%)	50 (53%)
Negative future expectations, n (%)			
Unhappy about future	158 (14%)	74 (47%)	84 (53%)
Anticipating bad events	344 (30%)	126 (37%)	218 (63%)
Anticipating early death	146 (13%)	65 (45%)	80 (55%)

Table 2.2. Measurement models for alcohol use and negative future expectations

	Est. loadings	*SE*	Standardized est.	*R-Square*	Thresholds		
Alcohol use					*1*	*2*	*3*
Alcohol frequency	1.00	---	.63	.40	-1.90	-.01	2.59
Alcohol amount	1.59	.61	.79	.63	.51	3.93	
Alcohol behavior (self)	1.04	.30	.47	.69	.98		
Alcohol behavior (others)	1.28	.36	.55	.73	2.06		
Negative future expectations							
Unhappy	1.00	---	.77	.60	3.06		
Bad events	.81	.17	.70	.50	1.27		
Early death	1.20	.31	.83	.68	3.61		

Note. Model fit statistics for alcohol use model: (χ^2=58.06, df=35, p=0.009), Loglikelihood: -1102.347, RMSEA: 0.00, (90% CI: 0.00, 0.09), CFI: 1.00, TLI: 1.02.

Table 2.3. Structural associations of child maltreatment, drinking status, problematic alcohol use, and negative future expectations on suicidal ideation among youth living in the slums of Kampala, Uganda

	Negative future expectations (Difference in means)		Problematic alcohol use (Difference in means)		Drinking status (Conditional log odds ratios)				Suicidal ideation (Log odds ratios)	
					Current (vs. Never)		Non-active (vs. Never)			
	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value
Sex abuse →	.53 (-.06, 1.13)	.14	**1.91 (1.09, 2.74)**	**<.001**	**.84 (.41, 1.27)**	**.001**	**1.11 (.37, 1.85)**	**.01**	**1.06 (.42, 1.70)**	**.01**
Maltreatment sum→	**.99 (.69, 1.29)**	**<.001**	.17 (-.13, .48)	.34	**.82 (.61, 1.03)**	**<.001**	.45 (.04, .86)	.07	**.63 (.39, .87)**	**<.001**
Sex abuse x Maltreatment sum→	-.22 (-.72, .27)	.46	**-.86 (-1.45, -.26)**	**.02**	.02 (-.43, .46)	.95	-0.01 (-.81, .80)	.99	**-.72 (-1.20, -.24)**	**.01**
Negative future expectations→	--	--	.06 (-.07, .20)	.43	.11 (.01, .20)	.07	-.12 (-.32, .07)	.30	**.37 (.24, .50)**	**<.001**
Drinking status										
Current drinker→	--	--	--	--	--	---	--	--	**.59 (.27, .90)**	**.002**
Non-active drinker→	--	--	--	--	--	--	--	--	.24 (-.43, .91)	.55
Problematic drinking	--	--	--	--	--	--	--	--	.05 (-.19, .30)	.72

Note. All statistically significant associations are bolded. All structural associations adjusted for gender and age.
Maltreatment sum score= sum score includes parental neglect and parental physical abuse (Min: 0, Max: 2); EST=estimate; SE=standard error. Model fit statistics: Loglikelihood: -3624.743. Number of parameters: 53.

Table 2.4. Structural associations between patterns of child maltreatment and negative future expectations, problematic alcohol use, drinking status, and suicidal ideation among youth living in the slums of Kampala, Uganda

	Negative future expectations	Problematic alcohol use	Drinking status		Suicidal ideation
			Current (vs. Never)	Non-active (vs. Never)	
	Means	Means	Odds ratio	Odds ratio	Odds ratio
No s. abuse	0	0	Ref.	Ref.	Ref.
S. abuse only	.53	1.91	2.32	3.03	2.89
S. abuse + sum (1)	1.30	1.22	5.37	4.71	2.64
S. abuse + sum (2)	2.07	.53	12.43	7.32	2.41
No s. abuse + sum (1)	.99	.17	2.28	1.57	1.88
No s. abuse + sum (2)	1.98	.34	5.16	2.46	3.52

Note. All structural associations adjusted for gender and age.

S. abuse= sexual abuse; Maltreatment sum score= sum score includes parental neglect and parental physical abuse (Min: 0, Max: 2)

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Appendix 2.1

List of measures used in analysis

Child maltreatment

Physical abuse: “Did your parents ever beat you so hard you had bruises or marks?”

Yes	(n=325, 28.7%)
No	(n=805, 71.0%)

Sexual abuse: “Has someone ever raped you or forced you to have sex with him or her?”

Yes	(n=191, 16.8%)
No	(n=939, 82.8%)

Parental neglect (due to alcohol use): “Did a parent beat you when they were drunk?”

Yes	(n=140, 12.3%)
No	(n=988, 87.1%)

Alcohol use (Current drinking status)

“How old were you when you had your first full drink of alcohol?”

1-12	(n=58, 5.1%)
13-14	(n=116, 10.2%)
15-16	(n=165, 14.6%)
17-18	(n=66, 5.8%)
Never	(n=721, 63.6%)

“Have you had a drink of alcohol in the past year?”

Yes	(n=346, 30.5%)
No	(n=65, 5.7%)

Alcohol use (Problematic alcohol use)

Alcohol frequency: “How often do you have a drink containing alcohol?”

Monthly or less	(n=70, 6.2%)
2-4 times a month	(n=104, 9.2%)
2-3 times a week	(n=128, 11.3%)
4 or more times a week	(n=44, 3.9%)

Alcohol amount: “How many full drinks containing alcohol do you have in a typical day when you are drinking?”

1-2 drinks	(n=195, 17.2%)
3-4 drinks	(n=118, 10.4%)
5 or more drinks	(n=32, 2.8%)

Alcohol behavior (1): “Have you ever been seriously injured or hurt due to your drinking?”

Yes	(n=132, 11.6%)
No	(n=214, 18.9%)

Alcohol behavior (2): “Has someone else been seriously injured or hurt because of your drinking?”

Yes	(n=95, 8.4%)
No	(n=251, 22.1%)

Negative future expectations

Anticipating unhappiness: “Overall, what do you think about the following statements- I will be unhappy.”

Yes (agree)	(n=158, 13.9%)
No (disagree)	(n=972, 85.7%)

Anticipating bad things: “Overall, what do you think about the following statements- Bad things happen to people like me.”

Yes (agree)	(n=344, 30.3%)
No (disagree)	(n=786, 69.3%)

Anticipating early death: “Overall, what do you think about the following statements- I will probably die before I am thirty.”

Yes (agree)	(n=146, 12.9%)
No (disagree)	(n=985, 86.9%)

Suicidal ideation

“In the past year, did you ever think of killing yourself?”

Yes	(n=266, 23.5%)
No	(n=864, 76.2%)

CHAPTER 3.

Child Maltreatment and Polysubstance Use Profiles from Adolescence to Adulthood

The use of alcohol, tobacco, and other drugs (heroin, cocaine, methamphetamine, and non-prescription drug use) is a major public health problem in the United States (National Institute on Drug Abuse, 2017). Nearly 25% of all deaths in the United States are attributable to alcohol, tobacco, and other illicit drug use (National Institute on Drug Abuse, 2017). An association between child maltreatment and alcohol and drug use has been well established in the literature (Norman et al., 2012; Shin, Miller, & Teicher, 2013; Wilsnack, Vogeltanz, Klassen, & Harris, 1997).

Theoretical mechanisms explaining the associations between child maltreatment and polysubstance use are based on the developmental traumatology theory, in which individuals who experience maltreatment may engage in internalizing (e.g., social withdrawal, depression, etc.) and externalizing (e.g., aggression) behaviors (De Bellis, 2002; Epstein, Saunders, Kilpatrick, & Resnick, 1998; Sroufe & Rutter, 1984; Yoon, Kobulsky, Yoon, & Kim, 2017). Through internalizing and externalizing behaviors, these individuals are at a higher risk for substance use (De Bellis, 2002; Epstein et al., 1998; Sroufe & Rutter, 1984; Yoon et al., 2017). Additionally, early adversity, such as child maltreatment, may lead to stress sensitization which increases susceptibility to stress-related events later in life, thus increasing risk of stress-related substance use (Enoch, 2011; Heim et al., 2002; Young-Wolff, Kendler, & Prescott, 2012).

Biological mechanisms may also play a role in the links between child maltreatment and adolescent substance use. Early trauma, including child maltreatment, may lead to dysregulation of the body's stress response system, which increases risk of experiencing internalizing and

externalizing behaviors (De Bellis, 2002; Yoon et al., 2017). Also, experiencing child maltreatment may also increase risk of post-traumatic stress symptoms through the biological stress pathway (De Bellis, 2002; Yoon et al., 2017). The conceptual model for this study is presented in Figure 2.1.

The research on substance use and child maltreatment has mainly focused on alcohol use. A study conducted on adolescents found that experiencing multiple types of child maltreatment was associated with problematic binge drinking (Shin, Edwards, & Heeren, 2009). Physical abuse and child neglect have also been found to be significant predictors of an accelerated trajectory to heavy episodic drinking among adolescents (Shin et al., 2013). Sexual abuse specifically has been linked to alcohol use, particularly among girls and women (Hughes et al., 2010; Sartor et al., 2013; Wilsnack et al., 1997; Wilsnack & Wilsnack, 1995). Smith and colleagues found an association between sexual abuse and alcohol use but only among those who endorsed drinking alcohol as a coping mechanism (Smith, Smith, & Grekin, 2014). Emotional abuse has also consistently been a predictor of alcohol use among adolescents (Mills, Alati, Strathearn, & Najman, 2014; Norman et al., 2012; Potthast, Neuner, & Catani, 2014; Shin et al., 2013; Shin, Lee, Jeon, & Wills, 2015).

Less research has been conducted on the association between child maltreatment and subsequent tobacco use (Norman et al., 2012). Biological mechanisms may also help explain the association between child maltreatment and smoking. Nicotine in tobacco is a psychoactive substance which may work to ameliorate stress and psychological distress associated with child maltreatment (Berrendero, Robledo, Trigo, Martín-García, & Maldonado, 2010). Among participants in the Chicago Longitudinal Study, substantiated child maltreatment was significantly associated with daily cigarette smoking among adults (Mersky & Topitzes, 2010).

Kristman-Valente and colleagues found that child physical abuse and child sexual abuse predicted the frequency of cigarette smoking in adolescence and adulthood; however, child physical abuse and child sexual abuse did not predict *ever* smoking (Kristman-Valente, Brown, & Herrenkohl, 2013). In this study, the frequency of smoking in adolescence was also predictive of smoking in adulthood (Kristman-Valente et al., 2013).

Additionally, few studies have examined the association between child maltreatment and other substance use, such as marijuana, cocaine, heroin, methamphetamine, and other illicit drugs. A 30-year longitudinal study found that childhood abuse and neglect were significant predictors of illicit substance use (cocaine, marijuana, heroin, psychedelics) in middle adulthood for women, but this association was not statistically significant for men (Wilson & Widom, 2009). Wilsnack and colleagues found that nearly 1/3 of women who experienced sexual abuse also reported using illicit substances during their lifetime (Wilsnack et al., 1997). Among adolescents, child maltreatment was associated with marijuana use, specifically early initiation of marijuana use (Proctor et al., 2017).

Research on the association between child maltreatment and polysubstance use is also scarce. This research is important because the use of one psychoactive substance often occurs with other substances (Armour, Shorter, Elhai, Elklit, & Christoffersen, 2014). A latent class analysis conducted on a sample of young, Danish adults found that childhood sexual abuse and childhood physical abuse were associated with classes of high drug use compared to the class of low drug use (Armour et al., 2014). Among females, child sexual abuse was strongly associated with polysubstance use, but this association was not significant for males (Shin, Hong, & Hazen, 2010). Charak and colleagues found that multiple types of victimization early in life predicted the use of multiple substances in adolescents; however, in addition to child maltreatment,

victimization also included general victimization, such as being threatened with a weapon (Charak, Koot, Dvorak, Elklit, & Elhai, 2015).

Furthermore, the operationalization of child maltreatment is another area of growing research. Previous studies have demonstrated that child maltreatment should be conceptualized as a multidimensional construct (Rivera, Fincham, & Bray, 2018), suggesting that chronicity (Hecht, Cicchetti, Rogosch, & Crick, 2014), frequency (Jonson-Reid, Kohl, & Drake, 2012), and co-occurrence (Berzenski & Yates, 2011) of child maltreatment experiences are meaningful when examining health outcomes such as substance use. Cumulative effects of child maltreatment, which occur when experiencing multiple types of child maltreatment have an additive effect on substance use behaviors, were found on binge drinking among adolescents (Abdala, Li, Shaboltas, Skochilov, & Krasnoselskikh, 2016; Shin et al., 2009) and substance use disorders among adults (Hughes, McCabe, Wilsnack, West, & Boyd, 2010). Interactive effects of child maltreatment occur when different types of child maltreatment experiences interact with one another. Specifically, interactive effects occur when experiencing specific types of child maltreatment have a stronger (or weaker) association with substance use compared to the additive effect of those types of child maltreatment. Hibbard and colleagues failed to detect a statistically significant interaction between child physical abuse and sexual abuse on problematic alcohol use (Hibbard, Ingersoll, & Orr, 1990), but other research has demonstrated interactive effects of child maltreatment types on other adverse health behaviors, such as sexual risk behaviors (Arata, Langhinrichsen-Rohling, Bowers, & O'Brien, 2007; Hahm, Lee, Ozonoff, & Van Wert, 2010; Thibodeau, Lavoie, Hébert, & Blais, 2017).

This study seeks to expand on previous studies examining child maltreatment and polysubstance use (Armour et al., 2014; Charak et al., 2015; Sunny Hyucksun Shin et al., 2010)

by analyzing the impact of child maltreatment patterns on polysubstance use profiles over the course of adolescence to adulthood using latent class analysis and latent transition analysis. This research will expand on the child maltreatment and alcohol use studies (Hughes et al., 2010; Mills et al., 2014; Potthast et al., 2014; Sartor et al., 2013; Shin et al., 2009; Shin et al., 2013; Smith et al., 2014; Wilsnack & Wilsnack, 1995; Wilsnack et al., 1997) by also incorporating other substances and tobacco use.

The research questions that inform this study are: 1) What is the association between child maltreatment and polysubstance use in adolescence and adulthood?; 2) What is the association between child maltreatment and longitudinal patterns of polysubstance use?

Methods

Study sample

The current study utilizes data from the National Longitudinal Study of Adolescent to Adult Health (Add Health). The sampling frame consisted of 80 high schools from which students were randomly selected. The purpose of the original study was to determine adolescent health behaviors, risk behaviors, and health and behavioral outcomes over the life course. This study uses the first four waves of in-home interviews. At Wave I, participants were in 7^{th}-12^{th} grade in 1995. Wave II consisted of interviews in 1996. Wave III was conducted in 2001-2002 when participants were young adults (ages 18-26), and Wave IV consisted of interviews in 2008-2009 when participants were ages 24-32 years (Harris et al., 2009).

Measures

Substance use variables. Alcohol use, cigarette use, marijuana use, and other drug use measures were the main indicators for the outcomes for this study. An overview of the original

and constructed measures is presented in Table 3.1. In addition, detailed descriptions of original measures and constructed variables are presented in Appendix 3.1.

Alcohol use. Alcohol use was measured two questions. The first question measured any alcohol use during lifetime (Wave 1 and 4) and since last interview (Waves 2-3) using, "Have you had a drink of beer, wine, or liquor more than 2 or 3 times in your life (or since month of last interview)?" Participants who answered, "No" to this question were categorized as "Non-drinkers" and subsequently skipped for the next question. Binge drinking was assessed using, "During the past 12 months, how many times have you had 5 or more drinks in a row?" Participants were categorized as "Non-binge drinkers" and "Binge drinkers." The binge drinking questions were the same across all four waves. The alcohol use question which captured binge drinking and non-binge drinking was the most applicable for our research questions (Shin et al., 2009; Shin et al., 2013) compared to the other alcohol use questions measured in this study. Furthermore, binge drinking was consistently assessed across all waves.

Cigarette use. Cigarette use was operationalized in the first wave and second wave as, "Have you smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?" Participants were categorized as "Non-smokers" if they answered "No" and "Smokers" if they answered "Yes." In Wave 1, this was operationalized as *ever* use, whereas in Wave 2, the question specified past year use (since month of last interview). In Waves 3 and 4, tobacco use was operationalized using, "During the past 30 days, on how many days did you smoke cigarettes?" Participants who were skipped for this question (answered "No" to "Have you ever smoked at all in the past 30 days?") were categorized as "Non-smokers." To maintain consistency with previous waves, participants who reported cigarette use between 1-29 days were categorized as "Non-regular smokers," and participants who reported cigarette use for all

30 days were categorized as “Regular smokers.” This operationalization was also consistent across previous studies examining cigarette smoking among adolescents and adults (King, Reboussin, Spangler, Cornacchione Ross, & Sutfin, 2018; Viner et al., 2017).

Marijuana use. Marijuana use was operationalized as marijuana use during the past 30 days, “During the past 30 days, how many times have you used marijuana?” across all 4 waves. Participants were collapsed into “No marijuana use,” “1 time,” “2-3 times,” “4-20 times,” and “20 or more times,” to maintain consistency with marijuana use response categories in Wave 4. Marijuana use was a self-reported count variable for Waves 1-3, and for Wave 4, participants could select from specific cut points of days. For example, participants could select “1 day,” “2-3 days,” “1 day a week,” “2 days a week,” “3-5 days a week,” and “Every day or almost every day.” We applied these approximate predetermined cut points to the earlier waves’ corresponding time categories to maintain consistency across waves.

Other drug use. Other drug use included multiple other drugs, which varied across waves. For Waves 1 and 2, other drug use included inhalants, cocaine, and “other” drugs (LSD, PCP, ecstasy, mushrooms, speed, ice, heroin, or pills). However, in Waves 3 and 4, inhalants were no longer included in the survey and crystal meth was added. The full list of other drugs that were assessed in the survey is located in Appendix 3.1.

Child maltreatment. The main predictor variables of interest were the child maltreatment variables, which were assessed in Wave 4 retrospectively. Participants were asked how often they experienced maltreatment prior to age 18. In the Wave 3 survey, maltreatment measures were also assessed; however, these measures were asked about child maltreatment prior to the 6^{th} grade. Additionally, the Wave 4 measure of child physical abuse asked about more serious physical abuse compared to the Wave 3 child physical abuse measure. Therefore,

we chose to use the Wave 4 measure of child maltreatment due to the wider time frame and a potentially more severe measure of physical abuse.

Physical abuse was assessed using, “How often did a parent or adult caregiver hit you with a fist, kick you, or throw you down on the floor, into a wall, or down stairs?” Sexual abuse was assessed using, “How often did a parent or other adult caregiver touch you in a sexual way, force you to touch him or her in a sexual way, or force you to have relations?” Participants could answer “one time,” “two times”, “three to five times,” “six to ten times,” “more than ten times,” or “this has never happened.”

Furthermore, two other child maltreatment questions were asked of participants but were not included in this study. Emotional abuse was assessed in Wave 4 using, “How often did a parent or caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved?” Neglect was assessed in Wave 3 using two questions, “How often had your parents or other adult caregivers left you home alone when an adult should have been with you” and “How often had your parents or other caregivers not taken care of your basic needs, such as keeping you clean or providing food or clothing?” These questions of emotional abuse and neglect did not operationalize the severe measures of these constructs. Therefore, due to our aims of examining child maltreatment in a more severe framework, we chose to only utilize the physical and sexual abuse questions that were measured in Wave 4 for this study.

Other covariates. Other covariates included age (in years), poverty (whether the participant’s parents received food stamps/welfare assistance), race, and sex. Race included categories of “White,” “Black/African-American,” “Hispanic/Latino,” and “Other.” Sex was a binary measure in the survey (male/female). This study was approved by Georgia State University Institutional Review Board (IRB).

Data Analysis

Latent class analysis was utilized for the main outcomes of substance use behaviors. Latent class analysis uses cross-sectional measures to identify underlying subgroups of people based on similarities and differences on categorical observed variables. First, a latent class measurement model for substance use behaviors was constructed in each wave. The final number of latent classes was determined using both an empirical and substantive approach.

Then, latent transition analysis was implemented to assess changes in latent class membership of substance use over time. Latent transition analysis is an extension of latent class analysis. Latent transition analysis is a longitudinal analysis which determines the probability of transition between classes over time (Collins & Lanza, 2010). All higher order moments were also tested compared to the simple Markov chain model. All higher order moments that were statistically significant in the nested model tests were incorporated in the final unconditional and conditional models. All freely estimated thresholds were allowed to vary across waves, thus we did not apply longitudinal invariance assumption. Instead, based on developmental trajectories of substance use patterns and behaviors over time (Shin et al., 2013; Chassin, Fora, & King, 2004), we allowed these parameters to be freely estimated and relaxed this assumption.

Child maltreatment variables were examined using nested model tests to determine the best operationalization of these variables. The child maltreatment variables were also examined as a latent class variable. We also tested whether child maltreatment influenced the transitions of substance use classes. This was accomplished by allowing associations between child maltreatment and substance use classes to be estimated in the previous wave. This comparison enabled us to conduct a global χ^2 test to determine whether transition probabilities between substance use classes were statistically significantly different across child maltreatment patterns.

In each wave, statistically significant direct effects of the predictor variables were examined on substance use indicators in each wave (Masyn, 2017). The direct effects allow for predictor variables to have an association with substance use indicators, above and beyond that explained by the predictor effect on latent class membership. Additionally, all child maltreatment variables, regardless of statistical significance, were allowed to have direct effects on substance use indicators. Therefore, the unconditional model consisted of no predictors, and the conditional model consisted of all predictor variables, direct effects, and applicable higher order moments.

An analytic model of this study is presented in Figure 3.2a. Additionally, a diagram of the direct effects of child maltreatment on substance use indicators is presented in Figure 3.2b. Latent class regressions and latent transition analyses were adjusted for age, race, poverty, and sex. Full information maximum likelihood (FIML) estimation was implemented to account for missing data (missing at random) using Mplus software (L. Muthén & Muthén, 1998). Sampling weights were not utilized in this study due to computational power; however, preliminary pairwise analyses revealed no inferential differences whether sampling weight were used. All analyses were conducted in R 3.5.1 and Mplus 8.2 (L. Muthén & Muthén, 1998).

Results

Among all participants (n=14,625), 15% (n=2,328) reported physical abuse only, 2% (n=365) reported sexual abuse only, and 3% (n=386) reported both physical abuse and sexual abuse, retrospectively in Wave 4 (Table 3.2). Among all persons reporting maltreatment (n=3,079), 12% reported both physical abuse and sexual abuse. A higher percentage of females compared to males reported sexual abuse only (4% vs. 0.9%, respectively) and both sexual and physical abuse (3.6% vs. 1.7%, respectively). For the child maltreatment variables, the model that incorporated distinction of child maltreatment by type of child maltreatment resulted in the

best fit. The original measures of physical abuse and sexual abuse were constructed as a latent class variable with two free classes and one fixed class of "no maltreatment." However, this resulted in no distinctive patterns of maltreatment in the two free classes. Therefore, classes were fixed based on observed patterns of maltreatment in the data and previous research on latent classes of child maltreatment (Rivera et al., 2018). These classes were distinguished by type of abuse: physical abuse, sexual abuse, and both physical and sexual abuse. This model resulted in classes being homogenous in terms of type of maltreatment, but the heterogeneity within classes was attributed to varying frequencies of the specific type of maltreatment. When testing inclusion criteria for these categories, individuals were classified as experiencing abuse if they reported one or more instance. This resulted in the best model fit. For example, for persons reporting one instance of only physical abuse, they were classified in the same class as persons reporting 6 instances of only physical abuse. However, individuals who were classified as experiencing sexual abuse only were in a separate class, and individuals classified as experiencing both physical and sexual abuse were in a third class. Since the entropy for these classes was high (0.998), we converted the latent class variable into observed indicator variables based on modal class assignment. This resulted in four observed variables: physical abuse only, sexual abuse only, physical and sexual abuse, and no maltreatment (referent category).

Table 3.3 presents substance use descriptive statistics across all waves. Generally, participants reported higher percentages of regular smoking and binge drinking in the adulthood waves compared to earlier adolescent waves. For example, the percentage of regular smokers was 25% in Wave 4 compared to 20% in Wave 1. Binge drinking was nearly twice as high (50%) in Wave 4 compared to Wave 1 (27%). The percentage of other drug use was the highest in Wave 1 (12%) and remained steady across the adult waves (7% for Waves 3 and 4). Frequent

marijuana use (>20 times) was the highest (7%) in early adulthood (Wave 3), whereas the percentage of marijuana use >30 days ago was the highest in Wave 1 (13%).

Latent Class Measurement Model for Substance Use

Initial exploratory latent class analyses of substance use behavior resulted in mixing of response patterns that did not hold substantively. For example, "abstainer" patterns, or youth who endorsed "no" to using all substances were initially mixed with youth who endorsed using "other drugs." Additionally, one exploratory class in Wave 3 consisted of both patterns of alcohol use and a complete abstainer pattern, yielding a substantively questionable class. Therefore, we conducted a partial-confirmatory latent class analysis in which the types of substances were specified for each class, but the intensity of substance use within each class was allowed to vary. Evidence for this model specification was also supported in the literature (Kristman-Valente et al., 2013), with previous findings of child maltreatment having an effect on the frequency of smoking but not *ever* smoking. This partial-confirmatory model specification was achieved by fixing some of the response category probabilities within latent classes to zero and allowing other probabilities to freely vary. Thus, all freely estimated thresholds were allowed to vary across waves, and we did not impose longitudinal invariance. This is reasonable, given the class characteristics, because the intensity of substances is allowed to vary in class; therefore, this variation corresponds to previous literature with the developmental trajectories of substance use changing over time (Chassin et al., 2004; Shin et al., 2013). A model specification table is presented in Table 3.4.

The final substance use classes included the abstainer class, alcohol only class, alcohol and cigarette only class, cigarette only class, marijuana only class, marijuana and cigarette only class, marijuana and alcohol only class, three substance class (cigarette, drinking, and

marijuana), other drug use class, and a polysubstance class which contained all four substances (Table 3.5). Overall, the abstainer class had the highest percentage of participants at the earlier waves compared to the later waves (Figure 3.3). For example, in adolescence Wave 1, the abstainer class had nearly half of the sample (49%, n=8,703) whereas in adulthood during Wave 4, the abstainer class only comprised 17% of participants (n=2,479). The alcohol only class contained a higher percentage of participants in the later waves compared to the earlier waves. The marijuana only classes, marijuana and cigarette use classes, and other drug use classes were among the smaller classes and contained similar percentages of participants across waves. In terms of item endorsement probabilities within classes, the alcohol only class had a higher item endorsement probability for binge drinking in the later waves compared to the earlier waves. Additionally, the marijuana only class had a higher item endorsement probability for more frequent use in the later waves compared to the earlier waves. Across all waves, the polysubstance classes resulted in higher item endorsement probabilities for more frequent marijuana use and binge drinking compared to the alcohol only and marijuana only classes. The other drug use classes varied across waves. In Waves 1 and 3, item endorsements for the other drug use class were higher for marijuana use and alcohol use compared to other waves, whereas in Waves 2 and 4, item endorsements were lower for marijuana use and alcohol use in the other drug use class compared to other waves.

Child Maltreatment and Latent Class Membership

For the first research question, the associations between child maltreatment and latent class membership were assessed in each wave, after adjusting for other covariates and direct effects of child maltreatment on substance use indicators. Prior to modeling maltreatment with substance use and covariates, descriptive statistics of child maltreatment patterns by substance

use classes are presented in Table 6. For youth reporting no maltreatment, the percentage classified by the abstainer class in Wave 1 (48%) was higher compared to youth reporting physical abuse only (39%), sexual abuse only (38%), and both physical and sexual abuse (32%). This was also evident in Wave 2; however, in Waves 3 and 4, percentages of youth classified by the abstainer class were similar among youth reporting no maltreatment and maltreatment.

The association between child maltreatment and substance use was then inferentially tested, starting with Wave 1. The model results for Wave 1 latent class regression are presented in Tables 7a-f. Overall, child maltreatment was statistically significantly associated with latent class membership in Wave 1. In Wave 1, compared to reporting no maltreatment, there was a statistically significant association between reporting physical abuse and being classified in almost all substance use classes compared to the abstainer class (with the exception of the cigarette and alcohol class and the cigarette and marijuana class). For example, individuals reporting physical abuse had higher odds of being classified in the cigarette only class (OR: 2.24; 95% CI: 1.60, 3.15) or the alcohol only class (OR: 1.76; 95% CI: 1.24, 2.51) compared to the abstainer class, after adjusting for all covariates. Compared to single substance use classes of alcohol and marijuana, physical abuse was associated with being classified in the polysubstance use class (OR: 2.03; 95% CI: 1.47, 2.80).

Also in Wave 1, compared to reporting no maltreatment, sexual abuse was statistically significantly associated with being classified in the single substance use classes, the marijuana and alcohol class, and the three substance class compared to the abstainer class. Reporting both physical and sexual abuse was associated with membership in almost all substance use classes compared to the abstainer class (with the exception of the marijuana only class) in Wave 1, suggesting a cumulative effect of physical abuse and sexual abuse on substance use.

Experiencing both physical and sexual abuse was associated with a higher odds of being classified in the polysubstance class compared to the alcohol only class (OR: 2.53; 95% CI: 1.44, 4.46) and the marijuana and alcohol class (OR: 2.28; 95% CI: 1.18, 4.41), after adjusting for covariates.

Comparisons between the types of maltreatment are presented in Tables 3.7d-f. The unique effects of physical abuse only compared to sexual abuse only are presented in Table 3.7d. Overall, physical abuse only was associated with being in the polysubstance use class in Wave 1 compared to sexual abuse only, suggesting a unique effect of physical abuse. Moreover, compared to sexual abuse only, physical abuse only was associated with being in the cigarette only class compared to the abstainer and alcohol only class in Wave 1. Finally, compared to sexual abuse only, physical abuse only was associated with a reduced odds of being in the other drug use class (OR: 0.63; 95% CI: 0.43, 0.93) compared to the polysubstance use class. Thus, compared to physical abuse, sexual abuse only was associated with a higher odds of being in the other drug use class compared to the polysubstance use class. Additionally, similar patterns were observed for sexual abuse only compared to reporting both physical and sexual abuse regarding the other drug use class. Compared to both physical and sexual abuse, sexual abuse only was associated with an increased odds of being in the other drug use class compared to the polysubstance use class (OR: 2.34; 95% CI: 1.10, 4.99). Overall, compared to both physical and sexual abuse, sexual abuse only was associated with a reduced odds of being classified in the polysubstance use class and the cigarette and marijuana use class. This suggests a cumulative effect of physical and sexual abuse on the polysubstance use and the cigarette and marijuana class compared to sexual abuse alone. Finally, the effects of physical abuse only compared to both physical and sexual abuse are presented in Table 3.7f. Physical abuse only, compared to

physical and sexual abuse, was still associated with the polysubstance use class and the cigarette only class; however, the pairwise comparisons with reporting both physical and sexual abuse were weaker compared to no maltreatment and sexual abuse only.

Direct effects were also examined between child maltreatment variables and substance use indicators. Individuals reporting both physical and sexual abuse had a higher odds of being classified in the other drug use class (OR: 2.15; 95% CI: 1.05, 4.41), and there were statistically significant direct effects of physical and sexual abuse on the alcohol indicator within this class (OR: 12.21; 95% CI: 3.50, 42.54). Thus, reporting both physical and sexual abuse were associated with higher levels of alcohol use in the other drug use class compared to no maltreatment, above and beyond the variation explained by the other drug use latent class membership. Also, individuals reporting both physical and sexual abuse had higher odds of being classified in the marijuana and alcohol class (OR: 1.71; 95% CI: 1.04, 2.81), compared to the abstainer class, and also had a statistically significant positive direct effect on the alcohol use indicator (OR: 3.26; 95% CI: 1.04, 10.26). Similar patterns were observed between experiencing physical and sexual abuse with the alcohol and cigarette class, but these direct effects were not observed in the alcohol only class.

We had similar findings for other waves, which are listed in the appendices (Tables 3.7d-l). The association between polysubstance use and physical abuse only persisted in Waves 2-4. In early adulthood, sexual abuse only was associated with the marijuana and cigarette use class, whereas in Wave 4, sexual abuse only was associated with the polysubstance use class and the other drug use class (compared to the abstainer class and the single substance classes of alcohol and cigarettes). In Wave 4, reporting both physical and sexual abuse was associated with the polysubstance use class compared to the abstainer and the alcohol only class, as well as the other

drug use class, compared to the abstainer, alcohol only, and marijuana and alcohol classes. Lastly, as expected, sex, race/ethnicity, age and poverty were all statistically significantly associated with latent class membership at all four waves.

Unconditional Latent Transition Model Results

The unconditional latent transition model consisted of all higher order moments. All higher order moments were statistically significant when tested using nested model tests. Specifically, substance use classes in previous waves were statistically significant predictors of substance use classes in later waves, in addition to the simple Markov chain ordering of waves. For example, in addition to predicting substance use class membership at Wave 2, Wave 1 substance use class membership was also predictive of membership at Wave 3 and membership at Wave 4, even when accounting for interim memberships.

Unconditional transition matrices are presented in Table 3.8. Due to the higher order moments incorporated in the model, transition probabilities for Waves 2 to 3 and for Waves 3 to 4 are holding all participants constant in the abstainer (referent) class in Wave 1 and 2. For the unconditional model, youth who start in classes characterized by alcohol and cigarettes in Wave 1 (e.g., the alcohol only class, the cigarette only class, and the alcohol and cigarette classes) had higher transition probabilities for staying in those same classes in Wave 2 compared to classes characterized by other types of substances. Moreover, high transition probabilities were observed for youth who remained in the 3 substance use class (cigarettes, alcohol, and marijuana) (0.449) and the polysubstance use class in Wave 2 (0.411). A high transition probability was also observed among youth classified in the cigarette and marijuana class in Wave 1 to the 3 substance use class in Wave 2 (0.653). Also, the abstainer class had the highest transition probability for staying in the same abstainer class across Waves 1 and 2 compared to later waves.

For transitions between Waves 2 and 3 (holding constant membership in the abstainer class at Wave 1), the unconditional model shows that among all participants (who start in the abstainer class in Wave 1), transition probabilities for staying in the alcohol use class were relatively high (0.596). This transition probability was higher for Waves 2 and 3 compared to Waves 1 and 2 (0.290). Patterns were also observed for higher transitions into the alcohol use class in Wave 3 from classes characterized by cigarette use in Wave 2. Transition probabilities for staying in the three substance class and the polysubstance class were lower for Waves 2 and 3 compared to Waves 1 and 2.

Additionally, for transitions between Waves 3 and 4 (accounting for participants starting in the abstainer classes in Waves 1 and 2), high transition probabilities were observed for staying in the alcohol use class overall in the unconditional model (0.657). Also, for participants reporting cigarette only use in Wave 3, high transition probabilities were observed for staying in the cigarette only class (0.347) and transitioning into the cigarette and alcohol class (0.354) in Wave 4. For participants already starting in the cigarette and alcohol only class in Wave 3, the highest transition probability was observed for staying in this same class in Wave 4 (0.435) among these participants. Participants who were classified in the polysubstance use class in Wave 3 were most likely to transition to the three substance use class in Wave 4 (0.298) compared to remaining in the polysubstance use class in Wave 4 (0.147).

Table 3.9 presents unconditional model results for the most frequently observed latent transition chains which start with the abstainer classes in Waves 1 and 2. Among all possible latent transition chains (n=10,000), Table 3.9 contains 46% of the chains observed in the data. The chain with the highest frequency among all chains was characterized by starting in the abstainer class for Waves 1 and 2 and transitioning into the alcohol use only class for Waves 3

and 4 (18%). The second most frequently occurring chain was characterized by staying in the abstainer class across all four waves (10%). Other frequently occurring chains included abstaining until transitioning into the alcohol only class in Wave 4 (2%), abstaining until transitioning into the cigarette and alcohol class in Wave 3 and the cigarette only class in Wave 4 (3%), and abstaining until transitioning into the marijuana and alcohol class in Waves 3 and 4 (2%).

Conditional Latent Transition Model Results

There was no evidence that child maltreatment had a statistically significant impact on the transitions between substance use classes (χ^2= 1077.93, *df*= 1,030, *p*=0.15). Transition probabilities for the conditional latent transition model, where child maltreatment was allowed to influence class membership but not transition probabilities, are shown in Table 3.10. Similarly to the unconditional model, due to the higher order moments, transition probabilities for Waves 2 to 3 and for Waves 3 to 4 are holding all participants constant in the abstainer (referent) class in Wave 1 and 2. Conditional model transition probabilities were very similar to the unconditional model transition probabilities.

