# High-Risk Sexual Behavior and Substance Use During Young Adulthood: Gender-Specific Developmental Trajectories and the Influence of Early Trauma, and Adolescent Peer and Family Processes

by

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ABSTRACT

High-risk sexual behavior (HRSB) and substance use (SU) are highly prevalent in the general population with adolescents and young adults at high risk for engaging in these behaviors. Unhealthy behavioral patterns established during these developmental periods can have detrimental long-term effects on physical and mental health. Health care expenditures, related to consequences of these behaviors, have been estimated to reach around $740 billion in the United States, indicating an imminent public health concern. Unfortunately, little is known about trajectories and risk factors of health risk behaviors (HRBs) beyond age 25, which is a critical developmental period regarding these behaviors. This study sought to better understand HRB trajectories throughout young adulthood as well as the mechanisms underlying the initiation and progression of these behaviors. This study used data from a large (n = 998), longitudinal, randomized-controlled trial with intensive measurement of HRBs and peer and family processes. Growth mixture modeling estimated gender-specific trajectories of HRSB and SU (tobacco, alcohol, marijuana) from ages 22-30. Multinomial logistic regression (MLR) then examined how family and peer factors, and trauma exposure during adolescence, both separately and in combination, influenced HRB trajectories. Four unique trajectories resulted for SU (low use class; increasing use class; decreasing use class; high use class) and three for HRSB (low HRSB class; increasing HRSB class; deceasing HRSB class). There were no differences in the number of classes or trajectory patterns between men and women. Results of the MLRs demonstrated that deviant peer affiliation (DP), family conflict, parental monitoring and trauma exposure impacted trajectories of tobacco and marijuana use and HRSB during young adulthood, but that the most salient influences were DP and trauma exposure. Alcohol use trajectories and differences between the increasing, decreasing and high trajectory classes for the other HRBs were difficult to predict. These results suggest that young adults are still at risk for engaging in HRBs, and there are risk factors in adolescence that influence typologies of HRBs during this developmental period. Prevention and intervention programs targeting young adulthood are needed, and better understanding factors that lead to vulnerabilities specific to this developmental period may inform targeted interventions.

# DEDICATION

This dissertation is dedicated to my family without whom it would not have been possible to be where I am today. To my mother, Naomi, whose unwavering support and unconditional love has given me the strength to take on challenges I never thought possible. To my father, Henry, who has taught me the patience and presence needed to be grateful for every moment in life, no matter how difficult, and to focus on the journey rather than the outcome. To my Nonnie and Poppie, whose work ethic and selfless dedication to helping others has inspired my love of psychology and taught me the value of persistence and hard work. To my brother, Scott, who has kept me grounded and always reminded me of the bright and fun side of life. To my dog, Charlie/Min/Mitchell/Tiny/Pinch/Sneezy/Itchington, who has shown me steadfast loyalty, and has made me smile, at least once, every single day. I love you all!

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# INTRODUCTION

Adolescence and young adulthood[1] are critical transitional periods that include vital biological and psychological changes as well as the need to negotiate key developmental tasks, such as establishing a sense of identity, autonomy and normative experimentation (e.g. DiClemente, Hansen & Ponton, 2013; Arnett, 2000; Dishion, Poulin & Medici Skaggs, 2000). Unhealthy behavioral patterns established during these developmental periods can have detrimental long-term effects on physical health and developmental outcomes, such as educational attainment and mental health (e.g. Whiteford et al., 2013; Owusu-Edusei Jr., et al, 2013; Perry, & Jessor, 1985; Seidman & Rieder, 1994). The Centers for Disease Control and Prevention (CDC) has identified and monitors six types of **health-risk behaviors (HRBs)** that contribute to the leading causes of death and disability among youth and adults, including 1) behaviors that contribute to unintentional injuries and violence, **2) sexual behaviors related to unintended pregnancy and sexually transmitted diseases, including human immunodeficiency virus (HIV) infection, 3) alcohol and other drug use, 4) tobacco use**, 5) unhealthy dietary behaviors, and 6) inadequate physical activity (CDC, 2015a).

High-risk sexual behavior and substance use make up half of these HRBs and are highly prevalent in the general population with adolescents and young adults at highest risk for engaging in these behaviors (Weinstock, Berman, & Cates, 2004; Satterwhite et al, 2013; Johnston, O'Malley, Bachman, & Schulenberg, 2013; Mosher, Chandra, & Jones, 2005). High-risk sexual behavior (HRSBs; multiple sexual partners, early sexual

[1] The terms "emerging adult" and "young adult" are often used interchangeably and are not well defined in studies. For clarification, in this study the term "young adult" will be used and refers to individuals in their early 20's- 30.

debut, sex without condoms, and alcohol/drug use with sex) increases the odds of both sexually transmitted infections (STIs) and unintended pregnancies (Mosher et al., 2005). Each year in the United States (U.S.), 20 million new cases of STIs are diagnosed (CDC, 2015b) with nearly half of the cases being diagnosed in young people ages 15–24 (Satterwhite et al, 2013). Additionally, around 45% of pregnancies in the U.S. are reported as being unintended (Finer & Zolna, 2016) with the highest rates of unintended pregnancy among adolescents aged 15–19 (Finer, 2010).

Substance use is also highly prevalent with an estimated 22 million people struggling with an alcohol or drug problem (Substance Abuse and Mental Health Services Administration [SAMHSA], 2015). In the United States, by the time individuals are in 12th grade, almost 70% will have tried alcohol, 50% will have used marijuana/hashish, 40% will have smoked a cigarette, and 29% will have used illicit drugs other than marijuana (Johnston et al., 2013). Substance use at an early age has been linked to elevated risk for problematic substance use during late adolescence and young adulthood (e.g. Hawkins et al., 1997; Van Ryzin & Dishion, 2014; Nelson, Van Ryzin & Dishion, 2015), with the median age of onset for substance use disorders around 20 years old (ranging from 18-27) (Kessler et al., 2005). Adolescence and young adulthood is a particularly vulnerable time for engaging in substance use and is a time marked by peaks in alcohol and drug use disorders (Johnston et al., 2013), with 12.5% of individuals meeting diagnostic criteria for a past-year alcohol or drug use disorder (Kessler et al., 2005).

Early and persistent engagement in these behaviors has been shown to increase risk for a host of adverse outcomes including, HIV/AIDS, STIs, cancer, unplanned pregnancy, violence, child abuse, motor vehicle crashes, lowered IQ and suicide (e.g. Whiteford et al., 2013; Owusu-Edusei Jr., et al, 2013; Perry, & Jessor, 1985; Seidman & Rieder, 1994; Meier et al., 2012). Health care expenditures, related to these consequences, have been estimated to reach more than $740 billion in the U.S. (National Institute on Drug Abuse [NIDA], 2017; Owusu-