While the transitions between substance use classes did not vary by reported child maltreatment experiences, there were some noted differences in latent class membership at specific waves for child maltreatment patterns. For example, individuals reporting physical abuse only had higher odds of being in the cigarette only class compared to the abstainer class in adolescence (Waves 1 and 2), but this was not observed in the adult waves. Additionally, individuals reporting physical abuse only had higher odds of being in the polysubstance use class compared to the abstainer class at all waves, from adolescence to adulthood. While sexual abuse only was associated with being in the polysubstance use class in adolescence (Wave 2 OR: 2.53;

95% CI: 1.25, 5.13) and adulthood (Wave 4 OR: 3.75; 95% CI: 1.61, 8.72), this association was not observed in early adulthood (Wave 3). Furthermore, experiencing both physical and sexual abuse was associated with the polysubstance use class in Wave 1 compared to the abstainer class; however, this association was not observed in any other waves.

Additionally, direct effects that were statistically significant in the individual wave latent class regressions were no longer statistically significant in the conditional latent transition model. Specifically, the effects of reporting both physical and sexual abuse on alcohol use indicators were no longer statistically significant. However, there were statistically significant effects of physical abuse only on cigarette use in Waves 2 and 3. For example, reporting physical abuse only was associated with being in the polysubstance use class in Wave 2 (OR: 1.89; 95% CI: 1.37, 2.61), and there was a statistically significant direct effect of physical abuse on cigarette use.

Discussion

This paper presents findings of the impact of child maltreatment on substance use across adolescence and adulthood among a nationally representative sample of U.S. participants. The reported prevalence of physical abuse only, sexual abuse only, and both physical and sexual abuse in this study are similar to previous estimates among the U.S. population (U.S. Preventive Services Task Force et al., 2018). In this study, compared to the abstainer class, a higher percentage of individuals who reported maltreatment were classified in substance use classes compared to individuals who reported no maltreatment, consistent with the literature on the association between child maltreatment and substance use (Norman et al., 2012; Shin et al., 2010; Wilsnack et al., 1997).

Overall, child maltreatment had a statistically significant effect on latent class membership of substance use. Compared to the abstainer class, all child maltreatment patterns were statistically significantly associated with being classified in the three substance use (cigarette, alcohol, and marijuana) class at Wave 1 in adolescence. Additionally, reporting physical abuse only and both physical and sexual abuse were statistically significantly associated with being classified in the polysubstance use class in Wave 1. There were also unique effects of physical abuse only compared to sexual abuse and both physical and sexual abuse on the polysubstance use class in Wave 1. In the latent transition analysis, individuals starting in the three substance class in Wave 1 and the polysubstance class in Wave 1 had high probabilities for staying in these respective classes in adolescence at Wave 2. However, it should be noted that among individuals "staying" in the same class, this is not indicative of a constant intensity or frequency of use. For example, individuals staying in the same class may exhibit lower, higher, or constant levels of use in this same class in later waves. While the transition probabilities were not statistically significantly different between maltreatment patterns, individuals experiencing maltreatment had higher odds of being classified in multiple substance use classes in adolescence. Additionally, latent transition probabilities suggest that individuals who start in these classes have a relatively high probability of staying in these classes in adolescence. These results are consistent with previous studies which have demonstrated that cumulative experiences of physical abuse and sexual abuse are associated with the co-occurrence of substance use (Armour et al., 2014; Charak et al., 2015).

These results also suggest that maltreatment has an effect on substance use profiles at specific time points, as evident by the association between child maltreatment and latent class membership, but the transition between substance use types did not depend on child

maltreatment. Additionally, previous substance use profiles predicted later substance use profiles; however, there was not an interaction between child maltreatment and previous substance use profiles. The impact of child maltreatment on future substance use profiles was uniform across previous profile memberships. Regardless of which substance use profile individuals were classified in previously, child maltreatment had an impact on substance use profiles in each wave. This expands on previous studies which primarily look at shorter timeframes (Charak et al., 2015; Shin, 2012), which found that child maltreatment influenced progression towards polysubstance use classes. Our findings are similar, which show that child maltreatment is associated with multiple substance use profiles. Our results are also very similar to Yarnell and colleagues, who found that among maltreated youth, previous substance use behaviors were the strong predictors of later substance use behaviors (Yarnell, Traube, & Schrager, 2016); however, our study also showed alongside prior substance use profiles, later substance use profiles were predicted also by child maltreatment experiences. Finally, this study found that child maltreatment continued to have an impact on substance use profiles across adolescence and adulthood and exhibited an indirect effect on the transition between substance use profiles through the impact on prior substance use.

Regarding cigarette use, all maltreatment types were statistically significantly associated with starting in the cigarette only class in Wave 1 compared to the abstainer class. Additionally, transition probabilities for staying in the cigarette only class were fairly high in adolescence (Wave 1 and 2) and adulthood (Wave 3 and 4). However, it should be noted that for all classes of substance use, intensity of use was allowed to vary within classes across waves. Moreover, all child maltreatment types were also associated with starting in the three substance use class, which also consisted of cigarette use alongside alcohol and marijuana, compared to the abstainer

class in Wave 1. Experiencing both physical and sexual abuse were statistically significantly associated with all substance use profiles that incorporated cigarettes in Wave 1 compared to the abstainer class. This is consistent with the literature on adolescent and adulthood smoking (Viner et al., 2017). As mentioned previously, the association between child maltreatment and cigarette use may be attributed to the psychoactive properties of nicotine (Berrendero et al., 2010) (Mersky & Topitzes, 2010; Norman et al., 2012). Previous research, however, has been inconsistent with the association between child maltreatment and tobacco use (Kristman-Valente et al., 2013; Norman et al., 2012). A meta-analysis on child physical abuse stated studies showed mixed results on the association with cigarette use (Norman et al., 2012). Additionally, Kristman-Valente and colleagues did not detect an association between child physical and sexual abuse with cigarette smoking in adolescence (Kristman-Valente et al., 2013). However, this study, similarly to ours, found associations between child maltreatment and adult cigarette smoking (Kristman-Valente et al., 2013). Further expanding on these studies, our results show that child maltreatment is not only associated with cigarette use in isolation but alongside other co-occurring substances.

Our study also found associations between child maltreatment and marijuana use, including both marijuana use only classes and polysubstance use classes which included marijuana use. Previous research has demonstrated an association between substantiated child maltreatment and frequent adult marijuana use (Mills, Kisely, Alati, Strathearn, & Najman, 2017). Heavier marijuana use has also been linked to more severe types of maltreatment (Dubowitz et al., 2016). Additionally, impulsivity may play a mediating role between maltreatment and marijuana use (Oshri et al., 2018). Research has been relatively scarce on the

associations between child maltreatment with the co-occurrence alcohol and marijuana use. Future studies should examine these substance use patterns with child maltreatment.

Furthermore, above and beyond latent class membership, the cumulative experience of reporting both physical and sexual abuse had a direct effect on the alcohol use indicators in the other drug use class and the marijuana and alcohol use class, above and beyond the variation in alcohol use explained by the latent classes. Similar patterns were observed between experiencing physical abuse only and sexual abuse only with the alcohol and cigarette class, but these direct effects were not observed in the alcohol only class. These results are consistent with the strong research on child maltreatment and alcohol use (Bensley, Van Eenwyk, & Simmons, 2000; Norman et al., 2012; Shin et al., 2009; Shin et al., 2013; Wilsnack et al., 1997). However, our study found associations between child maltreatment and alcohol use in the context of examining all other substances as well. Additionally, our findings suggest that child maltreatment is not only associated with membership in classes characterized by alcohol but also was associated with reporting higher alcohol use in these classes compared to youth reporting no maltreatment. Among all participants, regardless of whether maltreatment was experienced, high transition probabilities of staying in the alcohol use classes were observed across waves, particularly in the adulthood waves. Interventions which target alcohol use among maltreated youth may also want to incorporate a component which addresses the frequency of alcohol use and the co-occurrence of alcohol use with other substances (Shin et al., 2009; Shin et al., 2013).

Limitations

While this study expands previous research for child maltreatment and substance use, several limitations are noted. First, reporting substance use and sensitive topics such as child maltreatment are susceptible to recall bias and social desirability bias, thus potentially

underestimating both substance use and child maltreatment experiences. Furthermore, only four general types of substance use were assessed in this study (cigarette use, alcohol use, marijuana use, and other drug use). Other drug use contained many substances which required collapsing into one class because of small number of individuals reporting specific other drug use substances. Future research may benefit from exploring these substances individually for their association with child maltreatment patterns. Additionally, opioid use was assessed collectively in the other drug use category in the original Wave 1-4 survey measures; however, Wave 5 of the ongoing Add Health study assess opioid use separately from other drugs. Additionally, cigarette use did not include e-cigarette use, which has implications due to the general population increase in use (Kwon, Seo, Lin, & Chen, 2018). However, e-cigarette use is also incorporated in Wave 5, and future studies should incorporate e-cigarette use and opioid use when examining a broad range of substance use.

Child maltreatment measures were limited to physical and sexual abuse. Future studies should expand to measures of child neglect and emotional abuse in addition to physical and sexual abuse. We chose to operationalize child physical and sexual abuse using the Wave 4 measures in the survey rather than the Wave 3 measures. Wave 4 asked about experiences prior to age 18, whereas Wave 3 asked about experiences prior to 6th grade. Additionally, the Wave 4 measure of child physical abuse asked about more serious physical abuse (hit with a fist, kicked, or thrown down on the floor, into a wall, or down stairs) compared to the Wave 3 child physical abuse measure. There were discrepancies in reporting abuse in Wave 3 and 4, which may be attributed to the difference in question wording and the time period assessed. Additionally, there may be issues with temporality regarding the timing of child maltreatment occurrences and the substance use behaviors measured in adolescence when individuals were less than 18 years of

age. Future research may benefit from examining the impact of differences in maltreatment patterns by age of occurrence in addition to severity on substance use, since previous research suggests that these dimensions may impact health outcomes (Rivera et al., 2018).

Implications

The overarching goal of this paper is to aid in informing secondary prevention interventions for substance use among individuals who have experienced child and physical abuse. Our findings show that child maltreatment and prior substance use profiles impacted future substance use profiles, but there was no interaction between prior substance use profiles and child maltreatment. Specifically, the changes between substance use profiles over time did not depend on child maltreatment. However, child maltreatment continued to have an impact on substance use profiles across adolescence and adulthood and exhibited an indirect effect on the transition between substance use profiles through the impact of prior substance use. This study presents a unique approach to modeling latent classes of substance use profiles longitudinally and further expands on the child maltreatment and polysubstance use literature by using advanced multivariate methods. Future studies should expand to incorporate other substances and to assess the severity and timing of the maltreatment experiences reported.

Figure 3.1. Conceptual model for child maltreatment and substance use

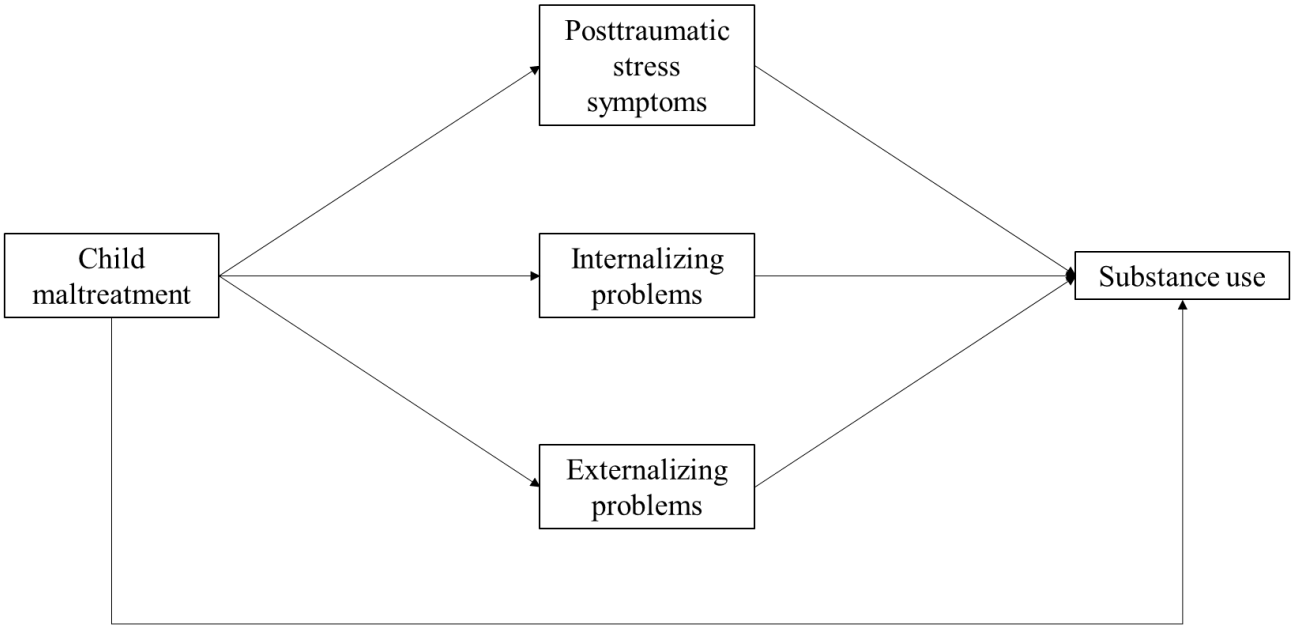
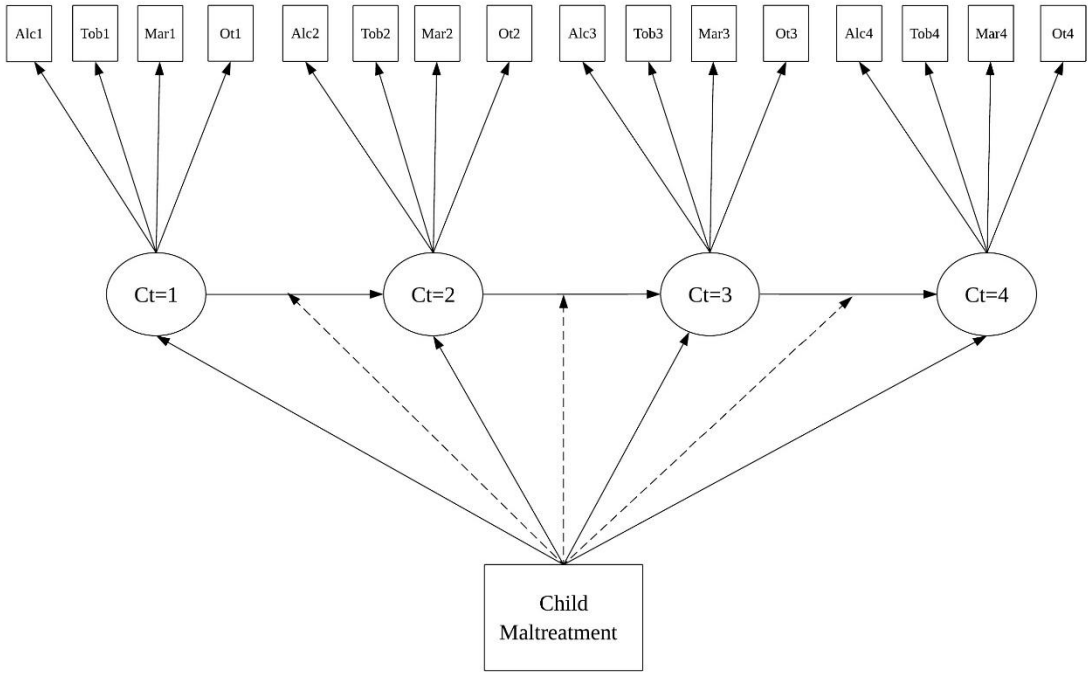
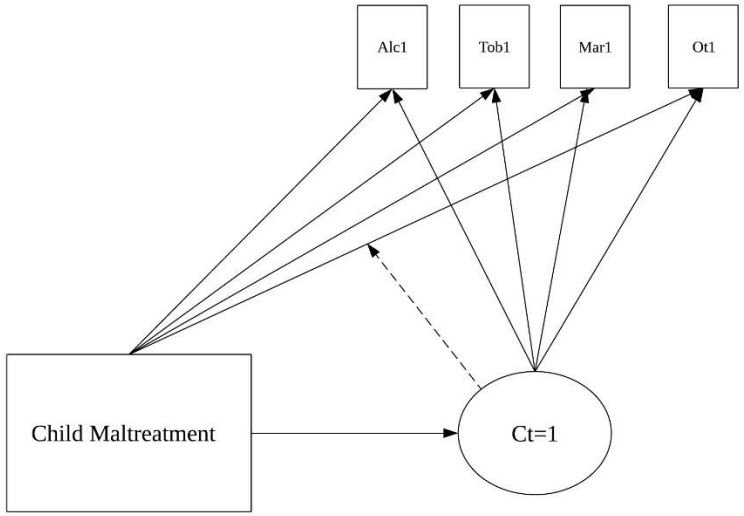


Figure 3.2a. Analytic model of the impact of child maltreatment on substance use classes among participants in the National Longidutinal Study of Adolescent to Adult Health (Waves 1-4)



Note. Alc=Alcohol; Tob=Tobacco; Mar=Marijuana; Ot=Other drug use.

Figure 3.2b. Analytic model of the direct effects of child maltreatment on substance use indicators among participants in the National Longidutinal Study of Adolescent to Adult Health (Waves 1-4)



Note. Alc=Alcohol; Tob=Tobacco; Mar=Marijuana; Ot=Other drug use.

Table 3.1. Measures of substance use used to construct latent class indicators among participants in the National Longitudinal Study of Adolescent to Adult Health

	Survey questions			
	Wave 1	Wave 2	Wave 3	Wave 4
Alcohol	Non-drinker: never used Non-binge drinker: used in lifetime, but not binge Binge drinker: at least one time of 5 or more drinks in a row in a day	Non-drinker: not used (since month of last interview) Non-binge drinker: used since month of last interview, but not binge Binge drinker: at least one time of 5 or more drinks in a row in a day	Same as Wave 2	Same as Wave 1
Cigarettes	Non-smoker: never used (lifetime) Smoker: used regularly at least 1/day for 30 days	Non-smoker: never used (since month of last interview) Non-regular smoker: used since month of last interview, but not regular smoker Regular smoker: used regularly at least 1/day for 30 days	Non-smoker: never used (in past 30 days) Non-regular smoker: used in past 30 days, but not regular smoker Regular smoker: used regularly at least 1/day for 30 days	Same as Wave 3
Marijuana	No use: no marijuana use Marijuana use >30 days: used marijuana in lifetime, but not in past 30 days 1 time in 30 days 2-3 times in 30 days 4-20 times in 30 days >20 times in 30 days	No use: no marijuana use Marijuana use >30 days: used marijuana in past 12 months, but not in past 30 days 1 time in 30 days 2-3 times in 30 days 4-20 times in 30 days >20 times in 30 days	Same as Wave 2	Same as Wave 2
Other drug use	No use: no other drug use in lifetime Other drug use: ever used other drugs (cocaine, inhalants, other drugs) in lifetime	No use: no other drug use in past 30 days Other drug use: ever used other drugs (cocaine, inhalants, other drugs) in past 30 days	No use: no other drug use in past 30 days Other drug use: ever used other drugs (cocaine, crystal meth, other drugs) in past 30 days	No use: no other drug use in past 30 days Other drug use: ever used other drugs (cocaine, crystal meth, other drugs) in past 30 days

Table 3.2. Descriptive statistics of demographics at baseline by reported experiences of childhood physical and sexual abuse at Wave 4 among respondents from the National Longitudinal Study of Adolescent to Adult Health (n=14,625)

	No child maltreatment (n=11,613, 79%)	Physical abuse only (n=2,328, 15%)	Sexual abuse only (n=365, 2%)	Both physical and sexual abuse (n=386, 3%)	Total
Sex					
Male	5,488 (80%)	1,203 (18%)	56 (0.8%)	118 (1.7%)	6,865 (47%)
Female	6,123 (78%)	1,125 (14%)	309 (4.0%)	268 (3%)	7,825 (53%)
Age, M (SD)	16.1 (1.7)	16.1 (1.7)	16.1 (1.7)	16.3 (1.7)	16.2 (1.7)
Race/ethnicity					
White	6,285 (80%)	1,192 (15%)	181 (2%)	186 (2%)	7,844 (53%)
Hispanic/Non-White	1,819 (78%)	384 (17%)	55 (2%)	76 (3%)	2,334 (16%)
Black/African American	2,503 (79%)	486 (15%)	97 (3%)	92 (3%)	3,178 (22%)
Other	995 (75%)	265 (19%)	32 (2%)	32 (4%)	1,324 (9%)
Welfare/assistance recipient					
Yes	750 (70%)	228 (21%)	43 (4%)	55 (5%)	1,076 (9%)
No	9.293 (80%)	1,727 (15%)	269 (2%)	263 (2%)	11,552 (90%)

Note. Observed frequencies and weighted percentages are reported.

Table 3.3. Descriptive statistics of substance use among respondents from the National Longitudinal Study of Adolescent to Adult Health

	Wave 1	Wave 2	Wave 3	Wave 4
Cigarette smoking				
Non-smoker	15,171 (80%)	7,634 (53%)	9,690 (66%)	9,466 (61%)
Non-regular smoker	--	3,200 (25%)	1,603 (11%)	2,063 (14%)
Regular smoker	3,738 (20%)	2,730 (22%)	2,982 (24%)	3,144 (25%)
Binge drinking in past 12 months				
No	10,038 (53%)	7,620 (55%)	4,061 (28%)	4,129 (27%)
Drank, no binge	3,867 (20%)	2,136 (16%)	3,490 (22%)	3,725 (23%)
Binge drink $\geq$1	4,970 (27%)	3,766 (29%)	6,711 (51%)	6,888 (50%)
Marijuana (past 30 days)				
No	13,362 (72%)	10,058 (75%)	9,938 (68%)	11,548 (77%)
>30 days	2,530 (13%)	1,169 (9%)	1,324 (10%)	886 (6%)
1 times	684 (4%)	528 (4%)	594 (4%)	470 (3%)
2-3 times	639 (4%)	528 (4%)	550 (4%)	397 (3%)
4-20 times	891 (5%)	683 (5%)	1,024 (8%)	764 (5%)
>20 times	439 (2%)	375 (3%)	843 (7%)	719 (5%)
Other drug use (past 30 days)	Lifetime			
No	16,395 (88.5%)	12,509 (97%)	13,376 (93%)	13,911 (93%)
1 or more times	2,120 (11.5%)	1,023 (3%)	927 (7%)	882 (7%)

Note. Observed frequencies and weighted percentages are reported.

Table 3.4. Measurement model response category probabilities of substance use indicators across classes among participants in the National Longitudinal Study of Adolescent to Adult Health (Waves 1-4)

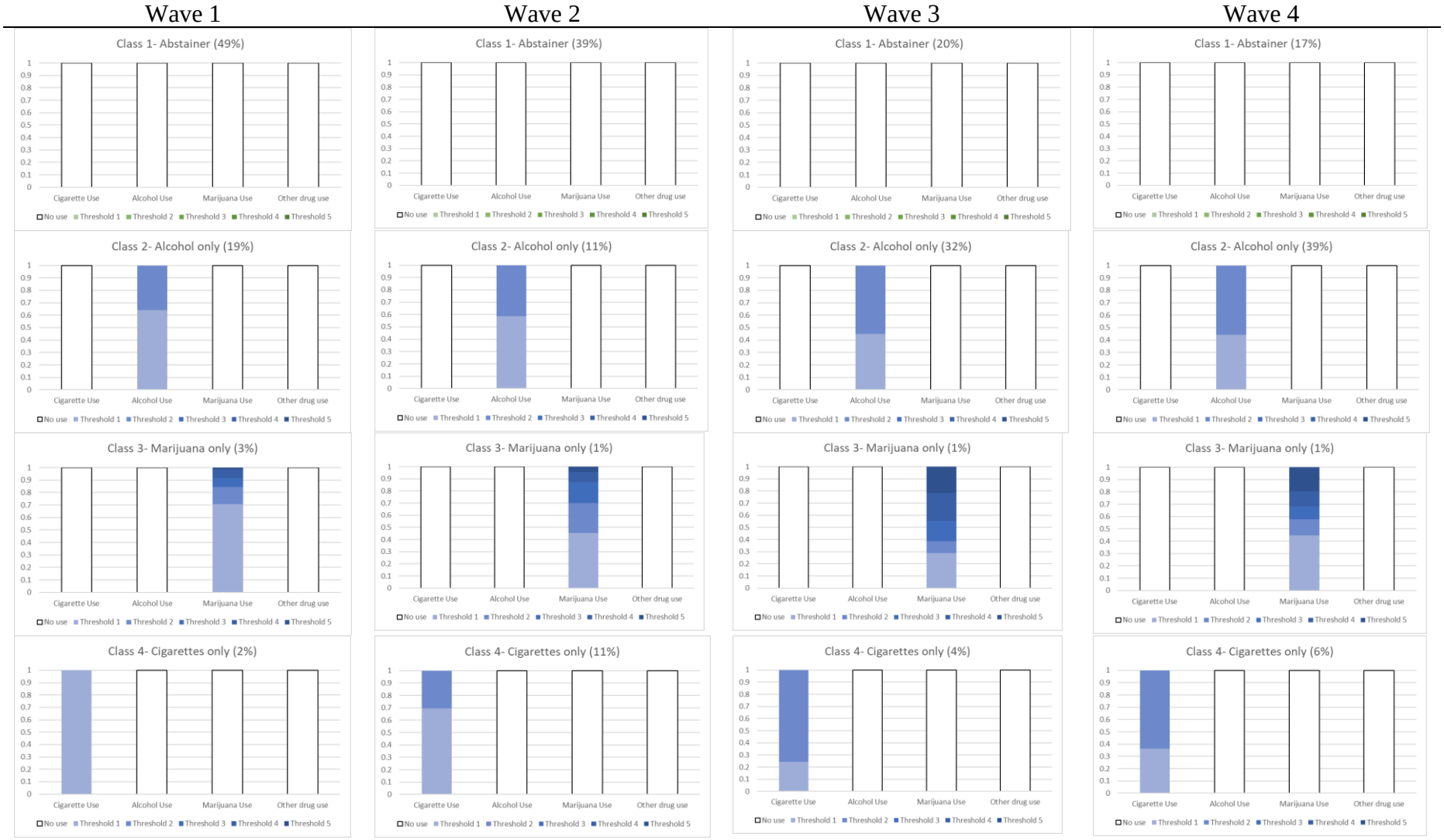
	Class 1 Abstainers	Class 2 Alcohol use only	Class 3 Marijuana use only	Class 4 Cigarette use only	Class 5 Cigarettes & alcohol	Class 6 Cigarettes & marijuana	Class 7 Marijuana & alcohol	Class 8 Cigarette, alcohol & marijuana	Class 9 Poly	Class 10 Other drug use patterns
Pr(Non-smoker)	1	1	1	0	0	0	1	0	0	*
Pr(Non-regular smoker)	0	0	0	*	*	*	0	*	*	*
Pr(smoker)	0	0	0	*	*	*	0	*	*	*
Pr(Non-drinker)	1	0	1	1	0	1	0	0	0	*
Pr(Non-regular drinker)	0	*	0	0	*	0	*	*	*	*
Pr(Drinker)	0	*	0	0	*	0	*	*	*	*
Pr(No marijuana use)	1	1	0	1	1	0	0	0	0	*
Pr(Marijuana >30 days)	0	0	*	0	0	*	*	*	*	*
Pr(Marijuana use 1 time)	0	0	*	0	0	*	*	*	*	*
Pr(Marijuana use 2-3 times)	0	0	*	0	0	*	*	*	*	*
Pr(Marijuana use 4-20 times)	0	0	*	0	0	*	*	*	*	*
Pr(Marijuana use >20 times)	0	0	*	0	0	*	*	*	*	*
Pr(No other drug use)	1	1	1	1	1	1	1	1	0	0
Pr(Other drug use)	0	0	0	0	0	0	0	0	*	1

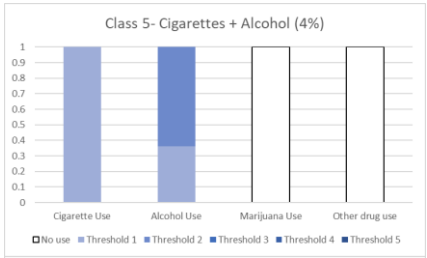
Note. *= freely estimated probabilities.

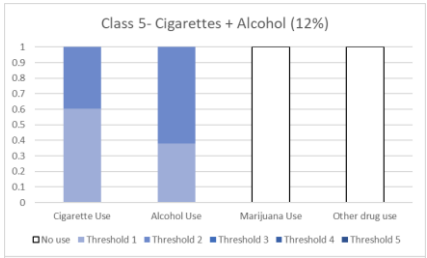
Table 3.5. Model-estimated descriptive statistics among substance use classes of participants in the National Longitudinal Study of Adolescent to Adult Health

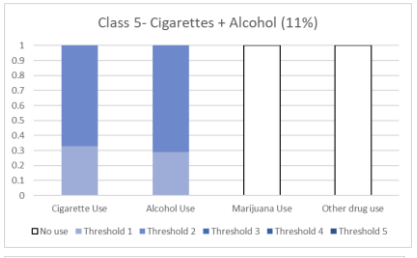
	Class 1 Abstainers	Class 2 Alcohol use only	Class 3 Marijuana use only	Class 4 Cigarette use only	Class 5 Cigarettes & alcohol	Class 6 Cigarettes & marijuana	Class 7 Marijuana & alcohol	Class 8 Cigarette, alcohol & marijuana	Class 9 Poly	Class 10 Other drug use patterns
Wave 1	8,703 (49%)	3,501 (19%)	522 (3%)	448 (2%)	902 (4%)	211 (1%)	1,615 (8%)	1,489 (7%)	907 (4%)	626 (3%)
Wave 2	5,104 (39%)	1,450 (11%)	165 (1%)	1,593 (11%)	1,747 (12%)	453 (3%)	353 (3%)	1,599 (12%)	737 (5%)	386 (3%)
Wave 3	2,900 (20%)	4,348 (32%)	157 (1%)	642 (4%)	1,712 (11%)	175 (2%)	1,552 (12%)	1,816 (12%)	612 (3%)	401 (3%)
Wave 4	2,479 (17%)	5,232 (39%)	81 (1%)	1,008 (6%)	2,363 (14%)	268 (2%)	998 (7%)	1,397 (9%)	429 (3%)	547 (3%)

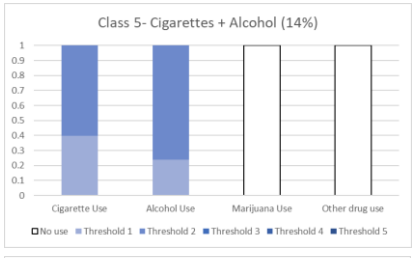
Figure 3.3. Unconditional model results for probabilities of item endorsement within classes of substance use among participants in the National Longitudinal Study of Adolescent to Adult Health (n=9,261)

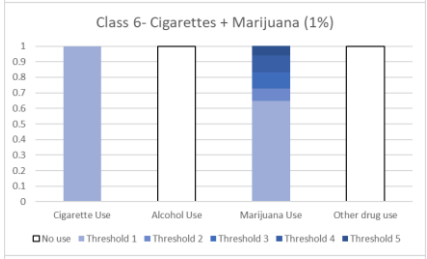


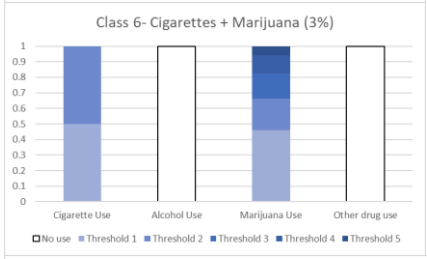

Class 5- Cigarettes + Alcohol (4%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

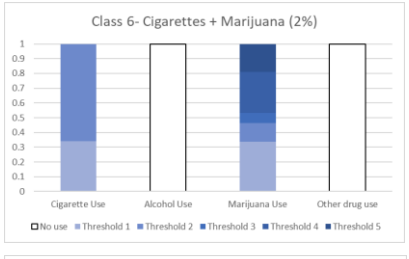

Class 5- Cigarettes + Alcohol (12%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

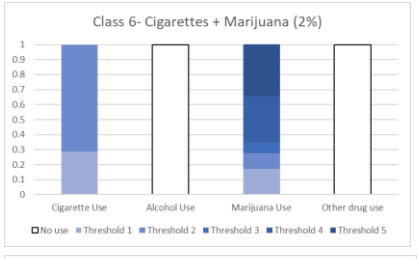

Class 5- Cigarettes + Alcohol (11%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

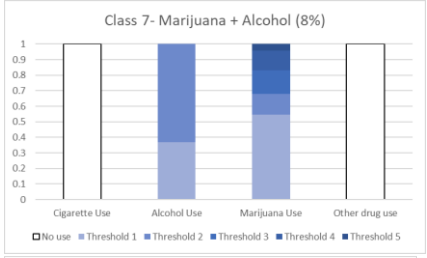

Class 5- Cigarettes + Alcohol (14%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

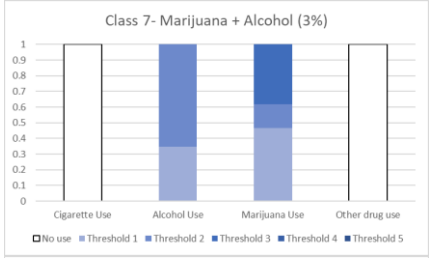

Class 6- Cigarettes + Marijuana (1%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

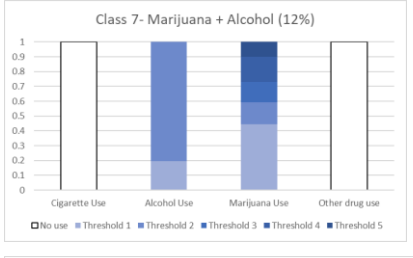

Class 6- Cigarettes + Marijuana (3%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

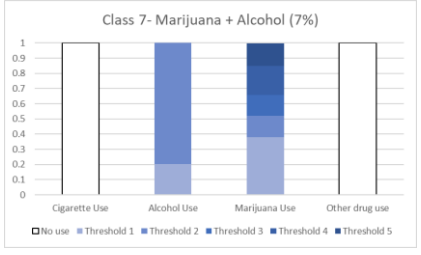

Class 6- Cigarettes + Marijuana (2%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

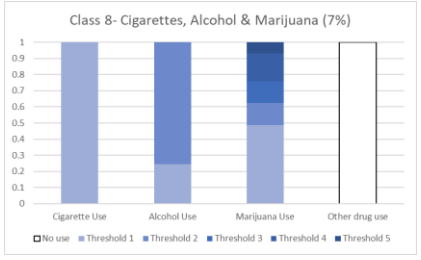

Class 6- Cigarettes + Marijuana (2%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

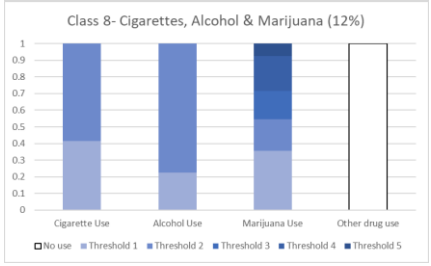

Class 7- Marijuana + Alcohol (8%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

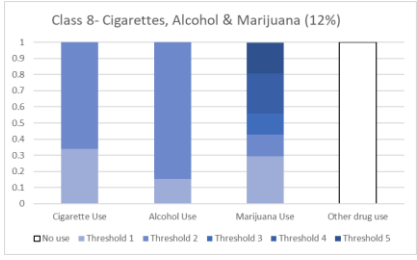

Class 7- Marijuana + Alcohol (3%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

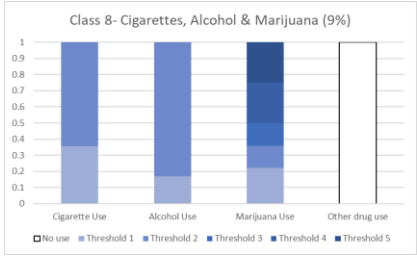

Class 7- Marijuana + Alcohol (12%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

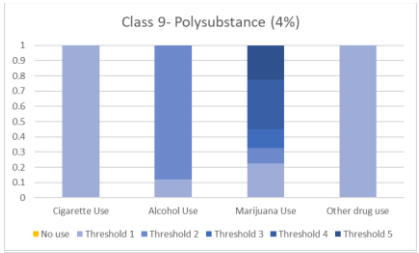

Class 7- Marijuana + Alcohol (7%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

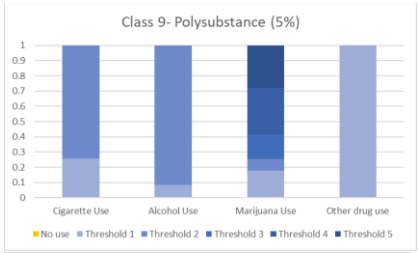

Class 8- Cigarettes, Alcohol & Marijuana (7%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

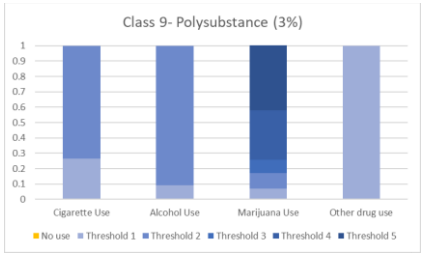

Class 8- Cigarettes, Alcohol & Marijuana (12%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

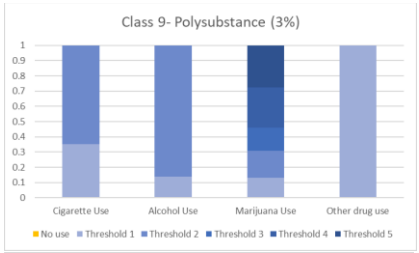

Class 8- Cigarettes, Alcohol & Marijuana (12%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

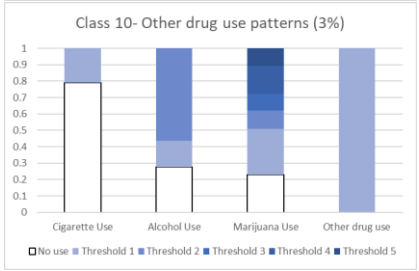

Class 8- Cigarettes, Alcohol & Marijuana (9%)
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

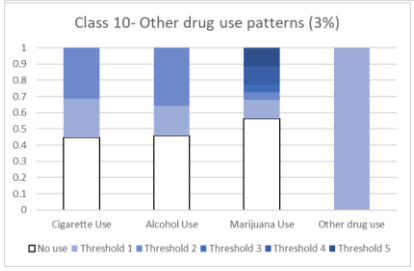

Class 9- Polysubstance (4%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

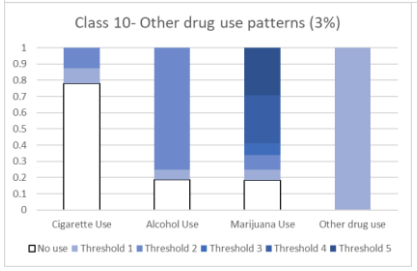

Class 9- Polysubstance (5%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5


Class 9- Polysubstance (3%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5


Class 9- Polysubstance (3%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5


Class 10- Other drug use patterns (3%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5


Class 10- Other drug use patterns (3%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5


Class 10- Other drug use patterns (3%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

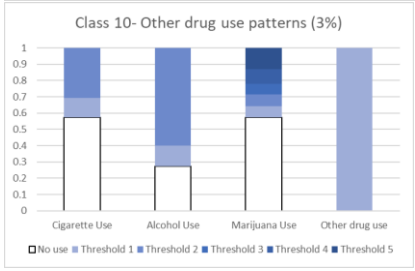

Class 10- Other drug use patterns (3%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Cigarette Use
Alcohol Use
Marijuana Use
Other drug use
No use
Threshold 1
Threshold 2
Threshold 3
Threshold 4
Threshold 5

Table 3.6. Child maltreatment among substance use classes of participants in the National Longitudinal Study of Adolescent to Adult Health

	Abstainer	Alcohol only	Marijuana only	Cigarette only	Cigarette & alcohol	Marijuana & cigarette	Marijuana & alcohol	Cigarette, alcohol, & marijuana	Polysubstance use	Other drug use
Wave 1										
None	5,511 (48%)	2,289 (19%)	336 (2%)	229 (2%)	493 (5%)	123 (1%)	1,040 (8%)	789 (7%)	446 (4%)	357 (3%)
P. abuse	902 (39%)	446 (18%)	88 (3%)	66 (3%)	104 (5%)	24 (1%)	225 (9%)	228 (11%)	148 (7%)	97 (5%)
S. abuse	148 (38%)	77 (19%)	14 (6%)	6 (0.4%)	17 (7%)	3 (1%)	44 (10%)	34 (12%)	11 (4%)	11 (2%)
Both	133 (32%)	64 (15%)	17 (4%)	17 (5%)	19 (7%)	10 (4%)	44 (11%)	42 (12%)	25 (7%)	15 (3%)
Wave 2										
None	3,644 (42%)	959 (11%)	123 (1%)	911 (11%)	1,052 (12%)	225 (3%)	230 (3%)	962 (11%)	388 (5%)	201 (2%)
P. abuse	513 (28%)	198 (11%)	26 (1%)	206 (13%)	235 (14%)	65 (5%)	41 (2%)	253 (15%)	116 (7%)	61 (4%)
S. abuse	88 (31%)	34 (11%)	0	30 (12%)	31 (11%)	14 (7%)	9 (2%)	36 (17%)	18 (8%)	5 (2%)
Both	81 (26%)	25 (7%)	6 (1%)	34 (13%)	36 (13%)	11 (4%)	11 (4%)	40 (17%)	23 (8%)	16 (7%)
Wave 3										
None	2,098 (20%)	3,248 (31%)	103 (1%)	371 (4%)	1,083 (12%)	98 (1%)	1,058 (11%)	1,083 (13%)	325 (4%)	246 (3%)
P. abuse	296 (16%)	563 (30%)	22 (1%)	67 (4%)	238 (13%)	28 (2%)	245 (13%)	257 (14%)	121 (6%)	53 (3%)
S. abuse	60 (20%)	99 (33%)	5 (2%)	14 (5%)	32 (11%)	8 (3%)	36 (12%)	35 (12%)	7 (2%)	8 (3%)
Both	64 (22%)	74 (25%)	2 (1%)	24 (8%)	28 (10%)	6 (2%)	23 (8%)	48 (16%)	14 (5%)	11 (4%)
Wave 4										
None	2,207 (17%)	4,476 (37%)	68 (0.4%)	745 (7%)	1,638 (16%)	192 (2%)	782 (7%)	910 (9%)	241 (3%)	354 (3%)
P. abuse	247 (12%)	796 (32%)	18 (1%)	140 (6%)	368 (18%)	49 (2%)	172 (7%)	278 (13%)	109 (5%)	124 (5%)
S. abuse	60 (15%)	131 (33%)	5 (1%)	23 (7%)	53 (16%)	6 (3%)	31 (7%)	30 (10%)	9 (5%)	17 (5%)
Both	59 (12%)	111 (29%)	7 (2%)	44 (12%)	58 (16%)	20 (5%)	22 (6%)	38 (11%)	12 (4%)	15 (5%)

Note. Model estimated frequencies and percentages are reported.

Table 3.7a. Associations of reporting physical abuse only compared to no abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	**1.27 (1.08, 1.49)**									
Class 3 Marij. Only	**1.56 (1.14, 2.12)**	1.23 (0.80, 1.70)								
Class 4 Cig. Only	**2.24 (1.60, 3.15)**	**1.76 (1.24, 2.51)**	1.44 (0.92, 2.24)							
Class 5 Cig. & Alc.	1.23 (0.90, 1.68)	0.97 (0.70 1.34)	0.79 (0.52, 1.21)	**0.55 (0.34, 0.85)**						
Class 6 Cig. & Marij.	1.55 (0.93, 2.59)	1.22 (0.73, 2.06)	1.00 (0.55, 1.79)	0.69 (0.38, 1.27)	1.26 (0.70, 2.25)					
Class 7 Marij. & Alc.	**1.28 (1.02, 1.59)**	1.00 (0.79, 1.27)	0.82 (0.57, 1.17)	**0.57 (0.39, 0.83)**	1.03 (0.72, 1.48)	0.82 (0.48, 1.41)				
Class 8 3 substance	**1.98 (1.59, 2.45)**	**1.56 (1.23, 1.96)**	1.27 (0.89, 1.81)	0.88 (0.60, 1.29)	**1.60 (1.13, 2.28)**	1.27 (0.74, 2.19)	**1.55 (1.17, 2.04)**			
Class 9 Poly	**2.59 (1.99, 3.39)**	**2.04 (1.54, 2.70)**	**1.67 (1.13, 2.46)**	1.16 (0.77, 1.74)	**2.10 (1.43, 3.09)**	1.67 (0.95, 2.93)	**2.03 (1.47, 2.80)**	1.31 (0.96, 1.80)		
Class 10 Ot. Drug	**1.79 (1.31, 2.44)**	**1.41 (1.02, 1.94)**	**1.15 (0.75, 1.74)**	0.80 (0.51, 1.23)	1.45 (0.96, 2.19)	1.15 (0.64, 2.06)	1.40 (0.98, 2.00)	0.90 (0.64, 1.28)	0.69 (0.47, 1.01)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7b. Associations of reporting sexual abuse only compared to no abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	**1.19 (0.83, 1.72)**									
Class 3 Marij. Only	**2.15 (1.14, 4.07)**	1.81 (0.92, 3.53)								
Class 4 Cig. Only	**1.16 (0.42, 3.20)**	0.97 (0.34, 2.75)	0.54 (0.17, 1.73)							
Class 5 Cig. & Alc.	1.56 (0.81, 3.01)	1.31 (0.66, 2.58)	0.72 (0.31, 1.71)	1.35 (0.42, 4.32)						
Class 6 Cig. & Marij.	1.10 (0.26, 4.60)	0.92 (0.22, 3.92)	0.51 (0.11, 2.37)	0.95 (0.17, 5.34)	0.71 (0.15, 3.28)					
Class 7 Marij. & Alc.	**1.63 (1.02, 2.60)**	1.36 (0.82, 2.26)	0.76 (0.37, 1.56)	1.40 (0.48, 4.12)	1.04 (0.50, 2.17)	1.48 (0.32, 6.40)				
Class 8 3 substance	**1.79 (1.07, 2.98)**	1.50 (0.88, 2.58)	0.83 (0.39, 1.77)	1.54 (0.52, 4.61)	1.15 (0.54, 2.44)	1.63 (0.37, 7.12)	1.10 (0.60, 2.01)			
Class 9 Poly	0.50 (0.15, 1.62)	0.42 (0.13, 1.37)	**0.23 (0.06, 0.86)**	0.43 (0.09, 1.97)	0.32 (0.09, 1.17)	0.45 (0.07, 2.78)	0.31 (0.09, 1.04)	**0.28 (0.08, 0.95)**		
Class 10 Ot. Drug	1.75 (0.86, 3.57**)**	1.47 (0.71, 3.06)	0.81 (0.33, 2.01)	1.51 (0.46, 5.04)	1.13 (0.45, 2.78)	1.59 (0.34, 7.57)	1.08 (0.49, 2.35)	0.98 (0.44, 2.19)	3.52 (0.94, 13.25)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7c. Associations of reporting both physical and sexual abuse compared to no abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	**1.54 (1.05, 2.26)**									
Class 3 Marij. Only	1.68 (0.79, 3.58)	1.09 (0.50, 2.39)								
Class 4 Cig. Only	**3.47 (1.69, 7.14)**	**2.26 (1.08, 4.72)**	2.07 (0.76, 5.64)							
Class 5 Cig. & Alc.	**1.98 (1.02, 3.84)**	1.29 (0.65, 2.53)	1.18 (0.45, 3.07)	0.57 (0.23, 1.41)						
Class 6 Cig. & Marij.	**5.12 (2.30, 11.42)**	3.33 (1.47, 7.53)	**3.06 (1.07, 8.72)**	1.47 (0.52, 4.20)	2.59 (0.98, 6.84)					
Class 7 Marij. & Alc.	**1.71 (1.04, 2.81)**	1.11 (0.65, 1.89)	1.02 (0.44, 2.34)	0.49 (0.22, 1.11)	0.86 (0.41, 1.83)	**0.33 (0.14, 0.81)**				
Class 8 3 substance	**2.79 (1.74, 4.47)**	1.82 (1.11, 2.97)	1.67 (0.73, 3.81)	0.80 (0.37, 1.76)	1.41 (0.69, 2.91)	0.55 (0.23, 1.28)	1.64 (0.90, 2.96)			
Class 9 Poly	**3.89 (2.23, 6.79)**	**2.53 (1.44, 4.46)**	2.32 (0.96, 5.64)	1.12 (0.49, 2.57)	1.97 (0.91, 4.23)	0.76 (0.31, 1.86)	**2.28 (1.18, 4.41)**	1.39 (0.75, 2.59)		
Class 10 Ot. Drug	**2.15 (1.05, 4.41)**	1.40 (0.67, 2.90)	1.28 (0.47, 3.49)	0.62 (0.24, 1.59)	1.09 (0.44, 2.66)	0.42 (0.15, 1.16)	1.26 (0.55, 2.86)	0.77 (0.36, 1.67)	0.55 (0.24, 1.25)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7d. Associations of reporting physical abuse only compared to sexual abuse only with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	**1.17 (1.02, 1.34)**									
Class 3 Marij. Only	1.25 (0.90, 1.73)	1.07 (0.76, 1.50)								
Class 4 Cig. Only	**1.92 (1.37, 2.69)**	**1.64 (1.16, 2.32)**	1.54 (0.97, 2.43)							
Class 5 Cig. & Alc.	1.07 (0.80, 1.43)	0.92 (0.68, 1.24)	0.86 (0.56, 1.31)	**0.56 (0.36, 0.86)**						
Class 6 Cig. & Marij.	1.32 (0.82, 2.14)	1.13 (0.69, 1.85)	1.06 (0.60, 1.88)	0.69 (0.38, 1.24)	1.23 (0.71, 2.13)					
Class 7 Marij. & Alc.	1.11 (0.90, 1.36)	0.94 (0.76, 1.18)	0.89 (0.61, 1.28)	0.58 (0.39, 0.84)	1.03 (0.74, 1.44)	0.83 (0.50, 1.39)				
Class 8 3 substance	**1.59 (1.27, 1.98)**	**1.36 (1.07, 1.72)**	1.27 (0.87, 1.85)	0.83 (0.56, 1.21)	**1.48 (1.05, 2.09)**	1.20 (0.72, 2.01)	**1.44 (1.09, 1.89)**			
Class 9 Poly	**2.33 (1.80, 3.01)**	**1.99 (1.52, 2.61)**	**1.87 (1.25, 2.79)**	0.69 (0.38, 1.24)	**2.17 (1.51, 3.13)**	**1.76 (1.03, 3.00)**	**2.11 (1.55, 2.87)**	**1.47 (1.06, 2.02)**		
Class 10 Ot. Drug	**1.47 (1.07, 2.03)**	1.26 (0.91, 1.75)	1.18 (0.76, 1.83)	0.70 (0.49, 1.20)	1.37 (0.91, 2.07)	1.11 (0.63, 1.97)	1.33 (0.93, 1.91)	0.93 (0.64, 1.34)	**0.63 (0.43, 0.93)**	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7e. Associations of reporting sexual abuse only compared to both physical and sexual abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	0.90 (0.70, 1.16)									
Class 3 Marij. Only	1.26 (0.67, 2.36)	1.39 (0.73, 2.68)								
Class 4 Cig. Only	0.55 (0.27, 1.12)	0.61 (0.29, 1.26)	0.44 (0.17, 1.11)							
Class 5 Cig. & Alc.	0.91 (0.52, 1.61)	1.01 (0.57, 1.81)	0.73 (0.32, 1.66)	1.67 (0.69, 4.05)						
Class 6 Cig. & Marij.	**0.32 (0.13, 0.79)**	**0.35 (0.14, 0.89)**	**0.25 (0.09, 0.75)**	0.58 (0.18, 1.94)	**0.35 (0.12, 0.99)**					
Class 7 Marij. & Alc.	1.01 (0.69, 1.49)	1.12 (0.74, 1.70)	0.80 (0.40, 1.63)	1.85 (0.84, 4.07)	1.11 (0.58, 2.12)	**3.16 (1.20, 8.31)**				
Class 8 3 substance	0.78 (0.50, 1.23)	0.87 (0.54, 1.39)	0.62 (0.29, 1.32)	1.43 (0.63, 3.25)	0.86 (0.43, 1.71)	2.45 (0.92, 6.54)	0.77 (0.45, 1.35)			
Class 9 Poly	**0.39 (0.25, 0.62)**	**0.44 (0.27, 0.70)**	**0.31 (0.15, 0.67)**	0.72 (0.32, 1.62)	**0.43 (0.22, 0.85)**	1.23 (0.46, 3.27)	**0.39 (0.22, 0.68)**	**0.50 (0.27, 0.92)**		
Class 10 Ot. Drug	0.92 (0.48, 1.76)	1.02 (0.52, 1.98)	0.73 (0.30, 1.78)	1.68 (0.65, 4.31)	1.01 (0.44, 2.30)	2.87 (0.96, 8.62)	0.91 (0.43, 1.91)	1.17 (0.55, 2.51)	**2.34 (1.10, 4.99)**	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7f. Associations of reporting physical abuse only compared to both physical and sexual abuse compared to no abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	1.13 (0.99, 1.30)									
Class 3 Marij. Only	1.32 (0.98, 1.78)	1.17 (0.86, 1.60)								
Class 4 Cig. Only	**1.63 (1.11, 2.38)**	1.44 (0.97, 2.12)	1.23 (0.77, 1.97)							
Class 5 Cig. & Alc.	1.05 (0.79, 1.39)	0.92 (0.69, 1.24)	0.79 (0.53, 1.17)	0.64 (0.41, 1.02)						
Class 6 Cig. & Marij.	0.88 (0.46, 1.72)	0.78 (0.40, 1.53)	0.67 (0.32, 1.37)	0.54 (0.25, 1.20)	0.85 (0.41, 1.73)					
Class 7 Marij. & Alc.	1.11 (0.91, 1.35)	0.98 (0.79, 1.21)	0.84 (0.60, 1.17)	0.68 (0.45, 1.03)	1.06 (0.76, 1.47)	1.25 (0.63, 2.48)				
Class 8 3 substance	**1.47 (1.17, 1.84)**	**1.29 (1.02, 1.64)**	1.11 (0.77, 1.58)	0.90 (0.59, 1.38)	1.40 (0.99, 1.98)	1.66 (0.83, 3.32)	**1.32 (1.00, 1.75)**			
Class 9 Poly	**1.77 (1.29, 2.43)**	**1.56 (1.13, 2.16)**	1.34 (0.88, 2.04)	1.09 (0.67, 1.76)	**1.69 (1.13, 2.53)**	2.00 (0.97, 4.14)	**1.60 (1.12, 2.28)**	1.21 (0.83, 1.77)		
Class 10 Ot. Drug	**1.43 (1.04, 1.96)**	1.26 (0.91, 1.75)	1.08 (0.71, 1.64)	0.88 (0.54, 1.42)	1.37 (0.91, 2.05)	1.61 (0.77, 3.37)	1.29 (0.90, 1.85)	0.98 (0.67, 1.41)	0.81 (0.53, 1.24)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.8. Transition probabilities for substance use classes among all participants in the National Longitudinal Study of Adolescent to Adult Health

	Unconditional Model Wave 2									
Wave 1	Abstainer (39%)	Alc only (11%)	Mar only (1%)	Cig only (11%)	Cig & Alc (12%)	Cig & Mar (3%)	Mar & Alc (3%)	Cig, Alc, & Mar (12%)	Ot drug (3%)	Poly (5%)
Abstainer (49%)	0.654	0.094	0.007	0.114	0.062	0.019	0.007	0.062	0.014	0.004
Alc only (11%)	0.087	0.286	0.005	0.104	0.289	0.028	0.033	0.116	0.026	0.025
Mar only (3%)	0.026	0.089	0.096	0.174	0.118	0.079	0.072	0.215	0.070	0.061
Cig only (2%)	0.008	0.022	0.000	0.432	0.252	0.065	0.024	0.116	0.042	0.040
Cig &Alc (4%)	0.007	0.055	0.009	0.181	0.387	0.052	0.017	0.236	0.014	0.042
Cig & Mar (1%)	0.001	0.022	0.009	0.092	0.057	0.078	0.001	0.653	0.054	0.033
Mar &Alc (8%)	0.014	0.086	0.027	0.087	0.116	0.070	0.102	0.377	0.037	0.083
Cig, Alc, & Mar (7%)	0.003	0.013	0.009	0.126	0.131	0.063	0.019	0.449	0.043	0.144
Ot drug (3%)	0.006	0.046	0.037	0.138	0.074	0.058	0.076	0.184	0.161	0.219
Poly (4%)	0.001	0.011	0.012	0.048	0.066	0.056	0.018	0.291	0.085	0.411

	Wave 3									
Wave 2	Abstainer (20%)	Alc only (32%)	Mar only (1%)	Cig only (4%)	Cig & Alc (11%)	Cig & Mar (3%)	Mar & Alc (3%)	Cig, Alc, & Mar (12%)	Ot drug (3%)	Poly (3%)
Abstainer (39%)	0.326	0.416	0.009	0.028	0.053	0.008	0.084	0.053	0.018	0.011
Alc only (11%)	0.018	0.546	0.016	0.024	0.057	0.004	0.196	0.098	0.028	0.012
Mar only (1%)	0.004	0.066	0.023	0.073	0.149	0.005	0.352	0.237	0.055	0.037
Cig only (11%)	0.026	0.244	0.013	0.126	0.211	0.017	0.081	0.215	0.024	0.043
Cig &Alc (12%)	0.006	0.264	0.008	0.054	0.232	0.017	0.157	0.177	0.035	0.049
Cig & Mar (3%)	0.003	0.261	0.022	0.075	0.226	0.053	0.128	0.145	0.019	0.068
Mar &Alc (3%)	0.001	0.252	0.017	0.025	0.090	0.009	0.329	0.134	0.092	0.052
Cig, Alc, & Mar (12%)	0.002	0.135	0.009	0.055	0.186	0.030	0.156	0.274	0.044	0.108
Ot drug (3%)	0.003	0.226	0.032	0.087	0.134	0.018	0.156	0.181	0.082	0.081
Poly (5%)	0.000	0.066	0.014	0.046	0.140	0.008	0.097	0.354	0.077	0.199

	Wave 4									
Wave 3	Abstainer (17%)	Alc only (39%)	Mar only (1%)	Cig only (6%)	Cig & Alc (14%)	Cig & Mar (2%)	Mar & Alc (7%)	Cig, Alc, & Mar (9%)	Ot drug (3%)	Poly (3%)
Abstainer (20%)	0.439	0.342	0.007	0.057	0.079	0.009	0.019	0.079	0.020	0.006
Alc only (32%)	0.150	0.657	0.002	0.022	0.077	0.004	0.046	0.019	0.022	0.001
Marij only (1%)	0.008	0.086	0.058	0.122	0.143	0.097	0.202	0.211	0.043	0.030
Cig only (4%)	0.007	0.098	0.005	0.347	0.354	0.030	0.021	0.079	0.022	0.038
Cig &Alc (11%)	0.009	0.213	0.000	0.145	0.435	0.013	0.015	0.116	0.035	0.020
Cig & Mar (2%)	0.001	0.067	0.009	0.168	0.183	0.101	0.037	0.325	0.069	0.041
Mar &Alc (12%)	0.014	0.422	0.006	0.015	0.105	0.003	0.248	0.116	0.047	0.023
Cig, Alc, & Mar (12%)	0.002	0.109	0.008	0.072	0.284	0.044	0.061	0.301	0.045	0.073
Ot drug (3%)	0.002	0.216	0.002	0.034	0.080	0.014	0.281	0.148	0.137	0.087
Poly (3%)	0.001	0.069	0.024	0.051	0.161	0.088	0.113	0.298	0.049	0.147

Note. Alc= Alcohol; Mar= Marijuana; Cig= Cigarette; 3 substance= Cigarette, Alcohol, and Marijuana; Ot drug= Other drug use; Poly= Polysubstance/4 substance use.
All transition probabilities are adjusted for sex, race/ethnicity, poverty, and age.

Table 3.9. Unconditional model results for the most common latent transition chains starting in the "Abstainer" class in Waves 1 among participants in the National Longitudinal Study of Adolescent to Adult Health, (n=9,261)

Wave 1	Wave 2	Wave 3	Wave 4	Frequency	Proportion
Abstainer		Abstainer	Abstainer	1537	0.10388
			Alcohol only	343	0.02319
			Cig + Alcohol	30	0.00204
			Cig only	46	0.00313
			Marij + Alcohol	15	0.00104
			Marij only	29	0.00196
			Other drug use	15	0.00104
		Alcohol only	Abstainer	173	0.0117
			Alcohol only	2617	0.1768
			Cig + Alcohol	49	0.00328
			Cig only	22	0.00146
			Cig+Alcohol+Marij	21	0.00141
			Marij + Alcohol	47	0.00319
			Other drug use	18	0.0012
		Cig + Alcohol	Abstainer	12	0.0008
			Alcohol only	32	0.00217
			Cig + Alcohol	67	0.0045
			Cig only	407	0.02752
			Cig+Alcohol+Marij	11	0.00073
		Cig only	Cig + Alcohol	18	0.0012
			Cig only	16	0.00107
		Cig+Alcohol+Marij	Alcohol only	19	0.00128
			Cig + Alcohol	45	0.00302
			Cig+Alcohol+Marij	38	0.00254
			Marij + Alcohol	17	0.00116
			Marij + Cig	105	0.00707
			Other drug use	205	0.01387
		Marij + Alcohol	Abstainer	22	0.00145
			Alcohol only	121	0.00816
			Cig + Alcohol	12	0.00081
			Cig+Alcohol+Marij	26	0.00178
			Marij + Alcohol	364	0.02462
		Marij only	Abstainer	10	0.00069
		Other drug use	Alcohol only	18	0.00119
			Cig+Alcohol+Marij	10	0.00065
		Polysubstance	Cig+Alcohol+Marij	16	0.00111

Table 3.10. Transition probabilities for substance use classes among participants in the National Longitudinal Study of Adolescent to Adult Health

	Conditional model Wave 2									
Wave 1	Abstainer (39%)	Alc only (11%)	Mar only (1%)	Cig only (11%)	Cig & Alc (12%)	Cig & Mar (3%)	Mar & Alc (3%)	Cig, Alc, & Mar (12%)	Ot drug (3%)	Poly (5%)
Abstainer (49%)	0.687	0.094	0.006	0.099	0.057	0.013	0.006	0.057	0.011	0.004
Alc only (11%)	0.106	0.290	0.009	0.098	0.269	0.025	0.037	0.124	0.024	0.018
Mar only (3%)	0.031	0.071	0.108	0.144	0.109	0.106	0.086	0.251	0.057	0.038
Cig only (2%)	0.008	0.024	0.000	0.480	0.281	0.035	0.015	0.099	0.030	0.028
Cig &Alc (4%)	0.007	0.073	0.015	0.203	0.364	0.037	0.012	0.241	0.021	0.027
Cig & Mar (1%)	0.001	0.005	0.011	0.096	0.065	0.065	0.009	0.677	0.031	0.039
Mar &Alc (8%)	0.015	0.096	0.026	0.084	0.116	0.067	0.112	0.377	0.035	0.073
Cig, Alc, & Mar (7%)	0.004	0.018	0.008	0.114	0.147	0.064	0.022	0.472	0.030	0.120
Ot drug (3%)	0.006	0.073	0.026	0.102	0.083	0.034	0.091	0.231	0.197	0.158
Poly (4%)	0.001	0.004	0.020	0.059	0.054	0.048	0.029	0.317	0.080	0.389

	Wave 3									
Wave 2	Abstainer (20%)	Alc only (32%)	Mar only (1%)	Cig only (4%)	Cig & Alc (11%)	Cig & Mar (3%)	Mar & Alc (3%)	Cig, Alc, & Mar (12%)	Ot drug (3%)	Poly (3%)
Abstainer (39%)	0.348	0.446	0.008	0.019	0.046	0.004	0.076	0.046	0.011	0.008
Alc only (11%)	0.025	0.627	0.017	0.022	0.052	0.004	0.155	0.072	0.019	0.008
Mar only (1%)	0.007	0.080	0.018	0.054	0.161	0.017	0.325	0.275	0.026	0.037
Cig only (11%)	0.038	0.353	0.015	0.094	0.190	0.012	0.098	0.155	0.016	0.028
Cig &Alc (12%)	0.011	0.391	0.015	0.043	0.206	0.008	0.147	0.127	0.022	0.031
Cig & Mar (3%)	0.006	0.306	0.024	0.082	0.237	0.026	0.140	0.121	0.025	0.033
Mar &Alc (3%)	0.001	0.427	0.010	0.029	0.080	0.011	0.263	0.095	0.048	0.035
Cig, Alc, & Mar (12%)	0.005	0.282	0.009	0.042	0.176	0.021	0.168	0.204	0.034	0.058
Ot drug (3%)	0.004	0.437	0.032	0.067	0.094	0.014	0.139	0.134	0.042	0.036
Poly (5%)	0.001	0.230	0.026	0.032	0.151	0.009	0.147	0.241	0.070	0.094

	Wave 4									
Wave 3	Abstainer (17%)	Alc only (39%)	Mar only (1%)	Cig only (6%)	Cig & Alc (14%)	Cig & Mar (2%)	Mar & Alc (7%)	Cig, Alc, & Mar (9%)	Ot drug (3%)	Poly (3%)
Abstainer (20%)	0.520	0.357	0.003	0.034	0.039	0.005	0.019	0.039	0.009	0.002
Alc only (32%)	0.225	0.659	0.001	0.016	0.038	0.003	0.038	0.011	0.009	0.000
Marij only (1%)	0.019	0.116	0.043	0.114	0.134	0.051	0.281	0.157	0.072	0.014
Cig only (4%)	0.018	0.214	0.004	0.340	0.256	0.023	0.024	0.077	0.020	0.024
Cig &Alc (11%)	0.024	0.409	0.000	0.135	0.300	0.014	0.018	0.073	0.019	0.009
Cig & Mar (2%)	0.002	0.066	0.004	0.176	0.151	0.085	0.048	0.383	0.051	0.034
Mar &Alc (12%)	0.035	0.558	0.006	0.017	0.060	0.007	0.205	0.069	0.031	0.011
Cig, Alc, & Mar (12%)	0.008	0.256	0.006	0.076	0.220	0.041	0.079	0.242	0.030	0.042
Ot drug (3%)	0.004	0.368	0.010	0.058	0.088	0.017	0.219	0.100	0.104	0.031
Poly (3%)	0.002	0.195	0.012	0.062	0.142	0.079	0.111	0.271	0.053	0.073

Note. Alc= Alcohol; Marij= Marijuana; Cig= Cigarette; 3 substance= Cigarette, Alcohol, and Marijuana; Ot drug= Other drug use; Poly= Polysubstance/4 substance use.
All transition probabilities are adjusted for sex, race/ethnicity, poverty, and age.

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Appendix 3.1
Recoding Variables
(original variables→ constructed variables)
Constructed variables include deletion of cases without weights, region, or PSU information. Original variables include all variables, regardless of missing weights, region, or PSU information.

Alcohol use

Wave 1

Alcohol use- any: Have you had a drink of beer, wine, or liquor- not just a sip or a taste of someone else's drink- more than 2 or 3 times in your life?

No (n=8,931)	Skipped alcohol questions (non-drinker)
Yes (n=11,609)	Asked all other alcohol questions

Alcohol use- past 12 months: During the past 12 months, on how many days did you drink alcohol?

Every day or almost every day (n=213)	Asked all other alcohol questions
3 to 5 days a week (n=497)	
1 or 2 days a week (n=1,318)	
2 or 3 days a month (n=1,618)	
Once a month or less (n=2,494)	
1 or 2 days in the past 12 months (n=3,506)	
Never (n=1,921)	Skipped rest of alcohol questions (non-drinker)
Skipped (n=9,137)	Skipped rest of alcohol questions (non-drinker)

Alcohol use- binge: Over the past 12 months, on how many days did you drink five or more drinks in a row?

Every Day (n=172, 0.8%)	Binge Drinker (n=4,970, 26.3%)
3-5 days/week (n=365, 1.8%)	
2-3 days/month (n=861, 4.2%)	
Once a month or less (n=1,198, 5.8%)	
1-2 days in the past 12 months (n=1,878, 9.1%)	
Never/None (n=4,171, 20.1%)	Non-Binge drinker (n=3,867, 20.5%)
Skipped (n=11,099, 53.5%)	Non-drinker (n=10,038, 53.2%)
Don't know (n=20, 0.1%	Missing (n=49)
Refused (n=32, 0.2%)	

Wave 2

Alcohol use- any: Since month of last interview, have you had a drink of beer, wine, or liquor- not just a sip or a taste of someone else's drink- more than two or three times?

No (n=7,711)	Skipped all alcohol questions
Yes (n=6,930)	Asked all other alcohol questions

Alcohol use- past 12 months: During the past 12 months, on how many days did you drink alcohol?

Every day or almost every day (n=145)	Asked all other alcohol questions
3 to 5 days a week (n=389)	
1 or 2 days a week (n=1,048)	
2 or 3 days a month (n=1,135)	
Once a month or less (n=1,719)	
1 or 2 days in the past 12 months (n=1,996)	
Skipped (n=7,808)	Skipped rest of alcohol questions (non-drinker)
Never (n=462)	Skipped rest of alcohol questions (non-drinker)

Alcohol use- binge: Over the past 12 months, on how many days did you drink five or more drinks in a row?

Every Day (n=158, 1.0%)	Binge Drinker (n=3,766, 29%)
3-5 days/week (n=291, 2.0%)	
1-2 days/week (n=683, 4.6%)	
2-3 days/month (n=699, 4.7%)	
Once a month or less (n=904, 6.1%)	
1-2 days in the past 12 months (n=1319, 9.0%)	
Never/None (n=2,328, 15.8%)	Non-Binge drinker (n=2,136, 16%)
Skipped (n=8,306, 56.4%)	Non-drinker (n=7,620, 55%)
Don't know (n=35, 0.2%)	Non-drinker (n=7,620, 55%)
Refused (n=15, 0.1%)	

Wave 3

Alcohol use- any: Since June 1995, have you had a drink of beer, wine, or liquor more than two or three times? Do not include sips or tastes from someone else's drink.

No (n=3,470)	Skipped all alcohol questions (non-drinker)
Yes (n=11,525)	Asked all other alcohol questions

Alcohol use- past 12 months: During the past 21 months, on how many days did you drink alcohol?

Every day or almost every day (n=318)	Asked all other alcohol questions
3 to 5 days a week (n=1,048)	

1 or 2 days a week (n=2,758)	
2 or 3 days a month (n=2,464)	
Once a month or less (n=2,503)	
1 or 2 days in the past 12 months (n=1,739)	
Skipped (n=3,665)	Skipped rest of alcohol questions (non-drinker)
Never (n=628)	Skipped rest of alcohol questions (non-drinker)

Alcohol use: During the past 12 months, on how many days did you drink five or more drinks in a row?

None (n=3,697)	Non-binge drinker (n=3,490, 22%)
1 or 2 days in the past 12 months (n=2401, 16%)	binge drinker (n=6,711, 51%)
Once a month or less (n=1,514, 10%)	
2 or 3 days a month (n=1,255, 8%)	
3 to 5 days a week (n=460, 3%)	
Every day or almost every day (n=111, 0.7%)	
Refused (n=12, 0.08%)	
Legitimate skip (n=4,360, 29%)	Non-drinker (n=4,061, 28%)
Don't know (n=37, 0.02%)	Missing (n=65)
Not applicable (n=9, 0.01%)	
Missing (n=7, 0.01%)	

Wave 4

Alcohol use (any- lifetime): Have you had a drink of beer, wine, or liquor more than two or three times?

No (n=3,252)	Skipped all other alcohol questions
Yes (n=12,379)	Asked alcohol questions

Alcohol use (past 12 months): During the past 12 months, on how many days did you drink alcohol?

Every day or almost every day (n=422)	Asked all other alcohol questions
3 to 5 days a week (n=1,300)	
1 or 2 days a week (n= 2,965)	
2 or 3 days a month (n=2,533)	
Once a month or less (n=2,340)	
1 or 2 days in the past 12 months (n=1,689)	
Skipped (n=3,322)	Skipped rest of alcohol questions (non-drinker)
Never (n=1,105)	Skipped rest of alcohol questions (non-drinker)

Alcohol use: During the past 12 months, on how many days did you drink five or more (or 4 or more if female) drinks in a row?

None (n=3,925)	Non-binge drinker (n=3,725, 23%)
1 or 2 days in the past 12 months (n=2,565, 16.3%)	Binge drinker (n=6,888, 50%)
Once a month or less (n=1,662, 10.6%)	
2 or 3 days a month (n=1,319, 8.4%)	
1 to 2 days a week (n=1,139, 7.3%)	
3 to 5 days a week (n=455, 2.9%)	
Every day or almost every day (n=148, 0.9%)	
Legitimate skip (n=4,427, 28.2%)	non-drinker (n=4,129, 27%)
Refused (n=21, 0.1%)	Missing (n=65)
Don't know (n=40, 0.3%)	

Cigarette use

Wave 1

Cigarette use: Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?

No (n=16,643, 80.2%)	Non-smoker (n=15,171, 80.2%)
Yes (n=4,086, 19.8%)	Regular smoker (n=3,738, 19.8%)
Refused (n=13, 0.1%)	Missing (n=15)
Don't know (n=2, 0.01%)	

Wave 2

Cigarette use (any): Since month of last interview, have you tried cigarette smoking, even just one or two puffs?

No (n=8,206)	Skipped rest of cigarette questions (non-smoker)
Yes (n=6,432)	Asked rest of cigarette questions

Cigarette use (regular): Since MOLI (month of last interview), have you smoked cigarettes regularly, that is, at least one cigarette every day for 30 days?

Skipped (n=8,306)	Non-smoker (n=7,634, 53%)
No (n=3,465, 23.5%)	Non-regular smoker (n=3,200, 25%)
Yes (n=2,960, 20.1%)	Regular smoker (n=2,730, 22%)

Wave 3

Cigarette use (any): Have you ever tried cigarette smoking, even just one or two puffs?

No (n=4,058)	Skipped rest of cigarette questions (non-smoker)
Yes (n=11,012)	Asked rest of cigarette questions

Cigarette use (entire cigarette): Have you ever smoked an entire cigarette?

No (n=2,123)	Skipped rest of cigarette questions (non-smoker)
Yes (n=8,886)	Asked rest of cigarette questions
Skipped (n=4,179)	Skipped rest of cigarette questions (non-smoker)

Cigarette use (regular ever use): Have you ever smoked cigarettes regularly- that is, at least one cigarette every day for 30 days?

No (n=3,017)	Skipped rest of cigarette questions (non-smoker)
Yes (n=5,844)	Asked rest of cigarette questions
Skipped (n=6,305)	Skipped rest of cigarette questions (non-smoker)

Cigarette use (regular): During the past 30 days, on how many days did you smoke cigarettes?

Skipped (n=10,277, 56.4%)	Non-smoker (n=9,690, 66%)
0-29 days (n=1,712, 11.2%)→	Non-regular smoker (n=1,603, 11%)
30 days (n=3,159, 20.8	Regular smoker (n=2,982, 24%)
Refused (n=6, 0.1%)→	Missing
Don't know (n=31, 0.2%)→	
Not applicable (n=5, 0.03%)→	
Missing (n=7, 0.04%)→	

Wave 4

Cigarette use: During the past 30 days, on how many days did you smoke cigarettes?

0 days (no skip pattern) (n=10,007, 63.7%)	Non-smoker (n=9,466, 61%)
1-29 days (n=2,218, 14%)	Non-regular smoking (n=2,63, 14%)
30 days (n=3,339, 21.3%	Regular smoker (n=3,144, 25%)
Refused (n=58, 0.4%)	Missing (n=125)
Don't know (n=79, 0.5%)	

<u>Marijuana use</u>

Wave 1

Marijuana use (any): How old were you when you tried marijuana for the first time? If you never tried marijuana, enter "0."

Never (n=14,606)	Skipped all other marijuana questions (non-marijuana user)
1 year- 18 years (n=5,831)	Asked rest of marijuana questions

Marijuana use (past 30 days): During the past 30 days, on how many days did you smoke marijuana?
Continuous variable (Range 0-900)

Skipped (n=14,605, 70.4%)	No marijuana use (13,362, 72%)
0 times (n=2,786, 13.4%)	Used marijuana previously, but >30 days (n=2,530, 13%)
1 time (n=757, 3.7%)	1 time (n=684, 4%)
2-3 times (n=703, 3.5%)	2-3 times (n=639, 4%)
4-20 times (n=994, 4.9%)	4-20 times (n=891, 5%)
>20 times (n=479, 2.4%)	>20 times (n=439, 2%)

Wave 2

Marijuana use (any): Since month of last interview, have you ever tried or used marijuana?

No (n=10,819)	Skipped all other marijuana questions (no marijuana use)
Yes (n=3,822)	Asked rest of marijuana questions

Marijuana use (past 30 days): During the past 30 days, how many times have you used marijuana?
Continuous variable (Range 0-900)

Skipped (n=10,058, 75%)	No marijuana use (n=10,058, 75%)
0 times (n=1,261, 8.6%)	0 times (n=1,169, 9%)
1 time (n=578, 3.9%)	1 time (n=528, 4%)
2-3 times (n=573, 3.9%)	2-3 times (n=528, 4%)
4-20 times (n=741, 5.0%)	4-20 times (n=683, 5%)
>20 times (n=659, 4.5%)	>20 times (n=375, 3%)
Refused (n=52, 3.5%)	Missing (n=227)
Don't know (n=201, 1.4%)	

Wave 3

Marijuana use (any): Since June 1995, have you used marijuana?

No (n=8,332)	Skipped rest of marijuana questions (no marijuana use)
Yes (n=6,614)	Asked marijuana questions

Marijuana use (past 12 months): In the past year, have you used marijuana?

No (n=1,951)	Skipped rest of marijuana questions (no marijuana use)
Yes (n=4,653)	Asked marijuana questions
Skipped (n=8,576)	Skipped rest of marijuana questions (no marijuana use)

Marijuana use: During the past 30 days, how many times have you used marijuana?
Continuous variable (Range 0-999)

Skipped (n=10,537)	No marijuana use (n=10,058, 75%)
0 times (n=1,393, 9.2%)	0 times (n=1,169, 9%)
1 time (n=638, 4.2%)	1 time (n=528, 4%)
2-3 times (n=591, 3.9%)	2-3 times (n=528, 4%)
4-20 times (n=1,089, 7.2%)	4-20 times (n=683, 5%)
>20 times (n=898, 5.9%)	>20 times (n=375, 3%)
Refused (n=12, 0.08%)	Missing (n=227)
Don't know (n=29, 0.2%)	
Not applicable (n=3, 0.01%)	
Missing (n=7, 0.01%)	

Wave 4

Marijuana use (any): Have you ever used any of the following drugs- marijuana?

No (n=7,241)	Skipped rest of marijuana questions (no marijuana use)
Yes (n=8,364)	Asked rest of marijuana questions

Marijuana use (more than 5 times): Have you used marijuana more than 5 times?

No (n=1,711)	Skipped rest of marijuana questions (no marijuana use)
Yes (n=6,647)	Asked rest of marijuana questions
Skipped (n=7,337)	Skipped rest of marijuana questions (no marijuana use)

Marijuana use (past 12 months): During the past 12 months, on how many days did you use marijuana?

None (n=3,206)	Skipped rest of marijuana questions (no marijuana use)
1 or 2 days in the past 12 months (n=936)	Asked rest of marijuana questions
2 or 3 days a month (n=354)	
1 or 2 days a week (n=355)	
3 to 5 days a week (n=455)	
Every day or almost every day (n=814)	
Skipped (n=9,048)	Skipped rest of marijuana questions (no marijuana use)

Marijuana use (past 30 days): During the past 30 days, how many times have you used marijuana?

Skipped (n=12,254)	No marijuana use (n=11,548, 77%)
None (n=926, 5.9%)→	None (n=886, 6%)
1 day (n=500, 3.2%)→	1 time (n=470, 3%)
2-3 days (n=425, 2.7%)→	2-3 times (n=397, 3%)

1 day a week (n=132, 0.8%)→	4-20 times (n=764, 5%)
2 days a week (n=266, 1.7%)→	
3-5 days a week (n=406, 2.6%)→	
Every day or almost every day (n=775, 4.9%)→	>20 times (n=719, 5%)
Refused (n=9, 0.1%)→	Missing (n=16)
Don't know (n=8, 0.1%)→	
Not applicable (n=3, 0.01%)→	
Missing (n=7, 0.01%)→	

Other drug use

Wave 1

Other drug use: Consisted of responding >1 for at least one of the following substances: cocaine, inhalants, other drugs

Cocaine (ever): How old were you when you tried any kind of cocaine for the first time? If you never tried cocaine, enter "0."

Never (n=19,732)	Skipped rest of cocaine questions
1 year- 18 years or older (n=698)	Asked rest of cocaine questions

Cocaine (lifetime frequency): During your life, how many times have you used cocaine?

Skipped (n=19,732)	0 times (n=18,019, 96.8%)
1-900 times (n=665, 3.2%)	at least one time (n=594, 3.2%)
Refused (n=204, 0.9%)	Missing (n=311)
Don't know (n=134, 0.6%)	
Not applicable (n=9, 0.04%)	

Inhalant use (ever): How old were you when you tried inhalants, such as glue or solvents, for the first time? If you never tried inhalants such as these, enter "0."

Never (n=19,217)	Skipped rest of inhalant questions
1 year- 18 years or older (n=1,211)	Asked rest of inhalant questions

Inhalant use (lifetime frequency): During your life, how many times have you used inhalants, such as glue or solvents?

Skipped (n=19,217)	0 times (n=17,551, 94.3%)
1-900 times (n=1,186, 5.7%)	at least one time (n=1,068, 5.7%)
Refused (n=191, 0.9%)	Missing (n=305)
Don't know (n=136, 0.6%)	
Not applicable (n=13, 0.06%)	
Missing (n=3, 0.01%)	

Other drug use (ever): How old were you when you first tried any other type of illegal drug, such as LSD, PCP, ecstasy, mushrooms, speed, ice, heroin, or pills, without a doctor's prescription? If you never tried any other type of illegal drug, enter "0."

Never (n=18,790)	Skipped other drug use questions
1 year- 18 years or older (n=1,641)	Asked rest of other drug use questions

Other drug use (frequency): During your life, how many times have you used any of these types of drugs?

Skipped (n=18,790)	0 times (n=17,154, 92.4%)
1-900 times (n=1,543, 7.4%)	at least one time (n=1,401, 7.6%)
Refused (n=193, 0.9%)	Missing (n=369)
Not applicable (n= 32, 0.2%)	
Missing (n=3, 0.01%)	

Cocaine use (n=594, 3.2%) or Inhalant use (n=1,068, 5.7%) or Other drug use (n=1,401, 7.6%)→ Other drug use new constructed variable:

No other drug use (n=16,395, 88.5%)

Yes other drug use (n=2,120, 11.5%)

Wave 2

Other drug use: Consisted of responding >1 for at least one of the following substances: cocaine, inhalants, other drugs

Cocaine use (ever): Since month of last interview, have you tried or used any kind of cocaine-including powder, freebase, or crack cocaine?

No (n=14,276)	Skipped rest of cocaine questions
Yes (n=360)	Asked rest of cocaine questions

Cocaine use (frequency past 30 days): During the past 30 days, how many times have you used cocaine?

Skipped (n=14,276)	0 times (n=13,232, 97.5%)
1-222 times (n=345, 2.3%)	at least one time (n=324, 2.4%)
Refused (n=4, 0.01%)	Missing (n=12)
Don't know (n=11, 0.01%)	

Inhalant use (ever): Since month of last interview, have you tried or used inhalants, such as glue or solvents?

No (n=14,341)	Skipped rest of inhalant questions
Yes (n=302)	Asked rest of inhalant questions

Inhalant use (frequency past 30 days): During the past 30 days, how many times have you used inhalants?

Skipped (n=14,436)	0 times (n=13,296, 98.0%)
1-222 times (n=285, 1.9%)	at least one time (n=261, 1.8%)
Refused (n=5, 0.01%)	Missing (n=11)
Don't know (n=12, 0.01%)	

Other drug use (ever): Since month of last interview, have you tried or used any other type of illegal drug, such as LSD, PCP, ecstasy, mushrooms, speed, ice, heroin, or pills without a doctor's prescription?

No (n=13,768)	Skipped all other drug use questions
Yes (n=877)	Asked rest of other drug use questions

Other drug use (past 30 day use): During the past 30 days, how many times have you used any of these types of illegal drugs?

Skipped (n=13,861)	0 times (n=12,760, 94.0%)
1-900 times (n=822, 5.6%)	at least one time (n=768, 5.7%)
Refused (n=9, 0.06%)	Missing (n=40)
Don't know (n=46, 3.1%)	

Cocaine use (n=324, 2.4%) or Inhalant use (n=261, 1.8%) or Other drug use (n=768, 5.7%)→ Other drug use new constructed variable:

No other drug use (n=12,509, 97%)

Yes other drug use (n=1,023, 3%)

Wave 3

Other drug use: Consisted of responding >1 for at least one of the following substances: cocaine, methamphetamine, other drugs

Cocaine (ever): Since June 1995, have you used any kind of cocaine- including crack, freebase, or powder?

No (n=13,500)	Skipped rest of cocaine questions
Yes (n=1,481)	Asked rest of cocaine questions

Cocaine (past year): In the past year, have you used any kind of cocaine?

No (n=546)	Skipped rest of cocaine questions
Yes (n=934)	Asked rest of cocaine questions
Skipped (n=13,709)	Skipped rest of cocaine questions

Cocaine (past 30 days): During the past 30 days, how many times have you used any kind of cocaine?

Skipped (n=14,256)	0 times (n=14,724, 96.9%)
1-888 times (n=460, 2.3%)	at least one time (n=459, 3.1%)
Refused (n=1, 0.01%)	Missing (n=14)
Don't know (n=5, 0.01%)	

Missing (n=7, 0.01%)	

Methamphetamine use (ever): Since June 1995, have you used crystal meth?

No (n=14,115)	Skipped rest of crystal meth questions
Yes (n=860)	Asked rest of crystal meth questions

Methamphetamine use (past 12 months): In the past year, have you used crystal meth?

No (n=440)	Skipped rest of crystal meth questions
Yes (n=416)	Asked rest of crystal meth questions
Skipped (n=14,330)	Skipped rest of crystal meth questions

Methamphetamine use (past 30 days): During the past 30 days, how many times have you used crystal meth?

Skipped (n=14,774)	0 times (n=14,093, 98.4%)
0 times (n=180, 1.2%)	
1-300 times (n=232, 1.5%)	at least one time (n=218, 1.5%)
Refused (n=1, 0.01%)	Missing (n=11)
Don't know (n=3, 0.01%)	
Missing (n=7, 0.05%)	

Other drug use (ever): Since June 1995, have you used any other types of illegal drugs, such as LSD, PCP, ecstasy, mushrooms, inhalants, ice, heroin, or prescription medicines not prescribed for you?

No (n=12,610)	Skipped rest of other drug use questions
Yes (n=2,352)	Asked rest of other drug use questions

Other drug use (past 12 months): In the past year, have you used any of these types of illegal drugs?

No (n=989)	Skipped rest of other drug use questions
Yes (n=1,354)	Asked rest of other drug use questions
Skipped (n=12,838)	Skipped rest of other drug use questions

Other drug use (past 30 days): During the past 30 days, how many times have you used any of these types of illegal drugs?

Skipped (n=13,836)	0 times (n=13,698, 95.6%)
0 times (n=703, 4.6%)→	
1-364 times (n=642, 4.2%)→	at least one time (n=608, 4.2%)
Don't know (n=9, 0.06%)→	Missing (n=16)
Missing (n=7, 0.05%)→	

Cocaine use (n=459, 3.1%) or Methamphetamine use (n=218, 1.5%) or Other drug use (n=608, 4.2%)

Other drug use new constructed variable:

No other drug use (n=13,376, 93%)

Yes other drug use (n=927, 7%)

Wave 4

Other drug use: During the past 30 days, on how many days did you use (favorite drug)? Favorite drug was selected from a list of "other drugs": sedatives, tranquilizers, stimulants, pain killers, steroids, cocaine, crystal meth, and other illegal drugs (such as LSD, PCP, ecstasy, heroin, mushrooms, or inhalants)

None (n=14,154)	0 times (n=13,911, 93%)
One day (n=268, 1.7%)→	At least one time (n=882, 7%)
2 or 3 days (n=257, 1.6%)→	
1 day a week (n=76, 0.5%)→	
2 days a week (n=107, 0.7%)→	
3 to 5 days a week (n=100, 0.6%)→	
Every day or almost every day (n=116, 0.7%)→	
Refused (n=1, 0.1%)→	Missing (n=5)
Don't know (n=4, 0.1%)→	

Table 3.7g. Associations of reporting physical abuse only with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 2

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	**1.64 (1.32, 2.02)**									
Class 3 Marij. Only	1.53 (0.92, 2.56)	0.94 (0.55, 1.59)								
Class 4 Cig. Only	**1.78 (1.45, 2.20)**	1.09 (0.85, 1.40)	1.17 (0.68, 1.99)							
Class 5 Cig. & Alc.	**1.68 (1.37, 2.07)**	1.03 (0.81, 1.32)	1.10 (0.65, 1.87)	0.94 (0.74, 1.21)						
Class 6 Cig. & Marij.	**2.06 (1.45, 2.92)**	1.26 (0.86, 1.83)	1.35 (0.74, 2.46)	1.15 (0.79, 1.68)	1.22 (0.84, 1.78)					
Class 7 Marij. & Alc.	1.41 (0.94, 2.11)	0.86 (0.56, 1.32)	0.92 (0.49, 1.74)	0.79 (0.52, 1.21)	0.84 (0.55, 1.28)	0.68 (0.41, 1.140)				
Class 8 3 substance	**1.92 (1.57, 2.35)**	1.17 (0.92, 1.50)	1.25 (0.74, 2.13)	1.08 (0.84, 1.37)	1.14 (0.90, 1.45)	0.93 (0.64, 1.35)	1.36 (0.89, 2.09)			
Class 9 Poly	**2.70 (2.06, 3.54)**	**1.65 (1.22, 2.23)**	**1.76 (1.01, 3.09)**	**1.51 (1.12, 2.05)**	**1.60 (1.20, 2.15)**	1.31 (0.87, 1.98)	**1.92 (1.21, 3.03)**	**1.41 (1.05, 1.89)**		
Class 10 Ot. Drug	**2.16 (1.50, 3.10)**	1.32 (0.89, 1.95)	1.41 (0.76, 2.59)	1.21 (0.82, 1.78)	1.28 (0.87, 1.88)	1.05 (0.65, 1.69)	1.53 (0.91, 2.57)	1.12 (0.76, 1.65)	0.80 (0.52, 1.22)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7h. Associations of reporting sexual abuse only with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 2

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	1.64 (1.04, 2.59)									
Class 3 Marij. Only	*	*								
Class 4 Cig. Only	1.48 (0.92, 2.39)	0.90 (0.51, 1.59)	*							
Class 5 Cig. & Alc.	1.17 (0.70, 1.97)	0.71 (0.40, 1.27)	*	0.79 (0.43, 1.47)						
Class 6 Cig. & Marij.	**2.39 (1.18, 4.83)**	1.46 (0.68, 3.14)	*	1.62 (0.74, 3.53)	2.04 (0.91, 4.58)					
Class 7 Marij. & Alc.	2.00 (0.94, 4.29)	1.22 (0.54, 2.78)	*	1.36 (0.59, 3.12)	1.71 (0.73, 4.00)	0.84 (0.32, 2.23)				
Class 8 3 substance	1.50 (0.94, 2.40)	0.92 (0.53, 1.57)	*	1.02 (0.57, 1.81)	1.28 (0.71, 2.30)	0.63 (0.29, 1.36)	0.75 (0.33, 1.70)			
Class 9 Poly	**2.23 (1.21, 4.11)**	1.36 (0.71, 2.62)	*	1.51 (0.75, 3.01)	1.90 (0.96, 3.78)	0.93 (0.39, 2.22)	1.11 (0.45, 2.73)	1.48 (0.76, 2.88)		
Class 10 Ot. Drug	0.55 (0.13, 2.29)	0.34 (0.08, 1.43)	*	*	0.47 (0.11, 2.05)	0.23 (0.05, 1.09)	1.19 (0.45, 3.16)	0.37 (0.09, 1.57)	0.25 (0.06, 1.11)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.

*=estimate not stable (0.00).

All statistically significant associations are bolded.

Table 3.7i. Associations of reporting both physical and sexual abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	1.07 (0.60, 1.88)									
Class 3 Marij. Only	1.95 (0.68, 5.58)	1.83 (0.58, 5.75)								
Class 4 Cig. Only	**1.77 (1.08, 2.89)**	1.66 (0.87, 3.17)	0.91 (0.30, 2.74)							
Class 5 Cig. & Alc.	1.51 (0.92, 2.50)	1.42 (0.75, 2.70)	0.78 (0.26, 2.36)	0.85 (0.48, 1.53)						
Class 6 Cig. & Marij.	1.93 (0.85, 4.36)	1.81 (0.72, 4.54)	0.99 (0.27, 3.58)	1.09 (0.46, 2.60)	1.27 (0.53, 3.04)					
Class 7 Marij. & Alc.	1.87 (0.83, 4.19)	1.75 (0.70, 4.36)	0.96 (0.27, 3.40)	1.05 (0.44, 2.51)	1.23 (0.52, 2.93)	0.97 (0.33, 2.87)				
Class 8 3 substance	**1.78 (1.11, 2.86)**	**1.67 (0.89, 3.12)**	0.91 (0.30, 2.75)	1.01 (0.57, 1.77)	1.18 (0.67, 2.05)	0.92 (0.39, 2.18)	0.95 (0.41, 2.25)			
Class 9 Poly	**3.63 (2.08, 6.35)**	**3.41 (1.72, 6.77)**	1.86 (0.59, 5.87)	**2.05 (1.09, 3.86)**	**2.40 (1.29, 4.45)**	1.89 (0.76, 4.67)	1.95 (0.79, 4.81)	**2.04 (1.12, 3.73)**		
Class 10 Ot. Drug	**3.00 (1.43, 6.29)**	**2.81 (1.20, 6.58)**	1.54 (0.44, 5.35)	1.69 (0.76, 3.77)	1.98 (0.89, 4.40)	1.56 (0.56, 4.35)	1.61 (0.57, 4.50)	1.68 (0.77, 3.69)	0.83 (0.36, 1.91)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig.=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7j. Associations of reporting physical abuse only with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 3

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	**1.26 (1.06, 1.48)**									
Class 3 Marij. Only	1.40 (0.83, 2.33)	1.11 (0.67, 1.84)								
Class 4 Cig. Only	1.26 (0.91, 1.73)	1.00 (0.74, 1.36)	0.61 (0.20, 1.85)							
Class 5 Cig. & Alc.	**1.56 (1.27, 1.93)**	**1.24 (1.03, 1.50)**	1.12 (0.66, 1.89)	1.24 (0.90, 1.73)						
Class 6 Cig. & Marij.	**1.96 (1.23, 3.12)**	1.56 (0.99, 2.47)	1.40 (0.72, 2.73)	1.56 (0.91, 2.66)	1.25 (0.78, 2.01)					
Class 7 Marij. & Alc.	**1.64 (1.34, 2.01)**	**1.31 (1.09, 1.57)**	1.18 (0.70, 1.98)	1.31 (0.94, 1.81)	1.05 (0.85, 1.31)	0.84 (0.52, 1.34)				
Class 8 3 substance	**1.67 (1.36, 2.04)**	**1.33 (1.11, 1.59)**	1.19 (0.71, 2.01)	1.33 (0.96, 1.84)	1.07 (0.86, 1.32)	0.85 (0.53, 1.36)	1.01 (0.82, 1.25)			
Class 9 Poly	**2.83 (2.18, 3.68)**	**2.25 (1.76, 2.87)**	**2.03 (1.18, 3.50)**	**2.25 (1.56, 3.24)**	**1.81 (1.38, 2.38)**	1.44 (0.88, 2.38)	**1.72 (1.32, 2.25)**	**1.70 (1.30, 2.22)**		
Class 10 Ot. Drug	**1.56 (1.09, 2.22)**	1.24 (0.88, 1.74)	1.12 (0.62, 2.02)	1.24 (0.80, 1.92)	1.00 (0.70, 1.43)	0.80 (0.46, 1.38)	0.95 (0.66, 1.36)	0.94 (0.65, 1.34)	0.55 (0.37, 0.82)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig.=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7k. Associations of reporting sexual abuse only with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 3

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	1.20 (0.83, 1.72)									
Class 3 Marij. Only	2.31 (0.88, 6.05)	1.93 (0.75, 5.00)								
Class 4 Cig. Only	1.42 (0.73, 2.77)	1.19 (0.62, 2.26)	0.61 (0.20, 1.85)							
Class 5 Cig. & Alc.	1.29 (0.79, 2.09)	1.07 (0.69, 1.67)	0.56 (0.20, 1.52)	0.90 (0.44, 1.85)						
Class 6 Cig. & Marij.	**3.52 (1.51, 8.20)**	**2.94 (1.29, 6.72)**	1.52 (0.45, 5.14)	2.48 (0.91, 6.73)	**2.74 (1.13, 6.65)**					
Class 7 Marij. & Alc.	1.42 (0.89, 2.28)	1.19 (0.78, 1.82)	0.62 (0.23, 1.65)	1.00 (0.50, 2.03)	1.11 (0.65, 1.89)	0.40 (0.17, 0.97)				
Class 8 3 substance	1.45 (0.90, 2.35)	1.22 (0.79, 1.87)	0.63 (0.23, 1.71)	1.03 (0.51, 2.08)	1.13 (0.67, 1.92)	0.41 (0.17, 1.01)	1.02 (0.61, 1.72)			
Class 9 Poly	1.21 (0.53, 2.76)	1.01 (0.46, 2.23)	0.52 (0.16, 1.74)	0.85 (0.32, 2.25)	0.94 (0.40, 2.20)	0.34 (0.11, 1.04)	0.85 (0.37, 1.97)	0.83 (0.36, 1.92)		
Class 10 Ot. Drug	1.57 (0.66, 3.73)	1.31 (0.57, 3.04)	0.68 (0.20, 2.33)	1.11 (0.40, 3.04)	1.22 (0.50, 2.99)	0.45 (0.14, 1.41)	1.10 (0.45, 2.69)	1.08 (0.44, 2.63)	1.30 (0.43, 3.95)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig.=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7l. Associations of reporting both physical and sexual abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 3

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	0.93 (0.63, 1.36)									
Class 3 Marij. Only	1.03 (0.25, 4.25)	1.11 (0.27, 4.56)								
Class 4 Cig. Only	**2.66 (1.57, 4.51)**	**2.87 (1.74, 4.74)**	2.58 (0.61, 11.01)							
Class 5 Cig. & Alc.	1.00 (0.60, 1.66)	1.07 (0.66, 1.74)	0.96 (0.23, 4.11)	0.37 (0.20, 0.68)						
Class 6 Cig. & Marij.	**2.55 (1.00, 6.53)**	**2.75 (1.09, 6.97)**	2.47 (0.44, 13.86)	0.96 (0.34, 2.59)	2.56 (0.95, 6.88)					
Class 7 Marij. & Alc.	0.88 (0.51, 1.52)	0.95 (0.56, 1.60)	0.85 (0.20, 3.67)	0.33 (0.17, 0.62)	0.88 (0.47, 1.64)	0.34 (0.13, 0.93)				
Class 8 3 substance	**1.89 (1.21, 2.96)**	**2.04 (1.36, 3.06)**	1.83 (0.44, 7.64)	0.71 (0.41, 1.22)	**1.90 (1.12, 3.22)**	0.74 (0.29, 1.92)	**2.16 (1.24, 3.76)**			
Class 9 Poly	1.51 (0.73, 3.16)	1.63 (0.80, 3.34)	1.47 (0.31, 6.85)	0.57 (0.26, 1.26)	1.52 (0.69, 3.35)	0.59 (0.19, 1.80)	1.72 (0.77, 3.87)	0.80 (0.38, 1.68)		
Class 10 Ot. Drug	**2.33 (1.14, 4.76)**	**2.51 (1.25, 5.02)**	2.25 (0.49, 10.38)	0.87 (0.40, 1.90)	**2.34 (1.08, 5.05)**	0.91 (0.30, 2.73)	**2.65 (1.20, 5.85)**	1.23 (0.60, 2.53)	1.54 (0.60, 3.93)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig.=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7m. Associations of reporting physical abuse only with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 4

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	**1.36 (1.11, 1.67)**									
Class 3 Marij. Only	**2.26 (1.14, 4.47)**	1.66 (0.85, 3.25)								
Class 4 Cig. Only	**1.53 (1.13, 2.06)**	1.12 (0.86, 1.47)	0.67 (0.33, 1.34)							
Class 5 Cig. & Alc.	**1.91 (1.51, 2.41)**	**1.40 (1.16, 1.69)**	0.84 (0.43, 1.66)	1.25 (0.93, 1.68)						
Class 6 Cig. & Marij.	**1.70 (1.05, 2.76)**	1.25 (0.79, 1.99)	0.75 (0.34, 1.67)	1.12 (0.67, 1.87)	0.89 (0.55, 1.44)					
Class 7 Marij. & Alc.	**1.51 (1.13, 2.02)**	1.11 (0.86, 1.43)	0.67 (0.33, 1.36)	0.99 (0.70, 1.39)	0.79 (0.60, 1.04)	0.89 (0.53, 1.47)				
Class 8 3 substance	**1.91 (1.51, 2.41)**	**1.64 (1.32, 2.02)**	0.98 (0.50, 1.95)	**1.46 (1.07, 1.99)**	1.17 (0.92, 1.48)	1.31 (0.80, 2.13)	**1.48 (1.10, 1.99)**			
Class 9 Poly	**3.86 (2.71, 5.49)**	**2.84 (2.06, 3.91)**	1.71 (0.82, 3.53)	**2.53 (1.71, 3.74)**	**2.03 (1.45, 2.84)**	**2.27 (1.32, 3.91)**	**2.56 (1.75, 3.75)**	**1.73 (1.22, 2.46)**		
Class 10 Ot. Drug	**2.54 (1.80, 3.60)**	**1.87 (1.36, 2.56)**	1.12 (0.54, 2.32)	**1.67 (1.13, 2.45)**	1.33 (0.95, 1.86)	1.49 (0.87, 2.57)	**1.69 (1.16, 2.46)**	1.14 (0.81, 1.62)	0.66 (0.43, 1.01)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig.=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7n. Associations of reporting sexual abuse only with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 4

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	1.13 (0.73, 1.75)									
Class 3 Marij. Only	3.45 (0.99, 11.96)	3.04 (0.90, 10.29)								
Class 4 Cig. Only	0.89 (0.42, 1.88)	0.79 (0.39, 1.60)	0.26 (0.07, 1.01)							
Class 5 Cig. & Alc.	**1.68 (1.01, 2.80)**	1.48 (0.96, 2.27)	0.49 (0.14, 1.70)	1.88 (0.88, 4.00)						
Class 6 Cig. & Marij.	2.28 (0.86, 6.05)	2.02 (0.79, 5.16)	0.66 (0.15, 3.00)	2.56 (0.84, 7.82)	1.36 (0.52, 3.59)					
Class 7 Marij. & Alc.	1.55 (0.82, 2.91)	1.37 (0.77, 2.43)	0.45 (0.12, 1.66)	1.73 (0.74, 4.03)	0.92 (0.49, 1.74)	0.68 (0.24, 1.95)				
Class 8 3 substance	1.53 (0.82, 2.85)	1.35 (0.78, 2.35)	0.44 (0.12, 1.64)	1.71 (0.74, 3.97)	0.91 (0.50, 1.68)	0.67 (0.24, 1.90)	1.08 (0.57, 2.04)			
Class 9 Poly	**3.33 (1.47, 7.50)**	**2.94 (1.37, 6.31)**	0.97 (0.24, 3.93)	**3.73 (1.39, 10.03)**	1.99 (0.88, 4.46)	1.46 (0.46, 4.66)	2.15 (0.87, 5.29)	2.17 (0.90, 5.27)		
Class 10 Ot. Drug	**3.16 (1.54, 6.50)**	**2.79 (1.43, 5.43)**	0.92 (0.24, 3.52)	**3.54 (1.42, 8.80)**	1.88 (0.92, 3.84)	1.38 (0.46, 4.14)	2.04 (0.91, 4.61)	2.06 (0.93, 4.58)	0.95 (0.36, 2.49)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig.=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

Table 3.7o. Associations of reporting both physical and sexual abuse with substance use latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 4

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Alc. only	Class 3 Marij. only	Class 4 Cig. only	Class 5 Cig. & Alc.	Class 6 Cig. & Marij.	Class 7 Marij. & Alc.	Class 8 3 substances	Class 9 Poly	Class 10 Ot. drug
Class 1 Abstainers										
Class 2 Alc. only	1.12 (0.71, 1.77)									
Class 3 Marij. Only	**7.74 (2.95, 20.35)**	**6.92 (2.74, 17.50)**								
Class 4 Cig. Only	0.89 (0.42, 1.88)	1.55 (0.90, 2.70)	**0.31 (0.12, 0.84)**							
Class 5 Cig. & Alc.	**1.68 (1.01, 2.80)**	1.42 (0.90, 2.24)	**0.21 (0.08, 0.54)**	0.66 (0.36, 1.20)						
Class 6 Cig. & Marij.	2.28 (0.86, 6.05)	**5.60 (2.97, 10.57)**	0.81 (0.28, 2.36)	**2.60 (1.22, 5.53)**	**3.95 (1.97, 7.92)**					
Class 7 Marij. & Alc.	1.55 (0.82, 2.91)	1.37 (0.77, 2.43)	**0.11 (0.03, 0.34)**	**0.34 (0.14, 0.83)**	0.92 (0.49, 1.74)	**0.13 (0.05, 0.34)**				
Class 8 3 substance	1.53 (0.82, 2.85)	1.35 (0.78, 2.35)	**0.22 (0.08, 0.62)**	0.72 (0.36, 1.43)	1.10 (0.59, 2.02)	**0.28 (0.13, 0.59)**	1.92 (0.82, 4.46)			
Class 9 Poly	**3.33 (1.47, 7.50)**	**2.94 (1.37, 6.31)**	**0.23 (0.06, 0.87)**	0.73 (0.24, 2.21)	1.11 (0.38, 3.22)	**0.28 (0.09, 0.90)**	2.13 (0.61, 7.44)	1.01 (0.33, 3.07)		
Class 10 Ot. Drug	**3.16 (1.54, 6.50)**	**2.66 (1.32, 5.36)**	0.38 (0.13, 1.16)	1.23 (0.56, 2.73)	1.87 (0.88, 3.96)	0.47 (0.20, 1.14)	**3.59 (1.33, 9.68)**	1.71 (0.76, 3.84)	1.69 (0.51, 5.56)	

Note. CI= Confidence intervals; Alc.=Alcohol; Marij.=Marijuana; Cig.=Cigarette; 3 substances= Cigarettes, alcohol, and marijuana; Poly=Polysubstance; Ot. Drug= Other drug use patterns.
All statistically significant associations are bolded.

CHAPTER 4.

The Impact of Child Maltreatment on Risky Sexual Behavior Profiles from Adolescence to Adulthood: A Latent Transition Analysis

Risky sexual behaviors are an important public health problem for adolescents and young adults (CDC Division of STD Prevention, 2014). Risky sexual behaviors, such as multiple sexual partners and inconsistent condom use, increase the risk for sexually transmitted infections (STIs) and HIV (CDC, 2016). Associations between child maltreatment, mainly childhood sexual abuse, and subsequent risky sexual behaviors have been well established in the literature (Lacelle, Hébert, Lavoie, Vitaro, & Tremblay, 2012; Norman et al., 2012; van Roode, Dickson, Herbison, & Paul, 2009; Walsh, Latzman, & Latzman, 2014). Research has also found that child sexual abuse is often experienced alongside other types of child maltreatment (Hahm, Lee, Ozonoff, & Van Wert, 2010; Lacelle et al., 2012), and some evidence suggests that other types of child maltreatment in addition to child sexual abuse may contribute to risky sexual behaviors (Norman et al., 2012).

Several theories help explain the potential link between child maltreatment and risky sexual behaviors. Emotion Dysregulation Theory states that child maltreatment has a significant impact on emotional regulation, and through emotional dysregulation, individuals experience a decreased ability to adequately control emotional responses, specifically negative emotional states (Gratz & Roemer, 2004; Walsh et al., 2014). Additionally, emotional dysregulation may lead to impulsivity when experiencing negative emotions (Gratz & Roemer, 2004). Messman-Moore and colleagues found that emotional dysregulation was a significant mediator between

child sexual abuse and risky sexual behaviors among college women (Messman-Moore, Walsh, & DiLillo, 2010).

Traumagenics Theory may also explain the association between child maltreatment and risky sexual behaviors, specifically among victims of child sexual abuse (Finkelhor & Browne, 1985; Senn & Carey, 2010). Traumatic sexualization in childhood may be associated with experiences of childhood rewards and affection, consequently leading to a dysfunctional relationship between sexual relations in adulthood and expectations of receiving rewards and affection (Finkelhor & Browne, 1985; Senn & Carey, 2010).

Moreover, Attachment Theory may also be a relevant framework to examine the associations between child maltreatment and sexual risk behaviors (Bowlby, 1982; Cicchetti & Toth, 2005; Thibodeau, Lavoie, Hébert, & Blais, 2017b). These attachment behaviors are theoretically divided into avoidant attachment and anxious attachment (Bowlby, 1982; Thibodeau et al., 2017b). Individuals who experience maltreatment may fear rejection and thus resort to anxious attachment, potentially engaging in sexual risk behaviors (Davis, Shaver, & Vernon, 2004; Thibodeau et al., 2017b). Additionally, individuals who experience maltreatment may avoid forming deep emotional connections with partners and thus engage in multiple sexual partners and casual sexual behavior, thus exhibiting avoidant attachment (Davis et al., 2004; Fraley, Garner, & Shaver, 2000; Thibodeau et al., 2017b).

While most studies on child maltreatment and risky sexual behaviors focus on childhood sexual abuse specifically, several studies have attempted to tease apart the differential impacts of other types of child maltreatment. Physical abuse was associated with inconsistent condom use and having a sexually transmitted infection among adolescents (Thibodeau, Lavoie, Hébert, & Blais, 2017a). Experiencing child neglect was linked to a higher number of sexual partners

among females, above and beyond physical, sexual, and emotional abuse (Abajobir, Kisely, Williams, Strathearn, & Najman, 2018).

Previous research has also examined cumulative effects of child maltreatment on sexual risk behaviors. Among a sample of high school students, Thibodeau and colleagues found that experiencing a higher number of different maltreatment types (cumulative effects) corresponded with a higher number of sexual risk behaviors, including a higher number of sexual partners, lower age at first sex, and more casual sex behaviors (Thibodeau et al., 2017a). Cumulative effects of child maltreatment types were found in other studies on the number of lifetime sexual partners (Arata, Langhinrichsen-Rohling, Bowers, & O'Brien, 2007; Senn & Carey, 2010).

Moreover, it's important to examine the unique and co-occurrence of child maltreatment types (Rivera, Fincham, & Bray, 2018). Unique effects are important to assess because examining one type of abuse at a time may lead to overestimation on the impact of sexual risk behaviors due to not controlling for other types of abuse (Thibodeau et al., 2017a). Moreover, unique effects refer to an effect that is observed above and beyond other types of abuse. Unique effects of child sexual abuse on sexual risk behaviors have been found in several studies, specifically on unprotected sexual encounters (Senn & Carey, 2010), the number of lifetime partners (Littleton, Breitkopf, & Berenson, 2007; Senn & Carey, 2010), and more frequent sexual intercourse among adolescents (Newcomb, Locke, & Goodyear, 2003).

While the link between child maltreatment and risky sexual behaviors has been well established, there are several gaps. Most studies on child maltreatment and risk sexual behaviors are limited to adolescence only (Arata et al., 2007; Thibodeau et al., 2017a) or female adults only (Senn & Carey, 2010). Moreover, rarely has the impact of child maltreatment and risky sexual behaviors been examined over the course of adolescence to adulthood (Wilson & Widom, 2008).

The majority of the literature focuses on childhood sexual abuse specifically, and while several studies have attempted to dissect the differential impacts of child maltreatment types on risky sexual behaviors, they are limited to cross-sectional studies (Arata et al., 2007; Senn & Carey, 2010) or longitudinal studies with a fairly short follow-up (Thibodeau et al., 2017a). The current study seeks to expand on the current literature of the association between child maltreatment and risky sexual behaviors by examining differential impacts of child maltreatment and the impact on the transition of sexual risk behaviors over the course of adolescence to adulthood.

The research questions that inform this study are: 1) What is the association between child maltreatment patterns and sexual risk behavior profiles in adolescence and adulthood?; 2) What is the longitudinal association between child maltreatment patterns and sexual risk behavior profiles over time? The conceptual model that informs this study is presented in Figure 4.1.

Materials and Methods

Sample and study design

Data from the National Longitudinal Study of Adolescent to Adult Health (Add Health) was used for this study. The study design is described in detail elsewhere (Harris et al., 2009). The Add Health study is a nationally representative school-based longitudinal study which aims to determine the influence of environmental, social, behavioral, and biological factors on a variety of outcomes and behaviors across the lifespan (adolescents to middle adulthood). Eighty schools were selected for participation, and 52 were eligible. In the 1995-95 school year, approximately 20,745 middle and high school students (7^{th} to 12^{th} grade) participated in an in-home survey (Wave 1) (79% participation). Wave II was completed in 1996 when the adolescents were in grades 8^{th}-12^{th} (88.6% participation). Wave III was collected in 2001-02

when participants were young adults ages 18-26 (77.4% participation), and Wave IV was collected in 2008 when participants were ages 24-32 (80.3% participation).

To enable comparability of the sample, we excluded all participants who reported engaging in transactional sex work (n=279 at Wave 1, n=402 at Wave 2, n=218 at Wave 3, and n=78 at Wave 4). We hypothesize that youth and adults who engage in transactional sex work represent a different population than the general population of adolescents we aim to examine in this study. Therefore, we chose to exclude the participants in this study.

Measures

Sexual behaviors. Sexual behaviors were the main outcomes of interest. Sexual behavior questions varied by wave. Detailed descriptions of original measures and constructed variables are listed in Appendix 4.1. In Wave 1 and 2, sexual behavior questions included ever having sex, romantic sexual partners, non-relationship sexual partners, and birth control the last time they had sex. In Wave 3, sexual behavior questions included ever having sex, sexual partners, birth control and condom use at last time sex, and sex with a partner with a known STD. In Wave 4, sexual behavior questions included ever having sex, sexual partners, birth control and condom use at last time sex, and concurrent sexual partners. A brief overview of actual measures and constructed variables are displayed in Table 4.1.

***Ever having sex*.** A question about engaging in sex was asked across all waves. This question, "Have you ever had sexual intercourse?" was the same across Waves 1-3. However, in Wave 4, other forms of sexual intercourse were included in three total questions, including anal sex and oral sex in addition to vaginal sex. Individuals were categorized as either ever having sex or never having sex.

Romantic sexual partners (adolescence). Romantic sexual partners were only assessed in Waves 1 and 2 (adolescence). For this question, participants initially list up to three romantic partners they have had in the past year. For the constructed variable, individuals were categorized as having romantic sexual partners if they reported, "We had sexual intercourse" with the respective partner. Romantic relationship partners were totaled for this constructed measure.

Non-relationship sexual partners (adolescence). Non-relationship sexual partners were only assessed in Waves 1 and 2 (adolescence), similarly to romantic sexual partners. However, for this question, participants could report a continuous number of non-relationship sexual partners. This question asked, "How many people, not including romantic relationship partners, have you had a sexual relationship with?" This question was asked approximately of the last 12 months. For Wave 1, a specific date was included in the question (since January 1, 1994) and for Wave 2, the question asked about non-relationship sexual partners since the month of last interview (which was also approximately 12 months).

Birth control and condom use at last time sex (adolescence). For birth control and condom use at Waves 1 and 2, youth could list up to three methods of birth control they used the last time they had sex. Measuring birth control and condom use at last time sex has been deemed a reliable way to measure consistent condom use over past sexual encounters (Fonner, Kennedy, O'Reilly, & Sweat, 2014; Younge et al., 2008). Categories were collapsed into, "Not sexually active," "No birth control," "Condom use only," "Hormonal birth control/Other birth control," or "Both condoms and hormonal/other type of birth control used."

Sexual partners (adulthood). For sexual partners, Waves 3 and 4 survey questions no longer made a distinction between types of sexual partners (romantic relationship partners and

non-relationship sexual partners). Instead, the total number of sexual partners was measured. The number of sexual partners in Wave 3 was measured using, “With how many different partners have you had vaginal intercourse in the past 12 months?” Additionally, other types of sexual behavior were not included in the sexual partner question in this wave. For the Wave 4 question on sexual partners, participants were asked about the total number of male sexual partners and female sexual partners for all types of sexual activity over the past 12 months. These were computed into a total number of sexual partner variable, which maintained the consistency of the categories with previous waves.

Birth control use (adulthood). In Wave 3, birth control at last time sexual encounter was measured using, “The most recent time you had vaginal intercourse, did you or your partner use some form of birth control?”. For Wave 4, birth control use was measured across the past 12 months using, “In the past 12 months, did you or your partner use any of these methods for birth control or disease prevention?” Participants could answer, “No,” “Yes,” or “Skipped-not sexually active.” These responses were maintained in the final constructed variable

Condom use (adulthood). In Wave 3, condom use at last time sexual encounter was measured similarly to birth control, “The most recent time you had vaginal intercourse did you/your partner use a condom?” Wave 4 switched to assessing past 12-month condom use by asking, “In the past 12 months, did you or your partner use any of these methods for birth control prevention?” Participants could answer, “No,” “Yes,” or “Skipped- not sexually active,” and these responses were also maintained in the final variable.

Sex with partner with known STD (adulthood). In Wave 3, sex with a partner with an STD was measured using, “Now, think about this person/these people with whom you had vaginal intercourse in the past 12 months. To the best of your knowledge, did (he/she/any of

them) ever in (his life/her life/their lives) have a sexually transmitted disease or STD?" Participants could answer, "No," "Yes," or "Skipped-not sexually active," and these responses were maintained.

Concurrent sexual partners (adulthood). For concurrent sexual partners in Wave 4, participants were asked, "In the past 12 months, did you have sex with more than one partner at around the same time?" to which they could respond, "No," "Yes," or "Skipped- not sexually active." These responses were maintained in the final constructed variable.

Child maltreatment. Child maltreatment variables were the predictors of interest. The two child maltreatment measures included physical abuse and sexual abuse. At both Waves III and IV, participants were asked retrospectively to provide information about previous child maltreatment and neglect. In Wave 3, the frequency of child maltreatment events was asked of the participants before the participant started 6th grade. In Wave 4, the frequency of child maltreatment events was asked before the participant's 18th birthday. We chose to use the questions in Wave 4 only, based on the larger window of time captured by the measures and the specific wording of the physical abuse question in Wave 4. For example, the question in Wave 3 about physical abuse asks, "How often had your parents or other adult caregivers slapped, hit or kicked you?" The question in Wave 4 asks, "How often did a parent or adult caregiver hit you with a fist, kick you, or throw you down on the floor, into a wall, or down stairs?" Sexual abuse was assessed using, "How often did a parent or other adult caregiver touch you in a sexual way, force you to touch him or her in a sexual way, or force you to have relations?" Participants could respond, "one time," "two times," "three to five times," "six to ten times," "more than ten times," "this has never happened," "refused," "don't know," and "not applicable."

Additionally, two other child maltreatment questions were asked of participants but were not included in this study. Neglect was assessed in Wave 3 using two questions, “How often had your parents or other adult caregivers left you home alone when an adult should have been with you” and “How often had your parents or other caregivers not taken care of your basic needs, such as keeping you clean or providing food or clothing?” Emotional abuse was assessed in Wave 4 using, “How often did a parent or caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved?” These questions of neglect and emotional abuse did not operationalize the severe measures of these constructs. Therefore, due to our overarching aims of examining child maltreatment in a more severe framework, we chose to only utilize the physical and sexual abuse questions that were measured in Wave 4 for this study.

Other covariates. Control covariates included age (in years), race/ethnicity (White, Black/African-American, Hispanic/Latino, and Other races), sex (male or female), and poverty (whether the participants’ parents or caregivers received food stamps or welfare assistance at Wave 1). This study was approved by Georgia State University Institutional Review Board (IRB).

Data Analysis

Latent class analysis was used to examine classes of sexual behaviors. The purpose of LCA is to determine the underlying latent categorical variable which is obtained by analyzing similarities on categorical item responses. LCA then provides the estimated proportion of individuals within each class. The number of classes can be assessed through multiple fit indices (Nylund, Asparouhov, & Muthén, 2007; Yungtai Lo, Mendell, & Rubin, 2001) as well as evaluating the substantive meaning of the classes. Initially, a latent class measurement model was built for latent classes of sexual behavior. This was assessed at each wave.

Then, latent transition analysis (LTA) was conducted to assess changes in latent class membership of sexual behaviors over time. LTA is a longitudinal extension of latent class analysis (LCA). LTA can determine the transition between classes longitudinally (Collins & Lanza, 2010). An analytic model of the associations between child maltreatment and substance use behaviors is presented in Figure 4.2a. All higher order moments were also tested to determine incorporation in the final latent transition models. Longitudinal invariance was not implemented across waves and is not necessary in latent transition analysis. Since the classes are substantively different across all waves, the model allowed for freely estimated parameters to vary across waves. Additionally, this aligns with developmental trajectories of sexual behaviors.

Child maltreatment variables were then examined to determine the best operationalization using a series of nested model tests. Child maltreatment was also assessed as a latent class variable. We also evaluated whether transitions between sexual behavior classes varied by sexual behaviors by allowing the associations between child maltreatment and sexual behavior classes to be estimated in the previous waves. This yielded a global χ^2 test that allowed us to evaluate whether the transitions between sexual behavior classes were statistically significant different across child maltreatment patterns.

Then, predictors were incorporated to conduct the latent class regressions in each wave to determine the associations between child maltreatment and latent classes of sexual behavior in adolescence and adulthood. Direct effects were assessed for all covariates (Masyn, 2017), and incorporated in final models. All child maltreatment variables were allowed to have direct effects on sexual behavior indicators, regardless of statistical significance (Figure 4.2b). Finally, predictors were incorporated in the latent transition analysis. Latent class regressions and latent transition analyses adjusted for age, race, poverty, and sex.

Full information maximum likelihood estimation was implemented to account for missing (missing at random) data using Mplus statistical software (Muthén & Muthén, 1998). Sampling weights were not used in this study due to computational power; however, preliminary pairwise analyses revealed no inferential differences whether sampling weights were used. All analyses were conducted in R 3.5.1 and Mplus 8.2 (Muthén & Muthén, 1998).

Results

Among all participants (n=14,433), 17% (n=2,538) reported at least one instance of physical abuse only, 1% (n=108) reported at least one instance of sexual abuse only, and 1% (n=122) reported at least one instance of both sexual and physical abuse (Table 4.2). A slightly higher percentage of females compared to males reported sexual abuse (1% vs. 0.1%, respectively) and both physical and sexual abuse (1.3% vs. 0.2%, respectively).

For the child maltreatment variables (physical abuse and sexual abuse), the final operationalization included distinction by type of child maltreatment: physical abuse only, sexual abuse only, and both physical and sexual abuse. Physical abuse and sexual abuse were initially constructed as a latent class variable with two free classes and one fixed class of "no maltreatment." However, this resulted in no distinctive patterns of maltreatment in the two free classes. Therefore, classes were fixed based on observed patterns of maltreatment in the data and previous research on latent classes of child maltreatment (Rivera et al., 2018). These classes were distinguished by type of abuse: physical abuse, sexual abuse, and both physical and sexual abuse. This model resulted in classes being homogenous in terms of type of maltreatment, but the heterogeneity within classes was attributed to varying frequencies of the specific type of maltreatment. When testing inclusion criteria for these categories, individuals were classified as experiencing abuse if they reported one or more instance. This resulted in the best model fit. For

example, for persons reporting one instance of only physical abuse, they were classified in the same class as persons reporting 6 instances of only physical abuse. However, individuals who were classified as experiencing sexual abuse only were in a separate class, and individuals classified as experiencing both physical and sexual abuse were in a third class. Since the entropy for these classes was high (0.998), we converted the latent class variables into observed variables based on modal class assignment. This resulted in four observed variables: physical abuse only, sexual abuse only, physical and sexual abuse, and no maltreatment. This approach enabled us to retain participants who were missing on one of the indicators, while saving computational power by not estimating the full latent class variable. Additionally, this operationalization of child maltreatment distinction by type of maltreatment and combination of experiences is consistent with previous literature (Rivera et al., 2018).

Descriptive statistics among sexual behaviors are presented in Table 4.3. Among participants at Wave 1, 38% (n=7,305) reported ever having sex while 97% (n=14,043) of participants at Wave 4 reported ever having sex. The percentage of romantic sexual partners and non-relationship sexual partners were consistent across Waves 1 and 2. The percentage of partners reporting one monogamous sexual partner in the past 12 months was slightly higher in Wave 4 compared to Wave 3 (63% vs. 52%, respectively). The percentage of participants using birth control and/or condoms were consistent across Waves 1 and 2. Additionally, the percentage of participants who reported condom use was slightly higher in Wave 4 compared to Wave 3 (45% vs. 33%, respectively). Among the other sexual risk behaviors, 6% (n=797) reported engaging in sex with a partner with an STD in Wave 3, and 13% (n=1,827) reported concurrent sexual partners in Wave 4.

Latent class measurement model for sexual behaviors

For this paper, the LCA of sexual risk behaviors were estimated in each time wave. We conducted a more confirmatory approach rather than an exploratory approach to determine the type and number of latent classes. We started with fixing item probabilities for an "Abstainer" class, which reported not having sex, and thus, not sexually active on all other measures. We then constructed profiles of youth based on sexual behavior. In Waves 1 and 2, nine classes were constrained by type of sexual partner (romantic vs. non-relationship/casual partners), whether they used birth control or not, and a free class where all thresholds were freely estimated. This yielded a class characterized by reporting non-relationship partners and no reported sex in Wave 1 and a class characterized by reporting a mixture of relationship and non-relationship partners in Wave 2. The types of birth control and condom use were allowed to vary within each class that reported using birth control/condom use at last time sexual encounter. Table 4.4 presents model specification probabilities for each class across waves.

Figure 4.2 presents classes that were estimated for each wave. In Waves 3 and 4, the type of sexual partner was no longer measured in the survey, and therefore, the number of sexual partners aided in defining fixed classes. For example, reporting "One" sexual partner was classified as "Monogamous" and reporting more than one partner was classified as "Multiple" sexual partners. Classes were distinguished based on monogamous partner compared to multiple partners, birth control use or not, ever having sex, and sex with a partner with an STD. Similarly in Waves 1 and 2, Wave 3 classes allowed the type of birth control to vary within each class if the class was characterized by using either condom use or other type of birth control. In Waves 4, classes were similarly classified as Wave 3; however, instead of "Sex with partner with an STD," this risk behavior was replaced with "Concurrent sexual partners" based on the changes in

survey measures across waves. In Wave 3, the class characterized by reporting multiple sexual partners and engaging in sex with a partner with a known STD contained combined responses for both birth control and condom use and non-use, mostly due to the low prevalence of response patterns for this class and misclassification errors when attempting to separate the classes by birth control use. Whereas in Wave 4, response patterns characterized by multiple sexual partners and having concurrent sexual partners at the same time were able to compose two classes, one which participants used birth control and/or condoms and one which participants did not report birth control or condom use. An "Abstainer" class and a class which reported previously having sex but no current sexual partners were maintained throughout all waves.

Table 4.5 presents class frequencies and percentages across waves. Across Waves 1 and 2, the abstainer class had the highest percentage of participants (60% and 54%, respectively). The non-relationship partner and no reported sex class was the freely estimated class in Wave 1, whereas in Wave 2, the freely estimated class was characterized by a mix of romantic and non-relationship partners. This class was fairly large in Wave 2 (14%). The abstainer class had the lowest percentage of participants across Waves in adulthood (3%). The class with the highest percentage of participants in early adulthood and adulthood was the class characterized by monogamous partner and birth control/condom use.

The latent classes and item endorsement probabilities from the unconditional model across all waves are presented in Figure 4.4. Across Waves 1 and 2, item endorsement probabilities within the classes are similar except for the freely estimated class. In Wave 3, among classes who reported using any birth control or condom use, birth control was more highly endorsed compared to condom use. In Wave 4 class 2, item endorsement probabilities for birth control were higher than condom use; however, in the classes characterized by multiple

partners or concurrent partners (class 5, 6, and 9), condom use had a higher probability of endorsement compared to birth control use.

Child maltreatment and latent class membership

For the initial research question, the associations between child maltreatment and latent class membership were estimate in each wave. Prior to examining maltreatment with substance use and covariates, we examined descriptive statistics of child maltreatment patterns by sexual behavior classes, which are presented in Table 4.6. Across Waves 1-3, a higher percentage of individuals reporting no abuse were classified in the abstainer class; however, this pattern was not observed by Wave 4. In Waves 1 and 2, the abstainer class had the highest number of individuals, whereas in Wave 3 and 4, the monogamous partner with birth control use had the highest number of individuals. In Waves 1 and 2, among individuals reporting sexual abuse and both physical and sexual abuse, a higher percentage were classified in the monogamous partner with birth control use class compared to individuals reporting physical abuse and no abuse. Additionally in Wave 1, a slightly higher percentage of participants who reported physical abuse (10%) were classified in the class characterized by both romantic and non-relationship partners with birth control use compared to participants who reported no abuse (7%), sexual abuse only (7%), and both physical and sexual abuse (8%).

In Wave 4, among those reporting both physical and sexual abuse, a slightly higher percentage (18%) were classified in the class characterized by both romantic and non-relationship partners with birth control compared to other participants. Additionally, among participants reporting physical abuse only, a higher percentage (18%) were classified in the class characterized by multiple sexual partners and concurrent sexual partners with birth control use compared to other participants.

Child maltreatment was then inferentially tested for the associations with sexual behavior classes, adjusting for covariates and direct effects. Table 4.7a-c present model results from the latent class regression of sexual behaviors on child maltreatment, adjusting for covariates, in Wave 1. Overall, child maltreatment had a statistically significant effect on latent class membership of sexual behaviors in adolescence and adulthood. In Wave 1, compared to the abstainer class, reporting physical abuse only compared to no abuse was associated with being classified in the non-relationship sexual partner only class without birth control (OR: 2.60; 95% CI: 1.44, 4.71). Additionally, compared to the romantic partner only class using birth control, reporting physical abuse only was also associated with being classified in the non-relationship sexual partner only class without birth control (OR: 1.65; 95% CI: 1.03, 2.66).

Among participants reporting sexual abuse only, a reduced odds of being classified in the non-relationship partner class with no reported sex were observed. For example, compared to the abstainer class, individuals reporting sexual abuse only compared to no abuse had reduced odds of being classified in the non-relationship partner class with no reported sex (OR: 0.05; 95% CI: 0.01, 0.49) compared to the romantic partner only using birth control class. For comparisons of both physical and sexual abuse compared to no abuse, there were no statistically significant differences in odds of sexual behavior class membership.

Comparisons were also made between child maltreatment patterns to evaluate the unique effects of the different child maltreatment patterns. In Wave 1, compared to sexual abuse only, physical abuse only was associated with being in the romantic partner class without birth control compared to the abstainer class (OR: 1.34; 95% CI: 1.02, 1.77) (Table 4.7d). Additionally, physical abuse only compared to sexual abuse only was associated with a higher odds in the non-relationship partner class using birth control compared to the non-relationship partner class

without reported sex (OR: 2.08; 95% CI: 1.31, 3.30). Table 4.7e presents comparisons between sexual abuse only with both physical and sexual abuse. Compared to both physical and sexual abuse, sexual abuse only was associated with a reduced odds of being classified in the romantic partner class without birth control compared to the romantic partner class with birth control (OR: 0.20; 95% CI: 0.07, 0.59). Finally, comparisons between physical abuse only and both physical and sexual abuse are presented in Table 4.7f. Compared to both physical and sexual abuse, physical abuse only was associated with being in the no partners but reported sex class compared to the abstainer class in Wave 1 (OR: 1.34; 95% CI: 1.03, 1.74).

Several direct effects of child maltreatment on sexual behavior indicators were statistically significant. For example, individuals reporting sexual abuse only compared to no abuse had higher odds of being classified in the non-relationship partner class with birth control use in Wave 1. Additionally, sexual abuse had a statistically significant negative direct effect on the number of non-relationship partners in this class. Individuals reporting sexual abuse only in this class endorsed fewer non-relationship partners compared to other individuals. Reporting physical abuse only compared to no abuse was associated with being in the romantic and non-relationship partners using birth control class compared to the abstainer class in Wave 1. Additionally, physical abuse only (compared to no abuse) had a statistically significant positive direct effect on ever having sex in this class.

Similar findings were found for subsequent Waves 2-4, which are presented in the appendices (Tables 4.7g-o). In adulthood (Waves 3 and 4), compared to no maltreatment, physical abuse only was associated with being in the multiple partner class without birth control use, compared to the abstainer class, the monogamous partner class using birth control, and the multiple partner class using birth control. Similar associations for the multiple partner class

without birth control use were also observed among individuals reporting sexual abuse only in early adulthood. Also, as expected, sex, race/ethnicity, age and poverty were all statistically significantly associated with latent class membership at all four waves.

Unconditional latent transition model results

All higher order moments were statistically significant. Previous sexual behavior classes impacted future sexual behavior classes, after accounting for interim memberships. Unconditional latent transition matrices are presented in Table 4.8. Overall, in adolescence, transition probabilities for all classes in Wave 1 were high for the romantic partners only and birth control use class transition to Wave 2. Transition probabilities were also high for transitioning into the romantic and non-relationship mixture class (freely estimated class) in Wave 2. For the transitions between adolescence and early adulthood (Wave 2 and 3), transition probabilities are held constant at the abstainer class in Wave 1. Between Waves 2 and 3, transition probabilities overall were highest for the romantic partners only and birth control use class. Additionally, transition probabilities into the multiple partner with birth control class were also high for transitions from adolescence to early adulthood. These patterns were observed for both transitions across Wave 2 and 3 as well as transitions across Wave 3 and 4.

Unconditional model results for longitudinal chains of latent classes of sexual risk behavior are presented in Table 4.9. The longitudinal chains presented are among individuals who start in the abstainer classes in Waves 1 and 2, and the chains presented in this table comprise 50% of all possible longitudinal chains in this analysis (n=7,290). The most frequently reported chain (9.8%) consisted of starting in the abstainer classes in the first two waves, transitioning into the monogamous partner class with some level of birth control use in Waves 3 and 4.

Conditional latent transition model results

There was no evidence of statistically significant differences in transition probabilities of sexual behaviors across patterns of child maltreatment. Therefore, the final conditional model consisted of allowing child maltreatment to predict class membership in each wave, adjusting for all covariates and higher order effects, but not estimating the differential effects of child maltreatment on the transitions of sexual behaviors. Transition probabilities based on the conditional model are presented in Table 4.10. These transition probabilities are similar compared to the unconditional model transition probabilities.

While there were no statistically significant differences in transition probabilities between child maltreatment patterns, there were differences in class membership across waves among child maltreatment patterns. For example, in early adulthood (Wave 3), compared to the abstainer class, reporting physical abuse only was statistically significantly associated with sexually active classes compared to the abstainer class. For example, physical abuse only compared to no abuse was associated with the multiple partner without birth control class (OR: 2.17, 95% CI: 1.59, 2.96) and the multiple partner and sex with a partner with known STD (OR: 2.25; 95% CI: 1.52, 3.32) in Wave 3. Additionally, physical abuse only was associated with the monogamous partner with birth control class (OR: 1.31; 95% CI: 1.04, 1.66), and physical abuse only had a statistically significant direct effect on condom use in this class (OR: 2.25; 95% CI: 1.88, 2.69). There was not, however, a statistically significant direct effect of physical abuse only on birth control use in this class. Also, in early adulthood, sexual abuse only was statistically significantly associated with being in the monogamous partner without birth control class (OR: 6.12, 95% CI: 1.19, 31.39) compared to the abstainer class, after adjusting for all covariates.

However, in adulthood (Wave 4), child maltreatment had no statistically significant effect on latent class membership of sexual behaviors.

Discussion

This study found that child maltreatment predicted latent class membership in adolescence and early adulthood but did not predict latent class membership in adulthood (Wave 4). In adolescence and early adulthood, experiencing physical abuse only compared to no abuse was associated with most of the sexually active classes compared to the abstainer class. Additionally, sexual abuse only compared to no abuse was associated with classes characterized by monogamous and romantic partners in adolescence and early adulthood, specifically with birth control use in adolescence and without birth control use in both adolescence and early adulthood. This pattern was also observed descriptively across Waves 1-3, as evident by the lower percentages of youth reporting maltreatment classified in the abstainer class, consistent with the literature (Arata et al., 2007; Newcomb et al., 2003; Thibodeau et al., 2017a).

Physical abuse only compared to no abuse was associated with being in the non-relationship (casual) sexual partner only class in Wave 1, without using birth control, compared to the abstainer class. Physical abuse only compared to sexual abuse only was associated with being in the romantic partner class without birth control use in Wave 1 (compared to the abstainer class). This is consistent with previous studies (Norman et al., 2012; Senn & Carey, 2010) demonstrating the link between child maltreatment and inconsistent condom use, lack of birth control use, and higher incidence of STD's. However, the transition probabilities for sexual behaviors were not determined to be statistically significantly different between child maltreatment and no maltreatment in this study. Previous research has demonstrated that most

adolescents transition to safer sex patterns over time (Fowler, Motley, Zhang, Rolls-Reutz, & Landsverk, 2015), which was also observed in our study.

This study also found that sexual abuse only compared to no abuse was not statistically significantly associated with classes characterized by non-birth control use. Sexual abuse only, in this study, was mostly associated with being classified in monogamous or romantic partner relationships; however, in early adulthood, sexual abuse was associated with being classified in the monogamous partner without birth control use. Additionally, previous research has demonstrated strong links between sexual abuse and sexual risk behaviors (Lacelle et al., 2012; Senn & Carey, 2010; van Roode et al., 2009; Wilson et al., 2015). However, we failed to detect statistically significant associations between sexual abuse and classes characterized by multiple partners and concurrent sexual partners. The lack of findings for sexual abuse may be due to the small sample size of individuals reporting sexual abuse and both physical and sexual abuse.

Furthermore, the interaction between child maltreatment and previous sexual behavior profiles was not statistically significant. Specifically, we found main effects of child maltreatment on sexual behavior profiles at Waves 1-3, and we also found that previous sexual behavior profiles predicted future sexual behavior profiles. While each of these effects (child maltreatment and prior sexual behavior profile membership) did not depend on one another with regards to future sexual behavior profiles, the effects of child maltreatment on future sexual behavior profiles was exhibited also indirectly through previous sexual behavior profiles. Specifically, there was an impact on future sexual behavior profiles through prior effects of child maltreatment on sexual behavior profiles. This is consistent with previous literature showing that early adolescent sexual behaviors may impact sexual risk behavior trajectories across adolescence and adulthood (Negriff et al., 2015). However, this study expands on previous

research by Negriff and colleagues by also examining adulthood and incorporating both prior sexual behavior history and child maltreatment in the same analytic framework.

Limitations

While this study contributes to the literature on sexual risk behaviors and child maltreatment by examining the impact of both physical and sexual abuse across adolescence and adulthood, several limitations are noted. First, sexual risk behaviors and child maltreatment measures are sensitive topics and thus susceptible to social desirability and recall bias. Additionally, sexual risk behavior measures in this study are limited. Romantic relationship and casual (non-relationship) partners were distinguished in earlier waves; however, in later waves, the total number of sexual partners was only assessed. Future studies should examine the nature of sexual relationships (romantic vs. casual) across adulthood. Concurrent sexual partners and the question about engaging in sex with a partner with a known STD attempt to measure domains of sexual risk behaviors aside from the other measures of the number and nature of sexual partners and birth control/condom use. However, the study may be strengthened if these measures were collected at all time points and could also be assessed in adolescence.

Additionally, the "ever having sex" question was limited to only vaginal intercourse for the first 3 waves, and finally expanded to ask about other forms of sex (oral and anal) in Wave 4. This severely limits generalizability of "ever having sex" in Waves 1-3 to participants only engaging in vaginal intercourse. Future studies should expand their measure of "ever having sex" to include youth engaging in all types of sexual behavior.

While this study did not detect an association of child maltreatment impacting the transitions between sexual behavior classes, other studies have demonstrated strong links between maltreatment and trajectories of sexual risk behaviors, particularly in adolescence

(Arata et al., 2007; Negriff et al., 2015; Thibodeau et al., 2017a). Future studies may benefit from examining shorter time frames in between early adulthood and adulthood.

Participants who engaged in transactional sex were excluded from this analysis. However, future analyses are planned to incorporate participants who engage in transactional sex as an additional latent class of sexual behavior. Additionally, participants will be allowed to move in and out of this class to determine the association of child maltreatment with the transitions in and out of the transactional sex class.

Lastly, the analyses documented in this paper include only pairwise model runs. Future analyses are planned and ongoing to estimate all four waves simultaneously. Thus, higher order moments are not captured in this analysis. Future analyses are also planned to estimate the interaction of child maltreatment with race/ethnicity and gender on sexual behaviors across adolescence and adulthood.

Conclusions

This study presents findings on the associations between child maltreatment and sexual risk behaviors among a nationally representative sample of U.S. adolescents and adults. This study found associations between child maltreatment and sexual behaviors at specific time points (adolescence and early adulthood), and past sexual behavior profiles influenced sexual behavior profiles in later waves. While there was no interaction between child maltreatment and prior sexual behavior profile on sexual behavior profiles in later waves, there was an indirect effect of child maltreatment on sexual behavior profiles in later waves through influencing prior sexual behavior profile membership. Future studies may benefit from examining the impact of child maltreatment on sexual risk behavior initiation in the context of multiple time points in adolescence and early adulthood.

Figure 4.1. Conceptual model for child maltreatment and sexual risk behaviors

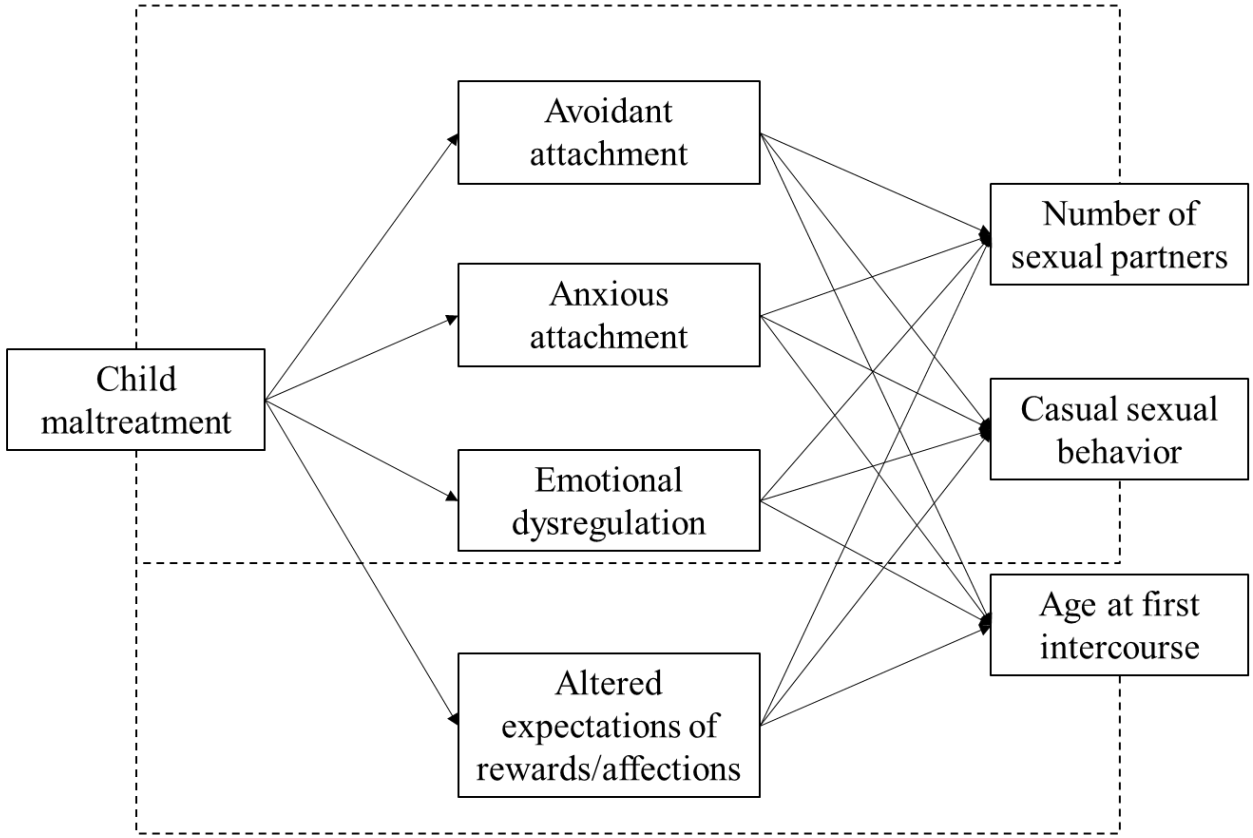
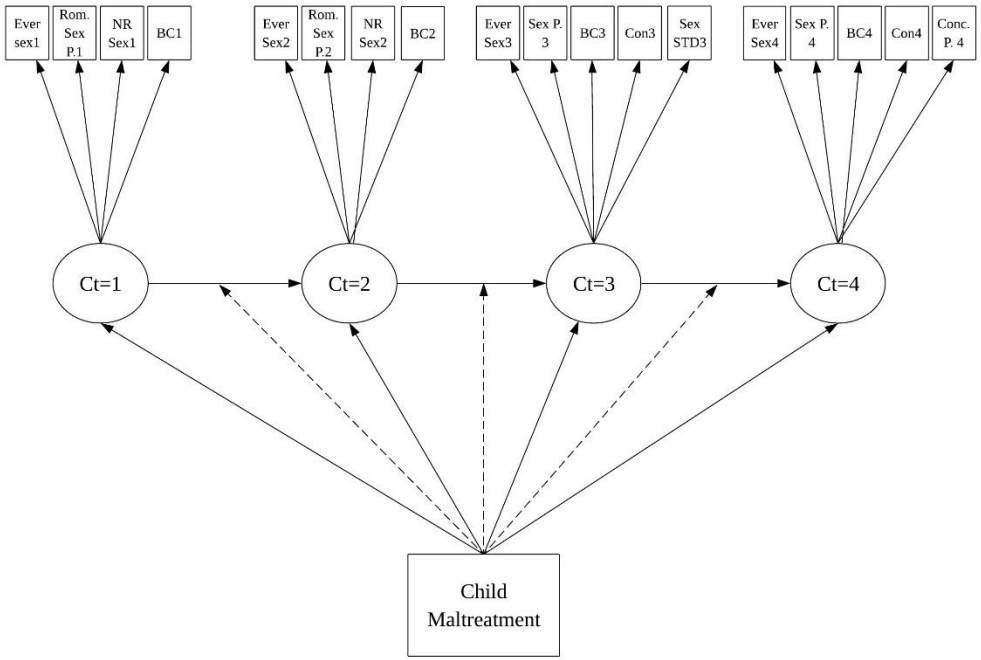
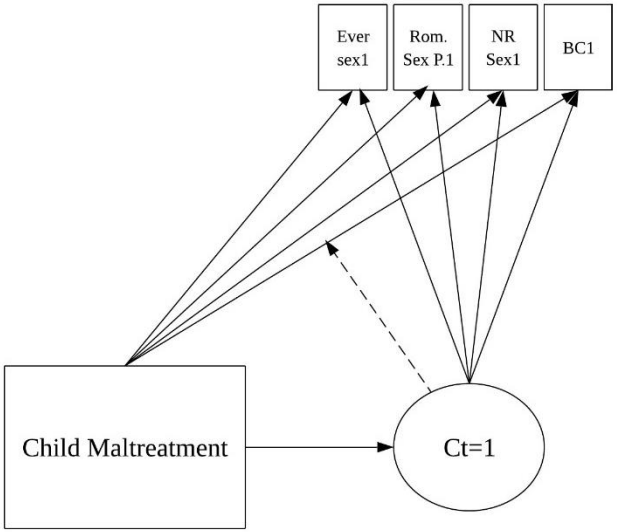


Figure 4.2a. Associations of child maltreatment with longitudinal patterns of sexual behaviors



Note. Rom. Sex P.= Romantic relationship sexual partner; NR sex= Non-relationship sexual partner; BC= Birth control; Sex P.=Sexual partner; Sex STD= Sex with partner with STD; Conc. P=Concurrent sexual partners.

Figure 4.2b. Direct effects of child maltreatment on sexual behavior indicators among participants



Note. Rom. Sex P.= Romantic relationship sexual partner; NR sex= Non-relationship sexual partner; BC= Birth control; Sex P.=Sexual partner; Sex STD= Sex with partner with STD; Conc. P=Concurrent sexual partners.

Table 4.1. Measures of sexual behavior used to construct latent class indicators among participants in the National Longitudinal Study of Adolescent to Adult Health

	Survey questions			
	Wave 1	Wave 2	Wave 3	Wave 4
Ever sex	-Never had vaginal sex -Previously had vaginal sex	Same as Wave 1	Same as Wave 1	-Never had vaginal, oral, or anal intercourse -Previously had vaginal, oral, and/or anal intercourse
Romantic sexual partners	-0 romantic sexual partners -1 romantic sexual partner -2 romantic sexual partners -3 romantic sexual partners	Same as Wave 1	N/A	N/A
Non-relationship sexual partners	-0 non-relationship partners -1 non-relationship partner -2-3 non-relationship partners -4-5 non-relationship partners ->6 non-relationship partners	Same as Wave 1	N/A	N/A
Birth control/ condom last time sex	-Not sexually active -No birth control/condom use -Condoms only -Hormonal birth control only -Both condoms and hormonal birth control	Same as Wave 1	N/A	N/A
Sexual partners	N/A	N/A	-0 sexual partners -1 sexual partner -2-3 sexual partners -4-5 sexual partners ->6 sexual partners	(Either male or female partners) -0 sexual partners -1 sexual partner -2-3 sexual partners -4-5 sexual partners ->6 sexual partners
Birth control last time sex	N/A	N/A	(Most recent) -Not sexually active -No birth control use -Use birth control	(Past 12 months) -Not sexually active -No birth control use -Use birth control prevention?
Condom use last time sex	N/A	N/A	(Most recent) -Not sexually active -No condom use	(Past 12 months) -Not sexually active -No condom use

			-Used condoms	-Used condoms
Sex with partner with STD	N/A	N/A	-Not sexually active -No sex with partner with known STD -Sex with partner with known STD	N/A
Concurrent sexual partners	N/A	N/A	N/A	-Not sexually active -No concurrent sexual partners (past 12 months) -Concurrent sexual partners (past 12 months)

Table 4.2. Baseline descriptive statistics of demographics among reported experiences of childhood physical and sexual abuse at Wave 4 among respondents from the National Longitudinal Study of Adolescent to Adult Health (n=14,433)

	No child maltreatment (n=11,665, 81%)	Physical abuse only (n=2,538, 17%)	Sexual abuse only (n=108, 1%)	Both physical and sexual abuse (n=122, 1%)	Total
Sex					
Male	5,408 (81%)	1,280 (19%)	7 (0.1%)	16 (0.2%)	9,044 (50%)
Female	6,257 (81%)	1,258 (17%)	101 (1%)	106 (1.3%)	9.484 (50%)
Age, M (SD)	16.2 (1.7)	16.1 (1.7)	16.2 (1.6)	16.1 (1.6)	16.2 (1.7)
Race/ethnicity					
White	6,301 (82%)	1,278 (16%)	64 (0.7%)	66 (0.8%)	9,460 (65%)
Hispanic/Non-White	1,826 (80%)	431 (20%)	11 (0.5%)	25 (1.0%)	3,156 (12%)
Black/African American	2,524 (81%)	548 (18%)	25 (0.7%)	22 (0.7%)	4,012 (16%)
Other	1,008 (77%)	280 (21%)	8 (1%)	8 (1%)	1,304 (7%)
Welfare/assistance recipient					
Yes	763 (73%)	260 (25%)	7 (0.7%)	18 (0.7%)	1,048 (8%)
No	9,333 (82%)	1,870 (17%)	82 (0.7%)	82 (1.7%)	11,367 (92%)

Table 4.3. Descriptive statistics of sexual behavior among respondents from the National Longitudinal Study of Adolescent to Adult Health

	Wave 1	Wave 2	Wave 3	Wave 4
Ever sex				
Yes	7,305 (38%)	5,691 (44%)	11,660 (87%)	14,043 (97%)
No	11,128 (62%)	7,292 (56%)	1,801 (13%)	390 (3%)
Sexual Partners				
Romantic sexual partners				
0 partners	12,804 (75%)	8,996 (72%)	---	---
1 partner	3,550 (20%)	2,930 (23%)		
2 partners	797 (5%)	472 (4%)		
3 partners	220 (1%)	129 (1%)		
Non-relationship sexual partners				
0 partners	14,908 (82%)	10,447 (82%)	---	---
1 partner	1,445 (8%)	1,182 (9%)		
2-3 partners	1,238 (7%)	741 (6%)		
4-5 partners	394 (2%)	245 (2%)		
>6 partners	372 (2%)	167 (1%)		
Sex partners				
0 partners	---	---	2,959 (22%)	1,924 (14%)
1 partner			6,921 (52%)	8,890 (63%)
2-3 partners			2,625 (20%)	2,399 (16%)
4-5 partners			563 (4%)	637 (5%)
≥6 partners			363 (3%)	400 (3%)
Birth control and condom use				
Birth control last time sex				
Not sexually active	11,223 (64%)	8,571 (66%)	---	---
Did not use birth control	2,396 (12%)	1,224 (9%)		
Used condoms only	2,302 (12%)	1,339 (10%)		
Used hormonal BC only	668 (4%)	482 (4%)		
Used both condoms + hormonal	1,661 (9%)	1,360 (11%)		
Any birth control last time sex				
Not sexually active	---	---	2,959 (22%)	2,123 (15%)
No			3,340 (24%)	4,960 (34%)
Yes			7,111 (54%)	7,426 (51%)
Condom use last time sex				
Not sexually active	---	---	2,959 (22%)	2,123 (15%)
No			6,080 (46%)	5,723 (40%)
Yes			4,406 (33%)	6,663 (45%)

Average birth control use				
Not sexually active	---	---	---	---
None of the time				
Some of the time				
About half of the time				
Most of the time				
All of the time				
Other sexual risk behaviors				
Sex with partner with STD				
Not sexually active	---	---	2,959 (22%)	---
No sex with partner with STD			9,348 (72%)	
Yes sex with partner with STD			797 (6%)	
Concurrent sexual partners				
Not sexually active	---	---	---	2,123 (15%)
No concurrent sexual partners				10,552 (72%)
Yes concurrent sexual partners				1,827 (13%)

Table 4.4. Measurement model response category probabilities of sexual behavior indicators across classes among participants in the National Longitudinal Study of Adolescent to Adult Health (Waves 1-4)

	Waves 1 & 2								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 Free class[a]	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Pr(Not ever sex)	1	0	0	0	0	0	*	0	0
Pr(Ever sex)	0	*	*	*	*	1	*	1	1
Pr(No romantic partners)	1	0	0	0	0	1	*	1	1
Pr(1 Romantic partner)	0	*	*	*	*	0	*	0	0
Pr(2 Romantic partners)	0	*	*	*	*	0	*	0	0
Pr(3 Romantic partners)	0	*	*	*	*	0	*	0	0
Pr(No NR partners)	1	1	1	0	0	1	*	0	0
Pr(1 NR partner)	0	0	0	*	*	0	*	*	*
Pr(2-3 NR partners)	0	0	0	*	*	0	*	*	*
Pr(4-5 NR partners)	0	0	0	*	*	0	*	*	*
Pr(>6 NR partners)	0	0	0	*	*	0	*	*	*
Pr(Not sexually active, no BC)	1	0	0	0	0	1	*	0	0
Pr(No BC)	0	0	1	0	1	0	*	0	1
Pr(Condoms only)	0	*	0	*	0	0	*	*	0
Pr(Hormonal BC only)	0	*	0	*	0	0	*	*	0
Pr(Both condoms & BC)	0	*	0	*	0	0	*	*	0
	Wave 3								
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, sex with STD	Class 8 Mon. partner, no BC, sex with STD	Class 9 Multiple partners, sex with STD
Pr(Not ever sex)	1	0	0	0	0	0	0	0	0
Pr(Ever sex)	0	1	1	1	1	1	1	1	1
Pr(No sexual partners)	1	0	0	0	0	1	0	0	0
Pr(1 sexual partner)	0	1	1	0	0	0	1	1	*
Pr(2-3 sexual partners)	0	0	0	*	*	0	0	0	*
Pr(4-5 sexual partners)	0	0	0	*	*	0	0	0	*
Pr(>6 sexual partners)	0	0	0	*	*	0	0	0	*
Pr(Not sexually active)	1	0	0	0	0	1	0	0	*
Pr(No BC last time sex)	0	0	1	0	1	0	0	1	*

Pr(Use BC last time sex)	0	*	0	*	0	0	*	0	*	
Pr(Not sexually active)	1	0	0	0	0	1	0	0	*	
Pr(No condoms last time sex)	0	0	1	0	1	0	0	1	*	
Pr(Use condoms last time sex)	0	*	0	*	0	0	*	0	*	
Pr(Not sexually active)	1	0	0	0	0	1	0	0	0	
Pr(No sex with partner STD)	0	1	1	1	1	0	0	0	0	
Pr(Sex with partner STD)	0	0	0	0	0	0	1	1	1	
						Wave 4				
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, conc. partners	Class 8 Mon. partner, no BC, conc. partners	Class 9 Multiple partners, use BC, conc. partners	Class 10 Multiple partners, no BC, conc. partners
Pr(Not ever sex)	1	0	0	0	0	0	0	0	0	0
Pr(Ever sex)	0	1	1	1	1	1	1	1	1	1
Pr(No sexual partners)	1	0	0	0	0	1	0	0	0	0
Pr(1 sexual partner)	0	1	1	0	0	0	1	1	*	*
Pr(2-3 sexual partners)	0	0	0	*	*	0	0	0	*	*
Pr(4-5 sexual partners)	0	0	0	*	*	0	0	0	*	*
Pr(>6 sexual partners)	0	0	0	*	*	0	0	0	*	*
Pr(Not sexually active)	1	0	0	0	0	1	0	0	0	0
Pr(No BC last time sex)	0	0	1	0	1	0	0	1	0	1
Pr(Use BC last time sex)	0	*	0	*	0	0	*	0	*	0
Pr(Not sexually active)	1	0	0	0	0	1	0	0	0	0
Pr(No condoms last time sex)	0	0	1	0	1	0	0	1	0	1
Pr(Use condoms last time sex)	0	*	0	*	0	0	*	0	*	0
Pr(Not sexually active)	1	0	0	0	0	1	0	0	0	0
Pr(No concurrent partners)	0	1	1	1	1	0	0	0	0	0
Pr(Concurrent partners)	0	0	0	0	0	0	1	1	1	1

[a]Free class was characterized by non-relationship sexual partners and no reported sex in Wave 1 and a combination of relationship and non-relationship partners.
Note. *= freely estimated probabilities.
Mon=Monogamous; NR=Non-relationship; BC=Birth control; Sex with STD= Sex with partner with known sexually transmitted infection (STD); Conc.=Concurrent.

Figure 4.3. Diagram of sexual behavior classes among participants in the National Longitudinal Study of Adolescent to Adult Health

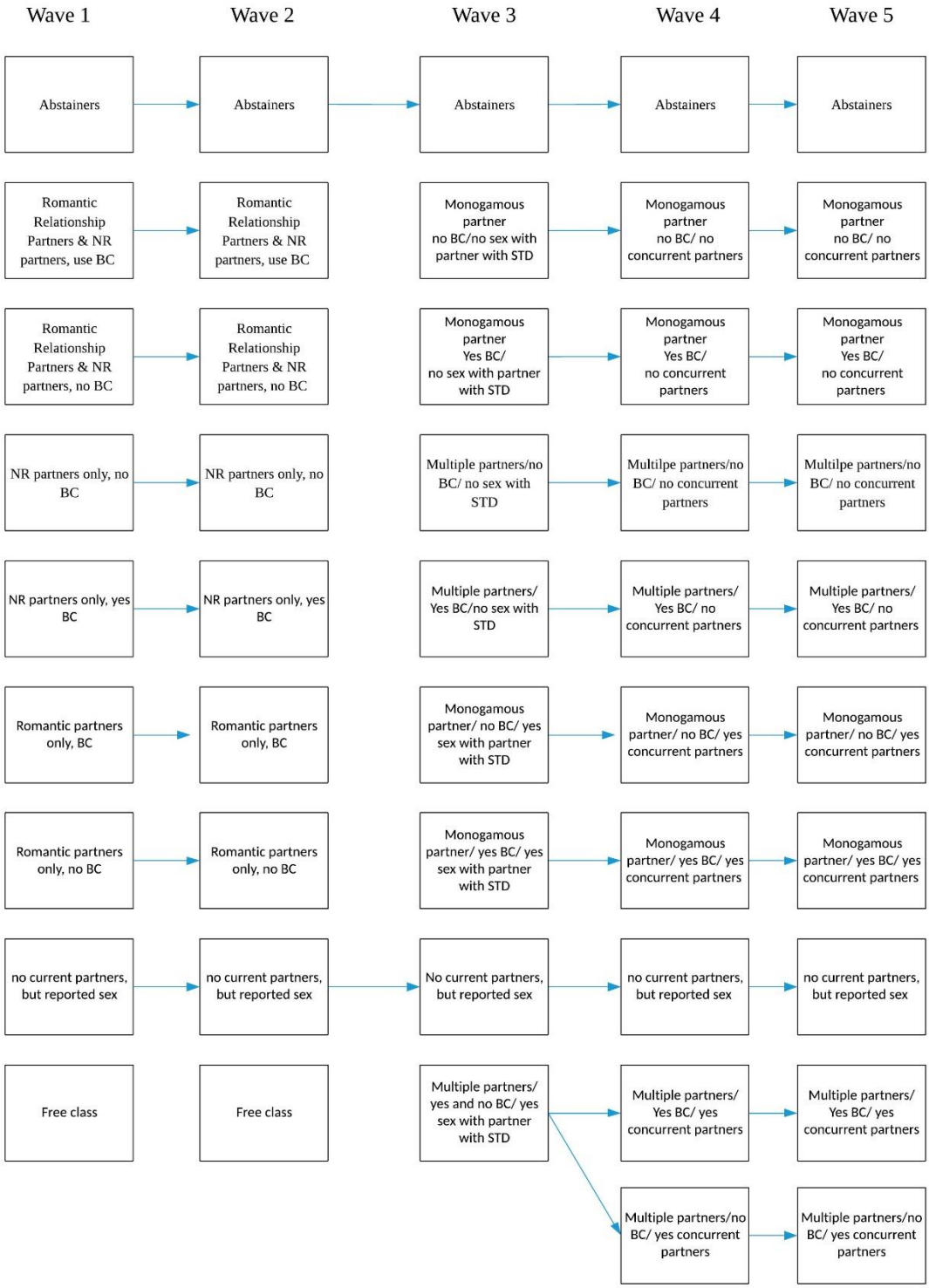


Table 4.5. Model-estimated descriptive statistics among classes of sexual behaviors among participants in the National Longitudinal Study of Adolescent to Adult Health

	Waves 1 & 2									
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 Free class[a]	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC	
Wave 1	11,203 (60%)	2,078 (11%)	849 (5%)	1,463 (8%)	785 (4%)	1,060 (6%)	390 (2%)	477 (3%)	223 (1%)	
Wave 2	7,046 (54%)	1,570 (12%)	564 (4%)	700 (5%)	306 (2%)	551 (4%)	1,771 (14%)	377 (3%)	137 (1%)	
	Wave 3									
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, sex with STD	Class 8 Mon. partner, no BC, sex with STD	Class 9 Multiple partners, sex with STD	
Wave 3	1,892 (14%)	4,926 (36%)	1,719 (13%)	2,465 (20%)	789 (6%)	1,000 (7%)	270 (2%)	146 (1%)	349 (1%)	
	Wave 4									
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, conc. partners	Class 8 Mon. partner, no BC, conc. partners	Class 9 Multiple partners, use BC, conc. partners	Class 10 Multiple partners, no BC, conc. partners
Wave 4	404 (3%)	6,905 (48%)	1,835 (13%)	1,557 (11%)	162 (1%)	1,816 (13%)	126 (1%)	36 (1%)	1,557 (11%)	157 (1%)

[a]Free class was characterized by non-relationship sexual partners and no reported sex in Wave 1 and a combination of relationship and non-relationship partners.
Note. Mon=Monogamous; NR=Non-relationship; BC=Birth control; Sex with STD= Sex with partner with known sexually transmitted infection (STD); Conc.=Concurrent.

Table 4.6. Child maltreatment among sexual behavior classes of participants in the National Longitudinal Study of Adolescent to Adult Health

	Class 1 Abstainers	*Class 2 Rom. Partners, use BC*	*Class 3 Rom. Partners, no BC*	*Class 4 Rom & NR partners, use BC*	*Class 5 Rom & NR partners, no BC*	*Class 6 No partners/ reported sex*	*Class 7 Free class*	*Class 8 NR partners, use BC*	*Class 9 NR partners, no BC*	
Wave 1										
None	7,105 (61%)	1,315 (11%)	463 (4%)	841 (7%)	463 (4%)	666 (6%)	234 (2%)	321 (3%)	140 (1%)	
P. abuse	1,361 (54%)	286 (11%)	118 (5%)	265 (10%)	118 (5%)	168 (7%)	76 (3%)	68 (3%)	40 (2%)	
S. abuse	51 (47%)	17 (16%)	7 (7%)	7 (7%)	7 (7%)	12 (11%)	2 (2%)	3 (3%)	3 (3%)	
Both	51 (42%)	14 (12%)	10 (8%)	10 (8%)	10 (8%)	8 (7%)	2 (2%)	2 (2%)	8 (7%)	
Wave 2										
None	4,679 (55%)	1,056 (12%)	384 (5%)	424 (5%)	180 (2%)	351 (4%)	1,103 (13%)	233 (3%)	86 (1%)	
P. abuse	844 (47%)	218 (12%)	102 (6%)	125 (7%)	57 (3%)	92 (5%)	260 (15%)	67 (4%)	28 (2%)	
S. abuse	25 (36%)	16 (23%)	6 (9%)	7 (10%)	1 (1%)	2 (3%)	11 (16%)	2 (3%)	0	
Both	31 (37%)	16 (19%)	8 (10%)	5 (6%)	3 (4%)	4 (5%)	10 (12%)	6 (7%)	1 (1%)	
Wave 3	*Class 1 Abstainers*	*Class 2 Mon. partner, use BC*	*Class 3 Mon. partner, no BC*	*Class 4 Mult. Partners, use BC*	*Class 5 Mult. Partners, no BC*	*Class 6 No current partners, reported sex*	*Class 7 Mon. partner, use, BC, sex STD*	*Class 8 Mon. partner, no BC, sex STD*	*Class 9 Mult. Partners yes/no BC,, sex with STD*	
None	1,346 (14%)	3,396 (36%)	1,174 (13%)	1,662 (18%)	506 (5%)	750 (8%)	194 (2%)	98 (1%)	240 (3%)	
P. abuse	196 (10%)	629 (33%)	272 (14%)	338 (18%)	155 (8%)	152 (8%)	63 (3%)	23 (1%)	73 (4%)	
S. abuse	4 (5%)	34 (39%)	12 (14%)	14 (16%)	8 (9%)	5 (6%)	1 (1%)	4 (5%)	5 (6%)	
Both	7 (8%)	32 (37%)	13 (15%)	16 (19%)	5 (6%)	3 (4%)	4 (5%)	1 (1%)	5 (6%)	
Wave 4	*Class 1 Abstainers*	*Class 2 Mon. partner, use BC*	*Class 3 Mon. partner, no BC*	*Class 4 Mult. Partners, use BC*	*Class 5 Mult. Partners, no BC*	*Class 6 No current partners, reported sex*	*Class 7 Mon. partner, use BC, conc. Partners*	*Class 8 Mon. partner, no BC, conc. Partners*	*Class 9 Mult. Partners, use BC, conc. Partners*	*Class 10 Mult. Partners, no BC, conc. partners*
None	1,463 (13%)	5,635 (49%)	130 (1%)	1,248 (11%)	94 (1%)	19 (0.2%)	1,404 (12%)	96 (1%)	1,113 (10%)	280 (2%)
P. abuse	289 (12%)	1,089 (45%)	34 (1%)	301 (12%)	23 (1%)	6 (0.2%)	274 (11%)	35 (1%)	349 (14%)	44 (2%)
S. abuse	11 (10%)	49 (46%)	6 (6%)	12 (11%)	1 (1%)	0	9 (8%)	0	19 (18%)	0
Both	21 (18%)	48 (40%)	5 (4%)	12 (10%)	0	0	13 (11%)	4 (3%)	16 (1%)	1 (1%)

Note. Model estimated frequencies. Rom=Romantic; NR=Non-relationship; BC= Birth control; Mon.=Monogamous, Conc.=Concurrent; Mult.=Multiple; P. abuse= Physical abuse; S. abuse= Sexual abuse; Both= Both physical and sexual abuse.

Table 4.7a. Associations of reporting physical abuse only compared to no maltreatment with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	1.58 (1.00, 2.48)								
Class 3 Rom. Partner, no BC	**1.94** **(1.19, 3.16)**	1.23 (0.89, 1.70)							
Class 4 Rom & NR partners, BC	**1.99** **(1.24, 3.19)**	1.26 (0.94, 1.69)	1.03 (0.73, 1.44)						
Class 5 Rom & NR partners, no BC	1.57 (0.94, 2.62)	0.99 (0.69, 1.43)	0.81 (0.54, 1.21)	0.79 (0.54, 1.15)					
Class 6 No partners, reported sex	**1.85** **(1.18, 2.88)**	1.17 (0.86, 1.59)	0.95 (0.67, 1.35)	0.93 (0.68, 1.27)	1.18 (0.80, 1.73)				
Class 7 NR partners, no reported sex	1.71 (0.91, 3.23)	1.08 (0.73, 1.60)	0.88 (0.58, 1.33)	0.86 (0.57, 1.28)	1.09 (0.69, 1.72)	0.93 (0.61, 1.40)			
Class 8 NR partners, use BC	1.50 (0.89, 2.53)	0.95 (0.64, 1.42)	0.77 (0.50, 1.20)	0.75 (0.49, 1.15)	0.96 (0.60, 1.53)	0.81 (0.54, 1.23)	0.88 (0.53, 1.45)		
Class 9 NR partners, no BC	**2.60** **(1.44, 4.71)**	**1.65** **(1.03, 2.66)**	1.34 (0.81, 2.22)	1.31 (0.81, 2.12)	1.66 (0.96, 2.90)	1.41 (0.86, 2.30)	1.52 (0.88, 2.63)	1.73 (0.99, 3.04)	

Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
All associations for reporting both physical and sexual abuse comparing to the abstainer group resulted in extremely large odds ratios. They are left out of this table.
All statistically significant associations are bolded.

Table 4.7b. Associations of reporting sexual abuse only compared to no maltreatment with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	1.14 (0.40, 3.26)								
Class 3 Rom. Partner, no BC	0.97 (0.21, 4.56)	0.85 (0.18, 3.91)							
Class 4 Rom & NR partners, BC	0.60 (0.10, 3.63)	0.53 (0.09, 3.02)	0.62 (0.08, 4.99)						
Class 5 Rom & NR partners, no BC	1.12 (0.27, 4.55)	0.98 (0.26, 3.74)	1.15 (0.19, 6.83)	1.86 (0.26, 13.29)					
Class 6 No partners, reported sex	2.05 (0.54, 7.75)	1.79 (0.57, 5.63)	2.11 (0.33, 13.52)	3.40 (0.55, 20.84)	1.83 (0.43, 7.88)				
Class 7 NR partners, no reported sex	**0.06 (0.00, 0.76)**	**0.05 (0.01, 0.49)**	**0.06 (0.00, 0.70)**	0.09 (0.01, 1.36)	**0.05 (0.00, 0.59)**	**0.03 (0.00, 0.28)**			
Class 8 NR partners, use BC	1.12 (0.12, 10.52)	0.98 (0.11, 8.83)	1.15 (0.09, 14.11)	1.86 (0.09, 38.40)	1.00 (0.09, 10.76)	0.55 (0.06, 4.70)	**19.65 (1.02, 379.02)**		
Class 9 NR partners, no BC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
All associations for reporting both physical and sexual abuse comparing to the abstainer group resulted in extremely large odds ratios. They are left out of this table.
All statistically significant associations are bolded.

Table 4.7c. Associations of reporting both physical and sexual abuse compared to no maltreatment with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	---								
Class 3 Rom. Partner, no BC	---	3.44 (1.16, 10.22)							
Class 4 Rom & NR partners, BC	---	1.00 (0.25, 3.99)	0.29 (0.08, 1.06)						
Class 5 Rom & NR partners, no BC	---	1.77 (0.34, 9.27)	0.52 (0.08, 3.34)	1.77 (0.27, 11.48)					
Class 6 No partners, reported sex	---	0.64 (0.13, 3.20)	0.19 (0.04, 0.88)	0.64 (0.11, 3.69)	0.36 (0.05, 2.69)				
Class 7 NR partners, no reported sex	---	1.34 (0.42, 4.23)	0.39 (0.14, 1.11)	1.34 (0.33, 5.37)	0.75 (0.14, 3.94)	2.07 (0.45, 9.61)			
Class 8 NR partners, use BC	---	1.28 (0.17, 9.47)	0.37 (0.05, 2.54)	1.28 (0.16, 10.49)	0.72 (0.09, 5.56)	1.99 (0.22, 17.94)	0.96 (0.15, 5.98)		
Class 9 NR partners, no BC	---	5.29 (1.42, 19.75)	1.54 (0.41, 5.73)	5.29 (1.19, 23.61)	2.99 (0.59, 15.15)	8.21 (1.50, 44.98)	3.96 (1.15, 13.68)	4.13 (0.62, 27.56)	

Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
All associations for reporting both physical and sexual abuse comparing to the abstainer group resulted in extremely large odds ratios. They are left out of this table.
All statistically significant associations are bolded.

Table 4.7d. Associations of reporting physical abuse only compared to sexual abuse only with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	1.11 (0.88, 1.39)								
Class 3 Rom. Partner, no BC	**1.34** **(1.02, 1.77)**	1.21 (0.88, 1.66)							
Class 4 Rom & NR partners, BC	1.27 (0.97, 1.67)	1.15 (0.81, 1.63)	0.95 (0.65, 1.39)						
Class 5 Rom & NR partners, no BC	0.99 (0.69, 1.42)	0.89 (0.59, 1.37)	0.74 (0.47, 1.17)	1.21 (0.74, 1.96)					
Class 6 No partners, reported sex	1.22 (0.94, 1.59)	1.10 (0.80, 1.52)	0.91 (0.64, 1.30)	0.96 (0.68, 1.36)	1.23 (0.81, 1.88)				
Class 7 NR partners, no reported sex	**0.74** **(0.59, 0.93)**	**0.67** **(0.50, 0.89)**	**0.55** **(0.40, 0.76)**	**0.58** **(0.42, 0.80)**	0.74 (0.50, 1.10)	**0.60** **(0.44, 0.82)**			
Class 8 NR partners, use BC	0.90 (0.61, 1.32)	0.81 (0.53, 1.25)	0.67 (0.42, 1.06)	0.71 (0.45, 1.10)	0.91 (0.55, 1.48)	0.73 (0.47, 1.15)	**2.08** **(1.31, 3.30)**		
Class 9 NR partners, no BC	1.53 (0.98, 2.39)	1.38 (0.85, 2.25)	1.14 (0.69, 1.90)	1.21 (0.74, 1.96)	1.54 (0.89, 2.69)	1.25 (0.76, 2.06)	1.22 (0.81, 1.83)	1.71 (0.97, 3.00)	

Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
All statistically significant associations are bolded.

Table 4.7e. Associations of reporting sexual abuse only compared to both physical and sexual abuse with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	1.37 (0.64, 2.93)								
Class 3 Rom. Partner, no BC	**0.27** **(0.11, 0.65)**	**0.20** **(0.07, 0.59)**							
Class 4 Rom & NR partners, BC	1.07 (0.42, 2.70)	0.78 (0.26, 2.37)	**3.92** **(1.16, 13.23)**						
Class 5 Rom & NR partners, no BC	1.56 (0.44, 5.49)	1.14 (0.28, 4.57)	**5.72** **(1.12, 29.16)**	1.46 (0.33, 6.42)					
Class 6 No partners, reported sex	**3.21** **(1.05, 9.83)**	2.33 (0.67, 8.15)	**11.75** **(2.44, 56.48)**	3.00 (0.81, 11.07)	2.05 (0.45, 9.46)				
Class 7 NR partners, no reported sex	1.39 (0.73, 2.66)	1.01 (0.41, 2.50)	**5.09** **(1.83, 14.16)**	1.30 (0.49, 3.46)	0.89 (0.23, 3.37)	0.43 (0.14, 1.39)			
Class 8 NR partners, use BC	0.50 (0.11, 2.16)	0.36 (0.07, 1.84)	1.82 (0.36, 9.09)	0.46 (0.08, 2.66)	0.32 (0.05, 2.14)	**0.15** **(0.03, 0.94)**	0.36 (0.08, 1.65)		
Class 9 NR partners, no BC	1.56 (0.44, 5.49)	**0.14** **(0.04, 0.48)**	0.72 (0.21, 2.47)	**0.18** **(0.05, 0.68)**	**0.13** **(0.03, 0.62)**	**0.06** **(0.01, 0.27)**	**0.14** **(0.05, 0.40)**	0.40 (0.07, 2.12)	

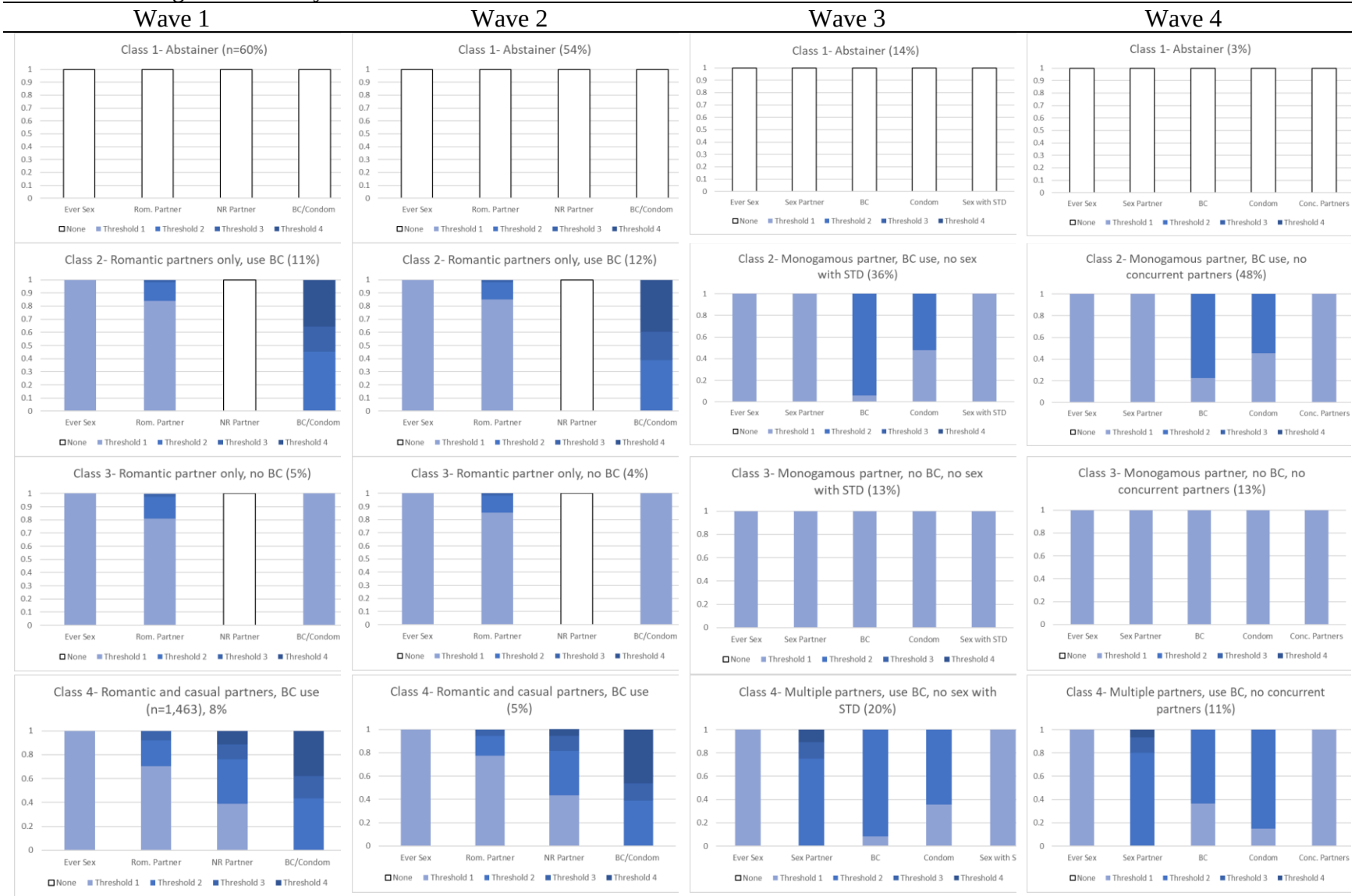
Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
All statistically significant associations are bolded.

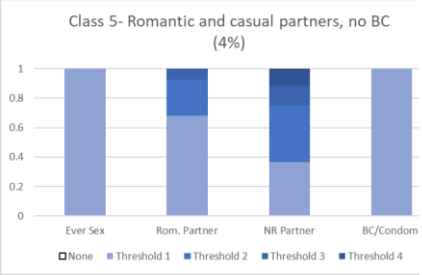
Table 4.7f. Associations of reporting physical abuse only compared to both physical and sexual abuse with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health

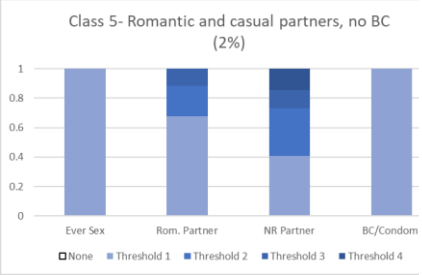
	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	1.14 (0.92, 1.41)								
Class 3 Rom. Partner, no BC	1.19 (0.87, 1.62)	1.04 (0.73, 1.48)							
Class 4 Rom & NR partners, BC	1.25 (0.97, 1.62)	1.10 (0.80, 1.51)	1.06 (0.72, 1.54)						
Class 5 Rom & NR partners, no BC	0.95 (0.66, 1.37)	0.84 (0.56, 1.25)	0.80 (0.49, 1.31)	0.76 (0.50, 1.15)					
Class 6 No partners, reported sex	**1.34 (1.03, 1.74)**	1.18 (0.87, 1.61)	1.13 (0.78, 1.65)	1.07 (0.77, 1.49)	1.41 (0.91, 2.18)				
Class 7 NR partners, no reported sex	0.78 (0.62, 0.97)	**0.68 (0.52, 0.90)**	**0.65 (0.46, 0.93)**	**0.62 (0.45, 0.84)**	0.81 (0.54, 1.22)	**0.58 (0.43, 0.77)**			
Class 8 NR partners, use BC	0.88 (0.59, 1.30)	0.77 (0.50, 1.18)	0.74 (0.46, 1.20)	0.70 (0.44, 1.10)	0.92 (0.55, 1.54)	0.65 (0.41, 1.03)	1.13 (0.74, 1.73)		
Class 9 NR partners, no BC	1.29 (0.70, 2.38)	1.13 (0.60, 2.13)	1.09 (0.55, 2.17)	1.03 (0.54, 1.97)	1.36 (0.68, 2.69)	0.96 (0.48, 1.91)	1.67 (0.89, 3.12)	1.47 (0.73, 2.98)	

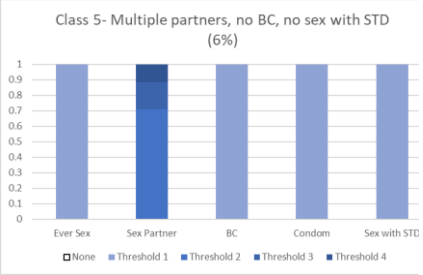
Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
All associations for reporting both physical and sexual abuse comparing to the abstainer group resulted in extremely large odds ratios. They are left out of this table.
All statistically significant associations are bolded.

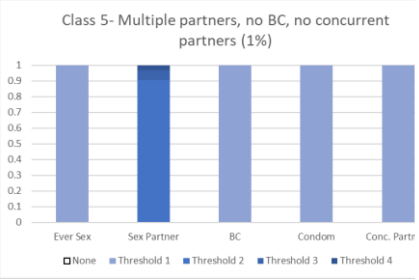
Figure 4.4. Unconditional model results for probabilities of item endorsement within classes of substance use among participants in the National Longitudinal Study of Adolescent to Adult Health

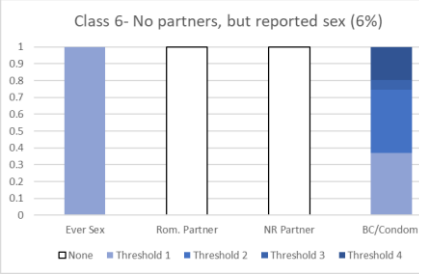


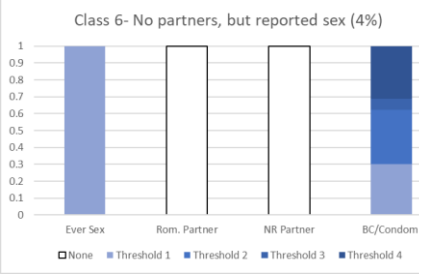

Class 5- Romantic and casual partners, no BC (4%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

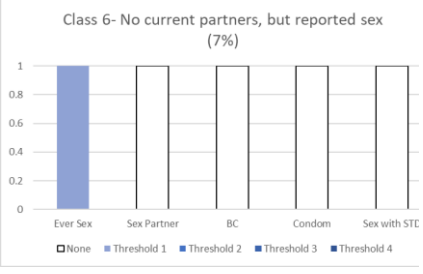

Class 5- Romantic and casual partners, no BC (2%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

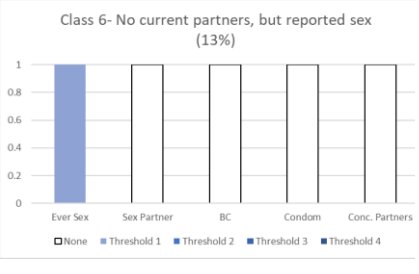

Class 5- Multiple partners, no BC, no sex with STD (6%)
Ever Sex
Sex Partner
BC
Condom
Sex with STD
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

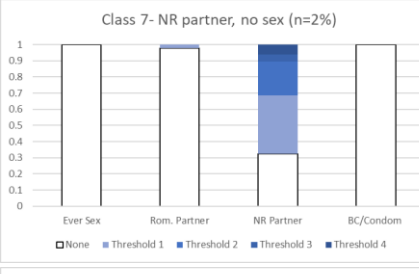

Class 5- Multiple partners, no BC, no concurrent partners (1%)
Ever Sex
Sex Partner
BC
Condom
Conc. Partr
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

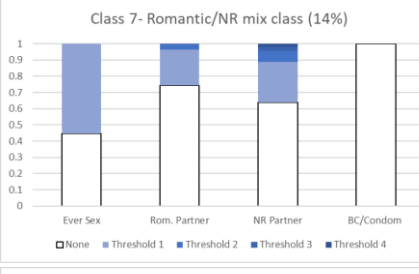

Class 6- No partners, but reported sex (6%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

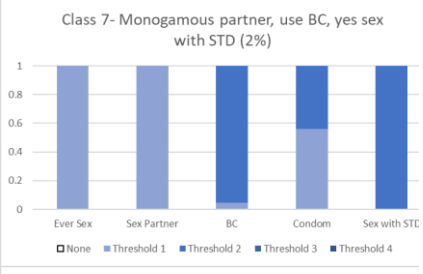

Class 6- No partners, but reported sex (4%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

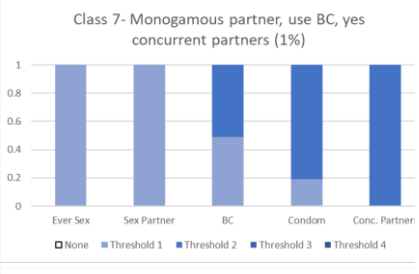

Class 6- No current partners, but reported sex (7%)
Ever Sex
Sex Partner
BC
Condom
Sex with STD
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

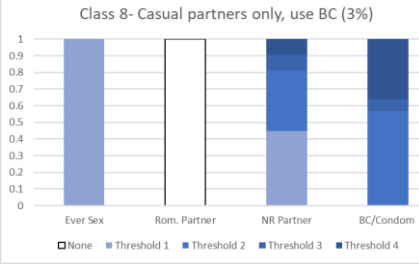

Class 6- No current partners, but reported sex (13%)
Ever Sex
Sex Partner
BC
Condom
Conc. Partners
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

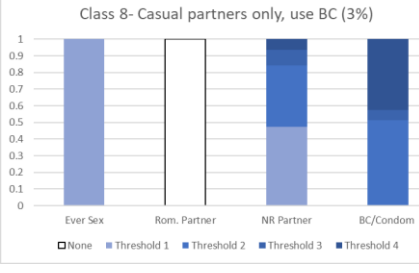

Class 7- NR partner, no sex (n=2%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

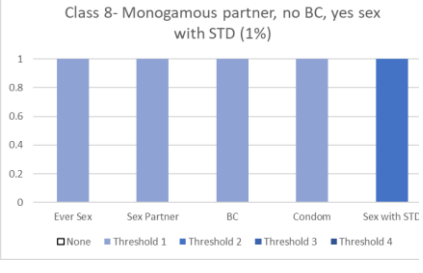

Class 7- Romantic/NR mix class (14%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

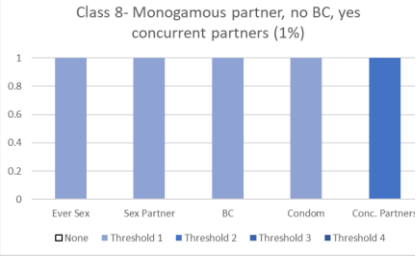

Class 7- Monogamous partner, use BC, yes sex with STD (2%)
Ever Sex
Sex Partner
BC
Condom
Sex with STD
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

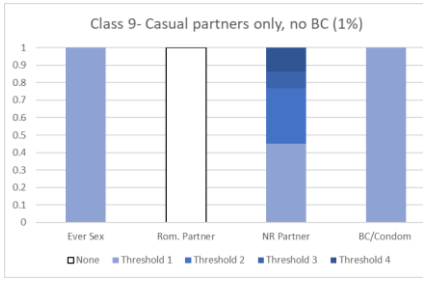

Class 7- Monogamous partner, use BC, yes concurrent partners (1%)
Ever Sex
Sex Partner
BC
Condom
Conc. Partners
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

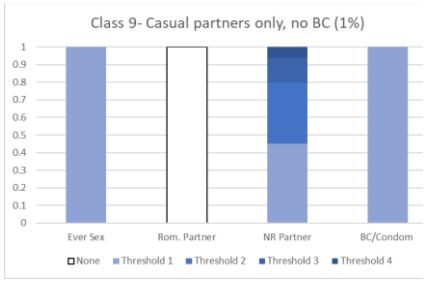

Class 8- Casual partners only, use BC (3%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

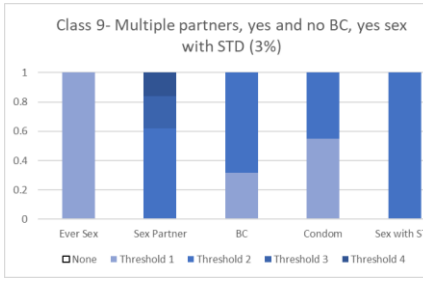

Class 8- Casual partners only, use BC (3%)
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

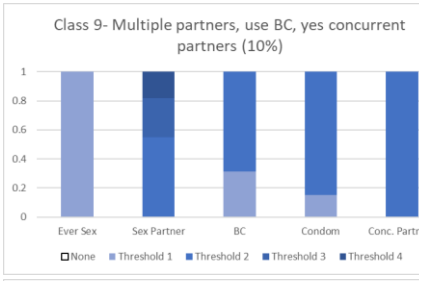

Class 8- Monogamous partner, no BC, yes sex with STD (1%)
Ever Sex
Sex Partner
BC
Condom
Sex with STD
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4


Class 8- Monogamous partner, no BC, yes concurrent partners (1%)
Ever Sex
Sex Partner
BC
Condom
Conc. Partners
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4


Class 9- Casual partners only, no BC (1%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4


Class 9- Casual partners only, no BC (1%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Ever Sex
Rom. Partner
NR Partner
BC/Condom
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4


Class 9- Multiple partners, yes and no BC, yes sex with STD (3%)
1
0.8
0.6
0.4
0.2
0
Ever Sex
Sex Partner
BC
Condom
Sex with S
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4


Class 9- Multiple partners, use BC, yes concurrent partners (10%)
1
0.8
0.6
0.4
0.2
0
Ever Sex
Sex Partner
BC
Condom
Conc. Partr
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

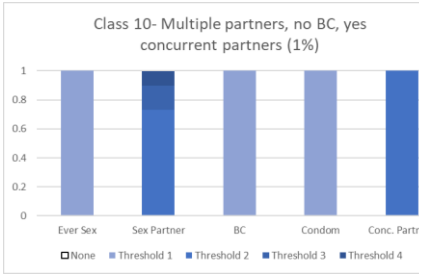

Class 10- Multiple partners, no BC, yes concurrent partners (1%)
1
0.8
0.6
0.4
0.2
0
Ever Sex
Sex Partner
BC
Condom
Conc. Partr
None
Threshold 1
Threshold 2
Threshold 3
Threshold 4

Table 4.8. Transition probabilities between sexual behavior classes among all participants (unconditional model) in the National Longitudinal Study of Adolescent to Adult Health

	Wave 2								
Wave 1	Abstainer (54%)	Rom. Partner only, use BC (12%)	Rom. Partner only, no BC (4%)	Rom & NR partners, use BC (5%)	Rom & NR partners, no BC (2%)	No partners, Reported sex (4%)	Rom/NR mix (14%)	Nr partners only, use bc (3%)	Nr partners only, no BC (1%)
Abstainer (60%)	0.907	0.029	0.006	0.004	0.000	x0.013	0.032	0.006	0.003
Rom. Partner only, use BC (11%)	0.003	0.335	0.067	0.104	0.035	0.096	0.319	0.036	0.006
Rom. Partner only, no bc (5%)	0.000	0.237	0.144	0.076	0.055	0.039	0.338	0.068	0.041
Rom & NR partners, use BC (8%)	0.001	0.260	0.076	0.223	0.072	0.088	0.209	0.052	0.019
Rom & NR partners, no BC (4%)	0.000	0.164	0.126	0.160	0.129	0.091	0.214	0.062	0.054
No partners, reported sex (6%)	0.016	0.187	0.066	0.086	0.030	0.120	0.374	0.081	0.040
Free (NR partners, no sex) (2%)	0.194	0.172	0.073	0.058	0.023	0.064	0.369	0.034	0.014
NR partners only, use BC (3%)	0.001	0.169	0.096	0.167	0.058	0.104	0.299	0.088	0.018
NR partners only, no BC (1%)	0.000	0.047	0.037	0.080	0.126	0.096	0.454	0.081	0.079

	Wave 3								
Wave 2	Abstainer (14%)	Mon. partner, use BC (36%)	Mon. partner, no BC (13%)	Mult. Partners, use BC (20%)	Mul. Partners, no BC (6%)	No partners, reported sex (7%)	Mon. partner, yes BC, sex with STD (2%)	Mon. partner, no BC, sex with STD (1%)	Mult. Partners, sex with STD (1%)
Abstainer (54%)	0.246	0.358	0.091	0.142	0.041	0.091	0.013	0.004	0.013
Rom. Partner only, use BC (12%)	0.000	0.411	0.119	0.249	0.092	0.064	0.014	0.014	0.036
Rom. Partner only, no BC (4%)	0.000	0.357	0.179	0.227	0.100	0.056	0.023	0.016	0.040
Rom & NR partners, use BC (5%)	0.000	0.373	0.138	0.275	0.054	0.055	0.031	0.015	0.060
Rom & NR partners, no BC (2%)	0.000	0.256	0.210	0.157	0.171	0.057	0.034	0.025	0.089
No partners, reported sex (4%)	0.001	0.334	0.196	0.242	0.078	0.069	0.018	0.010	0.053
Rom/NR mix (14%)	0.002	0.388	0.133	0.254	0.063	0.083	0.032	0.009	0.036
NR partners only, use BC (3%)	0.000	0.367	0.165	0.257	0.079	0.053	0.026	0.020	0.033
NR partners only, no BC (1%)	0.000	0.327	0.186	0.227	0.124	0.048	0.010	0.012	0.066

	Wave 4									
Wave 3	Abstainer (3%)	Mon. partner, use BC (48%)	Mon. partner, no BC (13%)	Mult. Partners, use BC (11%)	Mult. Partners, no BC (1%)	No partners, reported sex (13%)	Mon. Partner, use BC, conc. Partners (1%)	Mon. partner, no BC, conc. Partners (1%)	Mult. Partners, use BC, conc. Partners (11%)	Mult. Partners, no BC, conc. Partners (1%)
Abstainer (14%)	0.228	0.330	0.083	0.131	0.038	0.086	0.013	0.004	0.075	0.012
Mon. partner, use BC (36%)	0.009	0.450	0.114	0.162	0.018	0.077	0.027	0.003	0.126	0.014
Mon. partner, no BC (13%)	0.004	0.398	0.156	0.124	0.029	0.077	0.035	0.014	0.117	0.046
Mult. Partners, use BC (20%)	0.002	0.360	0.078	0.212	0.033	0.028	0.030	0.005	0.224	0.026
Multiple partners, no BC (6%)	0.001	0.295	0.155	0.187	0.038	0.019	0.027	0.025	0.188	0.064
No partners, reported sex (7%)	0.007	0.443	0.100	0.167	0.005	0.133	0.016	0.008	0.108	0.013
Mon. partner, use BC, sex with STD (2%)	0.000	0.400	0.134	0.135	0.078	0.073	0.000	0.000	0.181	0.000
Mon. partner, no BC, sex with STD (1%)	0.000	0.180	0.181	0.244	0.054	0.052	0.056	0.037	0.154	0.041
Mult. Partners, sex with STD (1%)	0.000	0.397	0.071	0.228	0.023	0.052	0.000	0.000	0.211	0.018

Note. Rom=Romantic; NR=Non-relationship; BC= Birth control; Mon.=Monogamous, Conc.=Concurrent; Mult.=Multiple; sex with STD= sex with partner with known STD.

Table 4.9. Unconditional model chains (50% of total chains) among adolescent abstainer classes from latent transition analysis of sexual behaviors among participants in the National Longitudinal Study of Adolescent to Adult Health

Wave 1	Wave 2	Wave 3	Wave 4	Freq	Proportion
		Monogamous partner, use BC	Monogamous partner, use BC	911	0.09856
		Abstainer	Monogamous partner, use BC	449	0.04858
		Multiple partners, use BC	Monogamous partner, use BC	404	0.04376
		Monogamous partner, no BC	Monogamous partner, use BC	225	0.02434
		No current partners	Monogamous partner, use BC	218	0.02357
		Monogamous partner, use BC	No current partners	198	0.02148
		Monogamous partner, use BC	Monogamous partner, no BC	190	0.02056
		Abstainer	Abstainer	189	0.02043
		Abstainer	No current partners	181	0.01957
		Monogamous partner, use BC	Multiple partners, use BC	163	0.01763
		Multiple partners, use BC	Multiple partners, use BC, conc. Partners	141	0.01526
		Monogamous partner, use BC	Multiple partners, use BC, conc. Partners	132	0.01429
		Abstainer	Multiple partners, use BC	130	0.01406
		Multiple partners, use BC	Multiple partners, use BC	118	0.01274
		Multiple partners, no BC	Monogamous partner, use BC	103	0.01111
		Abstainer	Monogamous partner, no BC	101	0.01092
		Monogamous partner, no BC	Monogamous partner, no BC	75	0.00814
		No current partners	No current partners	74	0.00798
Abstainer		Abstainer	Multiple partners, use BC, concurrent partners	63	0.00678
		Multiple partners, use BC	Monogamous partner, no BC	62	0.00669
		Monogamous partner, no BC	No current partners	55	0.00596
		Multiple partners, use BC	No current partners	44	0.00481
		Multiple partners, no BC	Monogamous partner, no BC	44	0.00479
		No current partners	Multiple partners, use BC	41	0.00441
		Monogamous partner, use BC, sex w/STD	Monogamous partner, use BC	38	0.0041
		Multiple partners, sex w/ STD	Monogamous partner, use BC	36	0.00395
		Multiple partners, no BC	Multiple partners, use BC, concurrent partners	34	0.0037
		Monogamous partner, no BC	Multiple partners, use BC	34	0.00368

	No current partners	Monogamous partner, no BC	34	0.00365
	Multiple partners, no BC	Multiple partners, use BC	32	0.00348
	Monogamous partner, no BC	Multiple partners, use BC, concurrent partners	24	0.00261
	No current partners	Multiple partners, use BC, concurrent partners	23	0.00249
	Abstainer	Multiple partners, no BC	13	0.00138
	Monogamous partner, use BC	Monogamous partner, use BC, concurrent partners	13	0.00138
	Multiple partners, sex w/ STD	Multiple partners, use BC, concurrent partners	11	0.00121
	Multiple partners, no BC	No current partners	11	0.00121
	Monogamous partner, use BC	Abstainer	11	0.00117
	Multiple partners, use BC	Monogamous partner, use BC, concurrent partners	10	0.00111

Table 4.10. Transition probabilities between sexual behavior classes in the conditional model among participants in the National Longitudinal Study of Adolescent to Adult Health

	Conditional model *Wave 2*								
Wave 1	Abstainer (54%)	Rom. Partner only, use BC (12%)	Rom. Partner only, no BC (4%)	Rom & NR partners, use BC (5%)	Rom & NR partners, no BC (2%)	No partners, Reported sex (4%)	Rom/NR mix (14%)	Nr partners only, use bc (3%)	Nr partners only, no BC (1%)
Abstainer (60%)	0.825	0.047	0.015	0.010	0.002	0.020	0.071	0.006	0.005
Rom. Partner only, use BC (11%)	0.005	0.338	0.065	0.110	0.034	0.099	0.302	0.042	0.007
Rom. Partner only, no bc (5%)	0.001	0.223	0.139	0.099	0.047	0.048	0.327	0.072	0.044
Rom & NR partners, use BC (8%)	0.001	0.264	0.063	0.219	0.077	0.082	0.220	0.053	0.020
Rom & NR partners, no BC (4%)	0.001	0.173	0.132	0.152	0.119	0.096	0.220	0.067	0.041
No partners, reported sex (6%)	0.015	0.213	0.076	0.088	0.029	0.102	0.359	0.085	0.034
Free (NR partners, no sex) (2%)	0.045	0.184	0.070	0.061	0.058	0.091	0.390	0.081	0.019
NR partners only, use BC (3%)	0.002	0.182	0.106	0.149	0.070	0.096	0.273	0.105	0.019
NR partners only, no BC (1%)	0.001	0.065	0.047	0.066	0.142	0.107	0.396	0.087	0.089

	Wave 3								
Wave 2	Abstainer (14%)	Mon. partner, use BC (36%)	Mon. partner, no BC (13%)	Mult. Partners, use BC (20%)	Mul. Partners, no BC (6%)	No partners, reported sex (7%)	Mon. partner, yes BC, sex with STD (2%)	Mon. partner, no BC, sex with STD (1%)	Mult. Partners, sex with STD (1%)
Abstainer (54%)	0.246	0.357	0.090	0.142	0.041	0.093	0.014	0.004	0.013
Rom. Partner only, use BC (12%)	0.002	0.422	0.121	0.240	0.086	0.059	0.015	0.014	0.042
Rom. Partner only, no BC (4%)	0.001	0.350	0.196	0.246	0.084	0.048	0.017	0.017	0.041
Rom & NR partners, use BC (5%)	0.001	0.380	0.145	0.284	0.048	0.047	0.027	0.009	0.058
Rom & NR partners, no BC (2%)	0.002	0.281	0.198	0.158	0.189	0.064	0.030	0.016	0.064
No partners, reported sex (4%)	0.003	0.342	0.178	0.238	0.080	0.062	0.023	0.009	0.065
Rom/NR mix (14%)	0.014	0.376	0.131	0.244	0.069	0.087	0.030	0.010	0.038
NR partners only, use BC (3%)	0.002	0.327	0.179	0.265	0.098	0.067	0.032	0.014	0.016
NR partners only, no BC (1%)	0.001	0.361	0.173	0.256	0.096	0.028	0.014	0.017	0.055

	Wave 4									
Wave 3	Abstainer (3%)	Mon. partner, use BC (48%)	Mon. partner, no BC (13%)	Mult. Partners, use BC (11%)	Mult. Partners, no BC (1%)	No partners, reported sex (13%)	Mon. Partner, use BC, conc. Partners (1%)	Mon. partner, no BC, conc. Partners (1%)	Mult. Partners, use BC, conc. Partners (11%)	Mult. Partners, no BC, conc. Partners (1%)
Abstainer (14%)	0.244	0.083	0.156	0.146	0.028	0.250	0.006	0.000	0.080	0.007
Mon. partner, use BC (36%)	0.017	0.123	0.234	0.196	0.015	0.245	0.014	0.000	0.147	0.009
Mon. partner, no BC (13%)	0.009	0.104	0.308	0.143	0.023	0.236	0.017	0.001	0.131	0.028
Mult. Partners, use BC (20%)	0.006	0.105	0.172	0.276	0.029	0.096	0.017	0.000	0.281	0.018
Multiple partners, no BC (6%)	0.004	0.081	0.320	0.227	0.031	0.062	0.014	0.002	0.220	0.041
No partners, reported sex (7%)	0.010	0.109	0.186	0.182	0.003	0.382	0.007	0.000	0.113	0.008
Mon. partner, use BC, sex with STD (2%)	0.000	0.104	0.262	0.154	0.060	0.220	0.000	0.000	0.200	0.000
Mon. partner, no BC, sex with STD (1%)	0.000	0.042	0.320	0.254	0.038	0.143	0.024	0.002	0.154	0.023
Mult. Partners, sex with STD (1%)	0.000	0.111	0.150	0.284	0.019	0.170	0.000	0.000	0.254	0.012

Note. Rom=Romantic; NR=Non-relationship; BC= Birth control; Mon.=Monogamous, Conc.=Concurrent; Mult.=Multiple; sex with STD= sex with partner with known STD.

References

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Appendix 4.1
Recoding Variables
(original variables→ constructed variables)
Constructed variables include deletion of cases without weights, region, or PSU information. Original variables include all variables, regardless of missing weights, region, or PSU information.

Ever had sex

Wave 1

Ever had sex: Have you ever had sexual intercourse?

No (n=12,226, 59%)	No (n=11,128, 62%)
Yes (n=8,274, 40%)	Yes (n=7,305, 38%)
Refused (n=159, 0.8%)	Missing
Don't know (n=82, 0.4%)	
Not applicable (n=5, 0.02%)	

Wave 2

Ever had sex: Have you ever had sexual intercourse?

No (n=11,128, 62%)	No (n=8,107, 55%)
Yes (n=7,305, 38%)	Yes (n=6,541, 44%)
Refused (n=61, 0.4%)	Missing (n=90)
Don't know (n=26, 0.2%)	

Wave 3

Ever had sex: Have you ever had sexual intercourse?

No (n=1,952, 13%)	No (n=1,128, 13%)
Yes (n=13,094, 86%)	Yes (n=7,305, 86%)
Refused (n=85, 0.6%)	Missing (n=95)
Don't know (n=20, 0.1%)	
Not applicable (n=46, 0.3%)	

Wave 4

Ever had sex: In Wave 4, questions about ever having sex also expanded to oral sex and anal sex. Therefore, if participants answered "Yes" to at least one of the following questions, they were classified as ever having sex.

Have you ever had vaginal intercourse?

No (n=888, 6%)	No (n=390, 3%)
Yes (n=14,732, 94%)	Yes (n=14,043, 97%)
Refused (n=65, 0.4%)	Missing (n=76)

Don’t know (n=16, 0.1%)	

Have you ever had oral sex?

No (n=1,098, 7%)	No (n=390, 3%)
Yes (n=14,378, 92%)	Yes (n=14,043, 97%)
Refused (n=194, 1%)	Missing (n=76)
Don’t know (n=31, 0.2%)	

Have you ever had anal intercourse?

No (n=8,844, 56%)	No (n=390, 3%)
Yes (n=6,659, 42%)	Yes (n=14,043, 97%)
Refused (n=172, 1%)	Missing (n=76)
Don’t know (n=26, 0.2%)	

<u>Romantic relationship sexual partners</u>

Wave 1

Sexual romantic relationship partners: Participants were asked to name/list up to three romantic partners they have had. Then, participants were asked about activities they participated in with their romantic partner. Sexual romantic relationship partners were totaled based on the three measures that asked about sexual intercourse:

(Partner 1) We had sexual intercourse

Card rejected (n=7,304, 35%)	No sexual romantic partner (n=12,804, 75%)
No partners (n=7,335, 35%%)	
Card kept (n=5,386, 26.0%) and no other partners	One partner (n=3,550, 20%)
Refused (n=260, 1.3%)	Missing (n=1,157)
Don’t know (n=160, 0.8%)	
Not applicable (n=8, 0.1%)	
Missing (n=293, 1.4%)	

(Partner 2) We had sexual intercourse

Card rejected (n=2,373, 11.4%)	No sexual romantic partner (n=12,804, 75%)/ 1 sexual romantic partner (n=3,550, 20%)
Card kept (n=1,516, 7.3%) and no other partners	Two partners (n=797, 5%)
Refused (n=148, 0.7%)	Missing
Don’t know (n=80, 0.3%)	
Not applicable (n=2, 0.01%)	
Missing (n=98, 0.5%)	

(Partner 3) We had sexual intercourse (H1R121O3)

Card rejected (n=750, 3.6%)	No sexual romantic partner (n=12,804, 75%)/ 1 sexual romantic partner (n=3,550, 20%)
Card kept (n=399, 1.9%) and no other partners	Two partners (n=797, 5%)
Refused (n=81, 0.4%)	Missing
Don't know (n=36, 0.2%)	
Missing (n=35, 0.2%)	

Wave 2

Sexual romantic relationship partners: Participants were asked to name/list up to three romantic partners they have had. Then, participants were asked about activities they participated in with their romantic partner. Sexual romantic relationship partners were totaled based on the three measures that asked about sexual intercourse:

(Partner 1) We had sexual intercourse

Card rejected (n=4,318, 29%)	No sexual romantic partner (n=8,996, 72%)
No partners (n=5,204, 35.4%)	
Card kept (n=5,059, 34%) and no other partners	One partner (n=2,930, 23%)
Refused to order card (n=17, 1.2%)	Missing (n=495)
Did not know order (n=16, 1.1%)	
Refused (n=81, 0.5%)	
Don't know (n=43, 0.2%)	

(Partner 2) We had sexual intercourse (H2RI33M2)

Card rejected (n=1,643, 11%)	No other sexual romantic partners (n=8,996, 72%)/ 1 sexual romantic partner (n=2,930, 23%)
Card kept (n=897, 6.1%)	Two partners (n=472, 4%)
Refused to order card (n=3, 0.01%)	Missing (n=495)
Did not know order (n=1, 0.01%)	
Refused (n=47, 0.3%)	
Don't know (n=18, 0.1%)	

(Partner 3) We had sexual intercourse

Card rejected (n=593, 4.0%)	No other sexual romantic partners (n=8,996, 72%)/ 1 sexual romantic partner (n=2,930, 23%)/ 2 sexual romantic partners (n=472, 4%)
Card kept (n=252, 1.7%)	Three partners (n=129, 1%)
Refused to order card (n=1, 0.01%)	Missing (n=495)

Did not know order (n=1, 0.01%)	
Refused (n=25, 0.2%)	
Don't know (n=6, 0.1%)	

Non-relationship sexual partners

Wave 1

Non-relationship partners (ever): Not counting the people you have described as romantic relationships, have you ever had a sexual relationship with anyone?

No (n=15,059)	Skipped non-relationship partner questions
Yes (n=5,418)	Asked non-relationship partner questions

Non-Relationship Sexual Partners (frequency): Since January 1, 1994, with how many people, not including romantic relationship partners, have you had a sexual relationship with? (H1NR8) Continuous variable- Range 0-555

Skipped (n=15,328)	No non-relationship sexual partners (n=14,908, 82%)
1 partner (n=1,627, 7.8%)	1 partner (n=1,445, 8%)
2-3 partners (n=1,406, 6.8%)	2-3 partners (n=1,238, 7%)
4-5 partners (n=454, 2.2%)	4-5 partners (n=394, 2%)
>6 partners (n=475, 2.3%)	>6 partners (n=372, 2%)
Refused (n=93, 0.4%)	Missing (n=1,456)
Don't know (n=111, 0.5%)	
Not applicable (n=2, 0.01%)	

Wave 2

Non-relationship partners (ever); Not counting the people you may have described as romantic relationships, since month of last interview, have you had a sexual relationship with anyone?

No (n=12,016)	Skipped non-relationship partner questions
Yes (n=2,600)	Asked non-relationship partner questions

Non-Relationship Sexual Partners (frequency): Since month of last interview, with how many people, not including romantic relationship partners, have you had a sexual relationship with? (H2NR9) Continuous variable- Range 1-444

Skipped (n=11,766)	No non-relationship sexual partners (n=10,447, 82%)
1 partner (n=1,332, 9%)	1 partner (n=1,182, 9%)
2-3 partners (n=846, 6%)	2-3 partners (n=741, 6%)
4-5 partners (n=285, 2%)	4-5 partners (n=245, 2%)
>6 partners (n=221, 2%)	>6 partners (n=167, 1%)
Refused (n=138, 0.9%)	Missing (n=288)
Don't know (n=150, 1%)	

Birth control last time sex

Wave 1

Birth control last time sex: Participants were asked up to three methods of birth control they used the last time they had sex. They were only asked this question if they answered, "Yes" to Question 6 (H1CO6): "Did you or your partner use any method of birth control when you had sexual intercourse most recently?" Participants could list up to 3 types of birth control.

Condoms only (constructed variable: n=2,302, 12%):
1st method: (n=4,347, 21.0%)
2nd method: (n=439, 2.1%)
3rd method: (n=100, 0.5%)
Participants were classified as "condoms only" if they answered "condoms" to the first birth control question, and no other birth control used. Additionally, if they reported condoms only multiple times and no other birth control, they were also classified as condoms only.
Hormonal/Other BC only (n=668, 4%):
Participants were classified as "hormonal BC/other BC only" if they answered "withdrawal, rhythm, birth control pills, vaginal sponge, foam/jelly/crème/suppositories, diaphragm, IUD, Norplant, ring, Depo Provera, contraceptive film, or some other method" only or a combination of these responses in the next two questions.

1st method: withdrawal (n=169), rhythm (n=16), birth control pills (n=551), vaginal sponge (n=2), foam/jelly/crème/suppositories (n=15), diaphragm (n=5), IUD (n=4), Norplant (n=31), ring (n=16), Depo Provera (n=140), contraceptive film (n=31), some other method (n=68)

2nd method: withdrawal (n=599), rhythm (n=86), birth control pills (n=791), vaginal sponge (n=30), foam/jelly/crème/suppositories (n=83), diaphragm (n=18), IUD (n=1), Norplant (n=22), ring (n=7), Depo Provera (n=67), contraceptive film (n=23), some other method (n=39)

3rd method: withdrawal (n=136), rhythm (n=106), birth control pills (n=178), vaginal sponge (n=34), foam/jelly/crème/suppositories (n=78), diaphragm (n=19), IUD (n=2), Norplant (n=13), ring (n=12), Depo Provera (n=29), contraceptive film (n=17), some other method (n=24)

Both hormonal/condom use (n=1,661, 9%):
Participants were classified as "Both hormonal/other BC and condoms" if they used a combination of the two categories.

Not sexually active (Previous question: Have you ever had sexual intercourse? H1CO1) (n=12,226, 59%)→ Not sexually active (n=11,223, 64%) (legitimate skip pattern→ participants who answered, "Don't Know/Refused" to "Have you ever had sexual

intercourse?" were asked subsequent questions about sexual intercourse most recently. Therefore, there is a slight discrepancy in the number who reported not being sexually active initially and not being sexually active most recently. Additionally, more youth reported not being sexually active currently rather than those who have never had sex.

Did not use birth control (Previous Question: Did you or your partner use any method of birth control when you had sexual intercourse most recently?") No (n=2,747, 13.2%)→ No birth control used (n=2,396, 12%)

Wave 2

Birth control last time sex: Participants were asked up to three methods of birth control they used the last time they had sex. They were only asked this question if they answered, "Yes" to Question 7 (H2CO7): "Did you or your partner use any method of birth control when you had sexual intercourse most recently?" Participants could list up to 3 types of birth control.

Condoms only (constructed variable: n=1,339, 10%):
1st method: (n=2,724, 18%)
2nd method: (n=279, 2%)
3rd method: (n=22, 0.1%)
Participants were classified as "condoms only" if they answered "condoms" to the first birth control question, and no other birth control used. Additionally, if they reported condoms only multiple times and no other birth control, they were also classified as condoms only.
Hormonal/Other BC only (n=482, 4%):
Participants were classified as "hormonal BC/other BC only" if they answered "withdrawal, rhythm, birth control pills, vaginal sponge, foam/jelly/crème/suppositories, diaphragm, IUD, Norplant, ring, Depo Provera, contraceptive film, or some other method" only or a combination of these responses in the next two questions.

1st method: withdrawal (n=118), rhythm (n=8), birth control pills (n=461), vaginal sponge (n=1), foam/jelly/crème/suppositories (n=11), diaphragm (n=0), IUD (n=3), Norplant (n=13), ring (n=14), Depo Provera (n=127), contraceptive film (n=37), some other method (n=35)

2nd method: withdrawal (n=582), rhythm (n=57), birth control pills (n=519), vaginal sponge (n=5), foam/jelly/crème/suppositories (n=51), diaphragm (n=8), IUD (n=2), Norplant (n=14), ring (n=5), Depo Provera (n=55), contraceptive film (n=13), some other method (n=48)

3rd method: withdrawal (n=135), rhythm (n=93), birth control pills (n=116), vaginal sponge (n=13), foam/jelly/crème/suppositories (n=28), diaphragm (n=10), IUD (n=1), Norplant (n=1), ring (n=3), Depo Provera (n=5), contraceptive film (n=5), some other method (n=30)

Both hormonal/condom use (n=1,360, 11%):

Participants were classified as "Both hormonal/other BC and condoms" if they used a combination of the two categories.

Not sexually active (Previous question: Have you ever had sexual intercourse? H2CO2) (n=8,107, 55%)→ Not sexually active (n=8,571, 66%) (legitimate skip pattern→ participants who answered, "Don't Know/Refused" to "Have you ever had sexual intercourse?" were asked subsequent questions about sexual intercourse most recently. Therefore, there is a slight discrepancy in the number who reported not being sexually active initially and not being sexually active most recently. Additionally, more youth reported not being sexually active currently rather than those who have never had sex.

Did not use birth control (Previous Question: Did you or your partner use any method of birth control when you had sexual intercourse most recently?") No (n=1,427, 10%)→ No birth control used (n=1,224, 9%)

Sexual partners

Wave 3

Ever had sex: Have you ever had sexual intercourse?

No (n=1,952, 13%)	Skipped rest of sex questions
Yes (n=13,094, 86%)	Asked rest of sex questions
Refused (n=85, 0.6%)	Missing
Don't know (n=20, 0.1%)	
Not applicable (n=46, 0.3%)	

Lifetime partners: With how many partners have you ever had vaginal intercourse, even if only once?

Skipped (n=2,103)	Skipped rest of sex questions
Partners range 1-50 (n=12,881)	Asked rest of sex questions
Refused (n=107)	Missing
Don't know (n=88)	
Not applicable (n=17)	

Sexual partners: With how many different partners have you had vaginal intercourse in the past 12 months?

Skipped (n=2,103, 14%)	0 partners (n=2,959, 22%)
0 partners (n=1,158, 8%)	
1 partner (n=7,573, 50%)	1 partner (n=6,921, 52%)
2-3 partners (n=3,032, 20%)	2-3 partners (n=2,625, 4%)
4-5 partners (n=685, 5%)	4-5 partners (n=563, 4%)
>6 partners (n=488, 3%)	>6 partners (n=363, 3%)
Refused (n=53, 0.3%)	Missing (n=158)
Don't know (n=26, 0.2%)	
Not applicable (n=11, 0.01%)	

Missing (n=68, 0.4%)	

Wave 4

Sexual partners: Two questions were used to determine the number of sexual partners in the past 12 months. Participants were asked about both male and female partners, and the total number of partners was added for the total number of sexual partners in the past 12 months.

Male partners (ever): Considering all types of sexual activity, with how many male partners have you ever had sex?

0 partners (n=6,953)	Skipped male partner questions
1-300 partners (n=8,292)	Asked rest of male partner questions
Refused (n=282)	Missing
Don't know (n=171)	

*Male partners (*Considering all types of sexual activity, with how many male partners have you had sex in the past 12 months, even if only one time?

Skipped (n=7,668)	0 male partners (n=7,742, 53%)
0 partners (n=634, 4%)	
1 partner (n=5,483, 35%)	1 male partner (n=5,146, 35%)
2 partners (n=893, 6%)	2 male partners (n=822, 6%)
3 partners (n=421, 3%)	3 male partners (n=380, 3%)
4 partners (n=157, 1%)	4 male partners (n=140, 1%)
5-75 partners (n=256, 1.6%)	5-75 partners (n=227, 2%)
Don't know (n=32, 0.2%)	Missing (n=208)
Missing (n=7, 0.1%)	
Refused (n=150, 1%)	

Female partners (ever): Considering all types of sexual activity, with how many female partners have you ever had sex?

0 partners (n=7,467)	Skipped female partner questions
1-354 partners (n=7,189)	Asked rest of female partner questions
Refused (n=215)	Missing
Don't know (n=285)	

Female partners (frequency): Considering all types of sexual activity, with how many female partners have had sex in the past 12 months?

Skipped (n=7,996)	0 female partners (n=8,576, 56%)
0 partners (n=1,040, 7%)	
1 partner (n=4,329, 28%)	1 female partner (n=4,047, 27%)
2 partners (n=857, 6%)	2 female partners (n=773, 0.5%)
3 partners (n=505, 3%)	3 female partners (n=437, 3%)
4 partners (n=261, 2%)	4 female partners (n=222, 1%)
5-56 partners (n=521, 3%)	5-56 female partners (n=402, 3%)

Refused (n=132, 0.8%)	Missing (n=209)
Don't know (n=58, 0.4%)	
Missing (n=2, 0.1%)	

Total number of sexual partners:
0 partners (n=1,924, 14%)
1 partner (n=8,890, 63%)
2-3 partners (n=2,399, 16%)
4-5 partners (n=637, 5%)
>6 partners (n=400, 3%)

Birth control last time sex (Waves 3 and 4)

Wave 3

Any birth control last time sex: The most recent time you had vaginal intercourse, did you or your partner use some form of birth control?

No (n=3,809, 25%)	No birth control used (n=3,340, 24%)
Yes (n=7,948, 52%)	Yes birth control used (n=7,111, 54%)
Legitimate skip (n=3,261, 21%)	Not sexually active (previously answered no sexual partners in past 12 months) (n=2,959, 22%)
Don't know (n=56, 4%)	Missing (n=46)
Refused (n=36, 0.2%)	
Not applicable (n=13, 0.1%)	
Missing (n=68, 0.4%)	

Condom use last time sex: The most recent time you had vaginal intercourse did you/your partner use a condom?

No (n=6,760, 44%)	No condom use (n=6,080, 46%)
Yes (n=5,036, 33%)	Yes condom use (n=4,406, 33%)
Legitimate skip (n=3,261, 21%)	Not sexually active (previously answered no sexual partners in past 12 months) (n=2,959, 22%)
Don't know (n=17, 0.1%)	Missing (n=111)
Not applicable (n=15, 0.1%)	
Missing (n=68, 0.4%)	

Wave 4

Birth control (hormonal/other forms) last time sex: In the past 12 months, did you or your partner use any of these methods for birth control or disease prevention? Select all that apply (H4SE26)

Birth control pills (n=4,876, 31%)→ Yes birth control (n=7,426, 51%)
Shot (Depo-Provera) (n=611, 4%)→ Yes birth control
Emergency contraception or "morning after" pill (n=333, 2%)→ Yes birth control
Norplant (n=35, 0.2%)→ Yes birth control
Diaphragm, cap or shield (n=63, 0.4%)→ Yes birth control
IUD (intrauterine device), coil, loop (n=602, 4%)→ Yes birth control
Natural family planning (safe periods by temperature, cervical mucus test) (n=188, 1%)→ Yes birth control
Withdrawal (n=2,742, 18%)→ Yes birth control
Rhythm or safe period by calendar (n=350, 2%)→ Yes birth control
Vaginal sponge (n=29, 0.1%)→ Yes birth control
Spermicide foam, jelly, crème, suppositories (n=280, 2%)→ Yes birth control
Ring (NuvaRing) (n=504, 3%)→ Yes birth control
Patch (Ortho Evra) (n=223, 1%)→ Yes birth control
Contraceptive film (n=70, 0.5%)→ Yes birth control
Emergency IUD Insertion (n=14, 0.1%)→ Yes birth control
Vasectomy (n=257, 2%)→ Yes birth control
Tubal ligation/sterilization (n=456, 3%)→ Yes birth control
Some other method (n=74, 0.5%)→ Yes birth control
Anti-retroviral or HIV/AIDS drugs (n=7, 0.1%)→ Yes birth control
Refused (n=18, 0.1%)→ Missing
Don't know (n=25, 0.1%)→ Missing
Missing (n=24, 0.1%)→ Missing

Condom use last time sex: In the past 12 months, did you or your partner use any of these methods for birth control or disease prevention? Select all that apply (H4SE26)

Condoms (n=7,262, 46%)→ Yes condom use (n=6,663, 45%)
Female condoms (n=164, 1%)→ Yes condom use (n=6,663, 45%)
Refused (n=18, 0.1%)→ Missing
Don't know (n=25, 0.1%)→ Missing
Missing (n=24, 0.1%)→ Missing

Sex with partner with STD

Wave 3

Ever had sex: Have you ever had sexual intercourse?

No (n=1,952, 13%)	Skipped rest of sex questions
Yes (n=13,094, 86%)	Asked rest of sex questions
Refused (n=85, 0.6%)	Missing
Don't know (n=20, 0.1%)	
Not applicable (n=46, 0.3%)	

Lifetime partners: With how many partners have you ever had vaginal intercourse, even if only once?

Skipped (n=2,103)	Skipped rest of sex questions
Partners range 1-50 (n=12,881)	Asked rest of sex questions
Refused (n=107)	Missing
Don't know (n=88)	
Not applicable (n=17)	

Sexual partners: With how many different partners have you had vaginal intercourse in the past 12 months?

Skipped (n=2,103, 14%)	Skipped rest of sex questions
0 partners (n=1,158, 8%)	
1 partner (n=7,573, 50%)	Asked rest of sex questions
2-3 partners (n=3,032, 20%)	
4-5 partners (n=685, 5%)	
>6 partners (n=488, 3%)	
Refused (n=53, 0.3%)	Missing (n=158)
Don't know (n=26, 0.2%)	
Not applicable (n=11, 0.01%)	
Missing (n=68, 0.4%)	

Sex with partner with STD: Now, think about (This person/these people) with whom you had vaginal intercourse in the past 12 months. To the best of your knowledge, did (he/she/any of them) ever in (his life/her life/their lives) have a sexually transmitted disease or STD?

Skipped (n=3,261, 21%)	Not sexually active (n=2,959, 22%)
No (n=10,456, 69%)	No sex with partner with STD (n=9,348, 72%)
Yes (n=986, 6%)	Yes sex with partner with STD (n=797, 6%)
Refused (n=23, 2%)	Missing (n=452)
Don't know (n=367, 2%)	
Not applicable (n=36, 0.2%)	
Missing (n=68, 0.4%)	

<u>Concurrent sexual partners</u>

Wave 4

Sexual partners: Two questions were used to determine the number of sexual partners in the past 12 months. Participants were asked about both male and female partners, and the total number of partners was added for the total number of sexual partners in the past 12 months.

Male partners (ever): Considering all types of sexual activity, with how many male partners have you ever had sex?

0 partners (n=6,953)	Skipped sex questions
1-300 partners (n=8,292)	Asked rest of sex questions
Refused (n=282)	Missing

Don’t know (n=171)	

*Male partners (*Considering all types of sexual activity, with how many male partners have you had sex in the past 12 months, even if only one time?

Skipped (n=7,668)	Skipped
0 partners (n=634, 4%)	
1 partner (n=5,483, 35%)	Asked rest of sex questions
2 partners (n=893, 6%)	
3 partners (n=421, 3%)	
4 partners (n=157, 1%)	
5-75 partners (n=256, 1.6%)	
Don’t know (n=32, 0.2%)	Missing (n=208)
Missing (n=7, 0.1%)	
Refused (n=150, 1%)	

Female partners (ever): Considering all types of sexual activity, with how many female partners have you ever had sex?

0 partners (n=7,467)	Skipped
1-354 partners (n=7,189)	Asked rest of sex questions
Refused (n=215)	Missing
Don’t know (n=285)	

Female partners (frequency): Considering all types of sexual activity, with how many female partners have had sex in the past 12 months?

Skipped (n=7,996)	Skipped
0 partners (n=1,040, 7%)	
1 partner (n=4,329, 28%)	Asked rest of sex questions
2 partners (n=857, 6%)	
3 partners (n=505, 3%)	
4 partners (n=261, 2%)	
5-56 partners (n=521, 3%)	
Refused (n=132, 0.8%)	Missing (n=209)
Don’t know (n=58, 0.4%)	
Missing (n=2, 0.1%)	

Concurrent sexual partners: In the past 12 months, did you have sex with more than one partner at around the same time?

Skipped (n= 2,256)	Not sexually active (n=2,123, 15%)
No (n=11,300, 72%)	No concurrent sexual partners (n=10,552, 72%)
Yes (n=2,110, 13.4%)	Yes concurrent sexual partners (n=1,827, 13%)
Refused (n=9, 0.06%)	Missing (n=7)
Don’t know (n=2, 0.01%)	
Missing (n=24, 0.2%)	

Table 4.7g. Associations of reporting physical abuse only with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 2

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
	C9	C5	C6	C1	C2	C7	C8	C4	C3
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	**1.87** **(1.37, 2.57)**								
Class 3 Rom. Partner, no BC	**3.11** **(2.10, 4.63)**	**1.66** **(1.24, 2.22)**							
Class 4 Rom & NR partners, BC	**2.70** **(1.88, 3.86)**	**1.44** **(1.07, 1.93)**	0.87 (0.62, 1.21)						
Class 5 Rom & NR partners, no BC	**3.36** **(2.21, 5.12)**	**1.79** **(1.24, 2.59)**	1.08 (0.71, 1.63)	1.25 (0.84, 1.85)					
Class 6 No partners, reported sex	**2.39** **(1.66, 3.45)**	1.27 (0.94, 1.72)	0.77 (0.54, 1.09)	0.89 (0.63, 1.25)	0.71 (0.47, 1.07)				
Class 7 NR partners, no reported sex	**2.96** **(1.73, 5.08)**	**1.58** **(1.12, 2.23)**	**0.95** **(0.67, 1.36)**	1.10 (0.76, 1.60)	0.88 (0.57, 1.37)	1.24 (0.84, 1.82)			
Class 8 NR partners, use BC	**2.30** **(1.51, 3.50)**	1.23 (0.86, 1.75)	0.74 (0.50, 1.10)	0.85 (0.57, 1.27)	0.68 (0.44, 1.07)	0.96 (0.64, 1.44)	0.78 (0.51, 1.18)		
Class 9 NR partners, no BC	**3.61** **(1.93, 6.75)**	**1.93** **(1.14, 3.26)**	1.16 (0.68, 1.97)	1.34 (0.77, 2.32)	1.07 (0.58, 1.98)	1.51 (0.86, 2.64)	1.22 (0.72, 2.06)	1.57 (0.88, 2.82)	

Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
All statistically significant associations are bolded.

Table 4.7h. Associations of reporting sexual abuse only with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 2

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	**3.34** **(1.64, 6.81)**								
Class 3 Rom. Partner, no BC	**7.48** **(3.16, 17.68)**	2.24 (0.96, 5.24)							
Class 4 Rom & NR partners, BC	**3.56** **(1.31, 9.65)**	1.06 (0.38, 3.02)	0.48 (0.15, 1.49)						
Class 5 Rom & NR partners, no BC	*	*	*	*					
Class 6 No partners, reported sex	**2.39** **(1.66, 3.45)**	*	*	*	*				
Class 7 NR partners, no reported sex	**2.96** **(1.73, 5.08)**	0.34 (0.10, 1.20)	**0.15** **(0.04, 0.63)**	0.32 (0.08, 1.34)	*	*			
Class 8 NR partners, use BC	**2.92** **(0.76, 11.16)**	0.87 (0.23, 3.34)	0.39 (0.10, 1.59)	0.82 (0.18, 3.80)	*	*	2.57 (0.45, 14.74)		
Class 9 NR partners, no BC	*	*	*	*	*	*	*	*	

Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
*=unstable estimates.
All statistically significant associations are bolded.

Table 4.7i. Associations of reporting both physical and sexual abuse with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 2

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Romantic partners only, use BC	Class 3 Romantic partners only, no BC	Class 4 Romantic & NR partners, use BC	Class 5 Romantic & NR partners, no BC	Class 6 No partners but reported sex	Class 7 NR partners, no reported sex	Class 8 NR partners only, use BC	Class 9 NR partners only, no BC
Class 1 Abstainers									
Class 2 Rom. Partner, use BC	**2.68** **(1.14, 6.28)**								
Class 3 Rom. Partner, no BC	**3.63** **(1.33, 9.89)**	1.35 (0.54, 3.38)							
Class 4 Rom & NR partners, BC	**5.06** **(1.94, 13.20)**	1.89 (0.81, 4.39)	1.40 (0.51, 3.82)						
Class 5 Rom & NR partners, no BC	3.33 (0.87, 12.79)	1.24 (0.36, 4.35)	0.92 (0.23, 3.64)	0.41 (0.05, 3.29)					
Class 6 No partners, reported sex	2.41 (0.76, 7.66)	0.90 (0.28, 2.90)	0.66 (0.18, 2.43)	0.48 (0.14, 1.62)	0.72 (0.16, 3.36)				
Class 7 NR partners, no reported sex	1.55 (0.23, 10.36)	0.58 (0.13, 2.67)	**0.43** **(0.08, 2.21)**	0.31 (0.06, 1.48)	0.47 (0.08, 2.89)	0.64 (0.11, 3.68)			
Class 8 NR partners, use BC	2.08 (0.28, 15.62)	*	*	*	*	*	*		
Class 9 NR partners, no BC	2.08 (0.28, 15.62)	0.78 (0.10, 5.92)	0.57 (0.07, 4.73)	0.41 (0.05, 3.29)	0.63 (0.06, 6.12)	0.86 (0.10, 7.76)	1.34 (0.12, 15.44)	*	

Note. CI= Confidence intervals; Rom=romantic; NR=Non-relationship; BC=Birth control.
*=unstable estimates.
All statistically significant associations are bolded.

Table 4.7j. Associations of reporting physical abuse only with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 3

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, sex with STD	Class 8 Mon. partner, no BC, sex with STD	Class 9 Multiple partners, sex with STD
Class 1 Abstainers									
Class 2 Mon. partner only, use BC	**2.60 (1.94, 3.48)**								
Class 3 Mon. partner only, no BC	**1.92 (1.48, 2.49)**	**1.29 (1.06, 1.58)**							
Class 4 Mult. Part., use BC	**1.58 (1.24, 2.01)**	1.06 (0.89, 1.28)	0.82 (0.66, 1.03)						
Class 5 Mult. Part., no BC	**2.60 (1.94, 3.48)**	**1.75 (1.37, 2.23)**	**1.36 (1.03, 1.79)**	**1.65 (1.27, 2.14)**					
Class 6 No current partners, reported sex	**1.53 (1.13, 2.06)**	1.03 (0.80, 1.32)	0.80 (060, 1.05)	0.97 (0.74, 1.26)	0.59 (0.43, 0.80)				
Class 7 Mon. part., use BC, sex STD	**2.89 (1.91, 4.37)**	**1.95 (1.33, 2.85)**	**1.51 (1.01, 2.25)**	**1.83 (1.24, 2.71)**	1.11 (0.73, 1.70)	**1.89 (1.23, 2.90)**			
Class 8 Mon. partner, no BC, sex STD	1.38 (0.68, 2.79)	0.93 (0.47, 1.85)	0.72 (0.36, 1.44)	0.87 (0.44, 1.75)	0.53 (0.26, 1.08)	0.90 (0.44, 1.84)	0.48 (0.22, 1.03)		
Class 9 Mult. Partner, sex STD	**2.85 (1.96, 4.15)**	**1.92 (1.37, 2.69)**	**1.49 (1.04, 2.13)**	**1.81 (1.27, 2.57)**	1.10 (0.75, 1.61)	**1.87 (1.27, 2.76)**	0.99 (0.61, 1.60)	2.07 (0.98, 4.37)	

Note. CI= Confidence intervals; Mon.= Monogamous; Part.=Partner; Mult.=Multiple; BC=Birth control; sex STD= sex with partner with known STD.
All statistically significant associations are bolded.

Table 4.7k. Associations of reporting sexual abuse only with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 3

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, sex with STD	Class 8 Mon. partner, no BC, sex with STD	Class 9 Multiple partners, sex with STD
Class 1 Abstainers									
Class 2 Mon. partner only, use BC	1.99 (0.58, 6.77)								
Class 3 Mon. partner only, no BC	2.16 (0.54, 8.62)	1.08 (0.42, 2.79)							
Class 4 Mult. Part., use BC	2.35 (0.62, 8.96)	1.19 (0.50, 2.79)	1.09 (0.37, 3.20)						
Class 5 Mult. Part., no BC	**2.60** **(1.94, 3.48)**	**2.70** **(1.04, 7.03)**	2.49 (0.78, 7.93)	2.28 (0.77, 6.71)					
Class 6 No current partners, reported sex	2.76 (0.62, 12.24)	1.39 (0.46, 4.18)	1.28 (0.36, 4.60)	1.17 (0.35, 3.95)	0.52 (0.14, 1.87)				
Class 7 Mon. part., use BC, sex STD	**2.89** **(1.91, 4.37)**	0.94 (0.12, 7.19)	0.87 (0.10, .7.39)	0.80 (0.10, 6.32)	0.35 (0.04, 2.96)	0.68 (0.07, 6.24)			
Class 8 Mon. partner, no BC, sex STD	**10.95** **(2.18, 54.93)**	**5.51** **(1.53, 19.90)**	**5.08** **(1.20, 21.57)**	**4.65** **(1.20, 18.05)**	2.04 (0.48, 8.66)	3.96 (0.84, 18.77)	5.84 (0.59, 57.64)		
Class 9 Mult. Partner, sex STD	**2.85** **(1.96, 4.15)**	2.32 (0.67, 8.06)	2.13 (0.52, 8.77)	1.95 (0.51, 7.51)	0.86 (0.20, 3.64)	1.66 (0.36, 7.79)	2.45 (0.26, 23.47)	0.42 (0.08, 2.10)	

Note. CI= Confidence intervals; Mon.= Monogamous; Part.=Partner; Mult.=Multiple; BC=Birth control; sex STD= sex with partner with known STD.
All statistically significant associations are bolded.

Table 4.7l. Associations of reporting both physical and sexual abuse with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 3

	Referent class Odds Ratios (95% CI)								
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, sex with STD	Class 8 Mon. partner, no BC, sex with STD	Class 9 Multiple partners, sex with STD
Class 1 Abstainers									
Class 2 Mon. partner only, use BC	1.89 (0.65, 5.53)								
Class 3 Mon. partner only, no BC	0.67 (0.15, 2.99)	0.35 (0.10, 1.21)							
Class 4 Mult. Part., use BC	2.87 (0.93, 8.88)	1.52 (0.74, 3.12)	**4.30** **(1.20, 15.39)**						
Class 5 Mult. Part., no BC	2.38 (0.59, 9.70)	1.26 (0.42, 3.85)	3.58 (0.78, 16.41)	0.83 (0.26, 2.62)					
Class 6 No current partners, reported sex	1.33 (0.30, 5.82)	0.70 (0.21, 2.41)	1.99 (0.40, 9.99)	0.46 (0.13, 1.63)	0.56 (0.12, 2.55)				
Class 7 Mon. part., use BC, sex STD	2.80 (0.48, 16.27)	1.48 (0.32, 6.89)	4.20 (0.68, 26.07)	0.98 (0.20, 4.66)	1.17 (0.20, 6.78)	2.11 (0.33, 13.40)			
Class 8 Mon. partner, no BC, sex STD	*	*	*	*	*	*	*		
Class 9 Mult. Partner, sex STD	2.36 (0.43, 13.03)	1.25 (0.29, 5.45)	0.63 (0.38, 1.05)	0.82 (0.18, 3.86)	0.99 (0.18, 5.44)	1.77 (0.30, 10.60)	0.84 (0.11, 6.22)	*	

Note. CI= Confidence intervals; Mon.= Monogamous; Part.=Partner; Mult.=Multiple; BC=Birth control; sex STD= sex with partner with known STD.
*=unstable estimates.
All statistically significant associations are bolded.

Table 4.7m. Associations of reporting physical abuse only with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 4

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, conc. partners	Class 8 Mon. partner, no BC, conc. partners	Class 9 Multiple partners, use BC, conc. partners	Class 10 Multiple partners, no BC, conc. partners
Class 1 Abstainer										
Class 2 Mon. partner only, use BC	**1.70 (1.05, 2.76)**									
Class 3 Mon. partner only, no BC	**2.26 (1.14, 4.47)**	1.33 (0.60, 2.96)								
Class 4 Mult. Part., use BC	**1.51 (1.13, 2.02)**	0.89 (0.53, 1.47)	0.67 (0.33, 1.34)							
Class 5 Mult. Part., no BC	**3.86 (2.71, 5.49)**	**2.27 (1.32, 3.91)**	1.71 (0.82, 3.53)	**2.56 (1.75, 3.75)**						
Class 6 No current part., reported sex	**2.54 (1.80, 3.60)**	1.49 (0.87, 2.57)	1.12 (0.54, 2.32)	**1.69 (1.16, 2.46)**	0.66 (0.43, 1.01)					
Class 7 Mon. part., use BC., conc. Partner	**2.23 (1.72, 2.87)**	1.31 (0.80, 2.13)	0.98 (0.50, 1.95)	**1.48 (1.10, 1.99)**	**0.58 (0.41, 0.82)**	0.88 (0.62, 1.24)				
Class 8 Mon. partner, no BC, conc. Part.	**1.53 (1.13, 2.06)**	0.90 (0.54, 1.50)	0.67 (0.33, 1.36)	1.01 (0.72, 1.42)	**0.39 (0.27, 0.58)**	0.60 (0.41, 0.88)	**0.68 (0.50, 0.93)**			
Class 9 Mult. Part., use BC, conc. Part.	**1.36 (1.11, 1.67)**	0.80 (0.50, 1.27)	0.60 (0.31, 1.17)	0.90 (0.70, 1.16)	**0.35 (0.26, 0.48)**	0.53 (0.39, 0.73)	**0.61 (0.49, 0.75)**	0.89 (0.68, 1.17)		
Class 10 Mult. Part., no BC., conc. Part.	**1.91 (1.51, 2.41)**	1.12 (0.69, 1.81)	0.84 (0.43, 1.66)	1.26 (0.96, 1.67)	**0.49 (0.35, 0.69)**	0.75 (0.54, 1.05)	0.86 (0.67, 1.09)	1.25 (0.93, 1.68)	1.40 (1.16, 1.69)	

Note. CI= Confidence intervals; Mon.=Monogamous; Part.=Partner; Mult.=Multiple; Conc.=Concurrent; BC=Birth control.
All statistically significant associations are bolded.

Table 4.7n. Associations of reporting sexual abuse only with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 4

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, conc. partners	Class 8 Mon. partner, no BC, conc. partners	Class 9 Multiple partners, use BC, conc. partners	Class 10 Multiple partners, no BC, conc. partners
Class 1 Abstainer										
Class 2 Mon. partner only, use BC	2.28 (0.86, 6.05)									
Class 3 Mon. partner only, no BC	3.45 (0.99, 11.96)	1.51 (0.33, 6.84)								
Class 4 Mult. Part., use BC	1.55 (0.82, 2.91)	0.68 (0.24, 1.95)	0.45 (0.12, 1.66)							
Class 5 Mult. Part., no BC	**3.33** **(1.47, 7.50)**	1.46 (0.46, 4.66)	0.97 (0.24, 3.93)	2.15 (0.87, 5.29)						
Class 6 No current part., reported sex	**3.16** **(1.54, 6.50)**	1.38 (0.46, 4.14)	0.92 (0.24, 3.52)	2.04 (0.91, 4.61)	0.95 (0.36, 2.49)					
Class 7 Mon. part., use BC., conc. Partner	1.53 (0.82, 2.85)	0.67 (0.24, 1.90)	0.44 (0.12, 1.64)	0.99 (0.48, 2.06)	0.46 (0.19, 1.12)	0.48 (0.22, 1.08)				
Class 8 Mon. partner, no BC, conc. Part.	0.89 (0.42, 1.88)	0.39 (0.13, 1.20)	0.26 (0.07, 1.01)	0.58 (0.25, 1.34)	0.27 (0.10, 0.72)	0.28 (0.11, 0.70)	0.58 (0.25, 1.35)			
Class 9 Mult. Part., use BC, conc. Part.	1.13 (0.73, 1.75)	0.50 (0.19, 1.27)	0.33 (0.10, 1.11)	0.73 (0.41, 1.30)	0.34 (0.16, 0.73)	0.36 (0.18, 0.70)	0.74 (0.42, 1.29)	1.27 (0.63, 2.57)		
Class 10 Mult. Part., no BC., conc. Part.	**1.68** **(1.01, 2.80)**	0.73 (0.28, 1.94)	0.49 (0.14, 1.70)	1.08 (0.57, 2.04)	0.50 (0.22, 1.13)	0.53 (0.26, 1.08)	1.10 (0.59, 2.02)	1.88 (0.88, 4.00)	1.48 (0.96, 2.27)	

Note. CI= Confidence intervals; Mon.=Monogamous; Part.=Partner; Mult.=Multiple; Conc.=Concurrent; BC=Birth control.
All statistically significant associations are bolded.

Table 4.7o. Associations of reporting both physical and sexual abuse with sexual behavior latent class membership among participants in the National Longitudinal Study of Adolescent to Adult Health in Wave 4

	Referent class Odds Ratios (95% CI)									
	Class 1 Abstainers	Class 2 Mon. partner only, use BC	Class 3 Mon. partner only, no BC	Class 4 Multiple partners, use BC	Class 5 Multiple partners, no BC	Class 6 No current partners, reported sex	Class 7 Mon. partner, use BC, conc. partners	Class 8 Mon. partner, no BC, conc. partners	Class 9 Multiple partners, use BC, conc. partners	Class 10 Multiple partners, no BC, conc. partners
Class 1 Abstainer										
Class 2 Mon. partner only, use BC	**6.27 (3.12, 12.59)**									
Class 3 Mon. partner only, no BC	**7.74 (2.95, 20.35)**	1.23 (0.42, 3.60)								
Class 4 Mult. Part., use BC	0.83 (0.36, 1.93)	**0.13 (0.05, 0.34)**	**0.11 (0.03, 0.34)**							
Class 5 Mult. Part., no BC	1.76 (0.60, 5.14)	**0.28 (0.09, 0.90)**	**0.23 (0.06, 0.87)**	2.13 (0.61, 7.44)						
Class 6 No current part., reported sex	**2.97 (1.39, 6.33)**	0.47 (0.20, 1.14)	0.38 (0.13, 1.16)	**3.59 (1.33, 9.68)**	2.13 (0.61, 7.44)					
Class 7 Mon. part., use BC., conc. Partner	1.74 (0.93, 3.26)	**0.28 (0.13, 0.59)**	**0.22 (0.08, 0.62)**	2.10 (0.86, 5.12)	2.10 (0.86, 5.12)	0.59 (0.26, 1.32)				
Class 8 Mon. partner, no BC, conc. Part.	**2.41 (1.32, 4.40)**	**0.38 (0.18, 0.82)**	**0.31 (0.12, 0.84)**	**2.91 (1.20, 7.05)**	**2.91 (1.20, 7.05)**	0.81 (0.37, 1.80)	1.39 (0.70, 2.74)			
Class 9 Mult. Part., use BC, conc. Part.	1.12 (0.71, 1.77)	**0.18 (0.09, 0.34)**	**0.14 (0.06, 0.36)**	1.35 (0.61, 2.99)	1.35 (0.61, 2.99)	**0.38 (0.19, 0.76)**	0.64 (0.37, 1.12)	0.46 (0.27, 0.79)		
Class 10 Mult. Part., no BC., conc. Part.	1.59 (0.92, 2.73)	**0.25 (0.13, 0.51)**	**0.21 (0.08, 0.54)**	1.92 (0.82, 4.46)	1.92 (0.82, 4.46)	0.53 (0.25, 1.13)	0.91 (0.49, 1.69)	0.66 (0.36, 1.20)	1.42 (0.90, 2.24)	

Note. CI= Confidence intervals; Mon.=Monogamous; Part.=Partner; Mult.=Multiple; Conc.=Concurrent; BC=Birth control.
All statistically significant associations are bolded.

CHAPTER 5.

Child maltreatment is a global public health and human rights issues. The goals of this dissertation were to focus on specific outcomes of child maltreatment, including suicidality, sexual risk behaviors, and polysubstance use. Moreover, the aims of this dissertation were to dissect the differential impacts of child maltreatment effects to identify the specific types of child maltreatment that are associated with suicidality, sexual risk behaviors, and polysubstance use.

The first paper focused on the association of child maltreatment, current drinking status, problematic alcohol use, and negative future expectations on suicidality among youth living in the slums of Kampala, Uganda, who may experience an exacerbated association between child maltreatment, other predictors, and suicidality due to their dire environmental and social conditions. Structural equation mixture modeling was utilized to determine the associations of these predictors on suicidal ideation simultaneously. Additionally, problematic alcohol use was only estimated in a class of current drinkers, which allowed flexibility in examining the broader context of the drinking process. This paper found that suicidal ideation was high among youth living in the slums of Kampala. Moreover, current drinking status and child maltreatment were statistically significantly associated with reporting suicidal ideation. Additionally, sexual abuse was statistically significantly associated with current drinking status, both alone and in context with other forms of abuse. This study highlights a population that would potentially benefit from suicide prevention efforts in addition to harm reduction efforts.

The second paper aimed to determine the associations between child maltreatment and polysubstance use across adolescence and adulthood. The analytic approach used for this study included latent class and latent transition analysis. This paper found that child maltreatment

statistically significantly predicted specific substance use profiles at individual waves, and child maltreatment was associated with concurrent substance use profiles compared to abstainer profiles. Additionally, previous substance use predicted substance use at later waves. While the interaction between previous substance use and child maltreatment did not statistically significantly impact substance use at later waves, there was an indirect impact of child maltreatment on substance use profiles in later waves through the prior impact on previous substance use profiles in earlier waves.

The third study sought to examine the associations between child maltreatment and patterns of sexual risk behaviors across adolescence and adulthood. Similarly to the previous study, this paper utilized latent class and latent transition analysis. This study found that child maltreatment predicted specific sexual behaviors at given time points (adolescence and early adulthood); however, there was no interaction between previous sexual behavior profiles and child maltreatment on the effect of sexual profiles in later waves. There was an indirect impact of child maltreatment on sexual behavior profiles in later waves through the prior impact in previous waves. Future research should seek to identify initiation patterns of specific sexual behaviors among maltreated youth.

Overall, these studies contribute to the growing literature on child maltreatment. The first study expanded on previous literature among youth living in the slums of Kampala by examining a large context of behaviors and experiences to determine the association between child maltreatment and suicidal ideation in this sample. This study also utilized an approach to evaluating alcohol use behaviors while also incorporating non-drinkers and non-active drinkers, which is important in the context of child maltreatment outcomes. The second study contributes to the robust literature on child maltreatment and substance use by specifically incorporating

cigarette use and by examining the co-occurrence patterns of substance use. Additionally, the third study expands on previous research between child maltreatment and sexual behaviors by including both physical and sexual abuse types and examining these patterns across adulthood. Lastly, both the second and third studies expand on child maltreatment outcome research by examining a broad timeline across adolescence and adulthood using advanced multivariate analyses in attempts to understand a larger context of child maltreatment on substance use and sexual behaviors. Future studies should incorporate additional types of child maltreatment and contextual information on timing, severity, and perpetration.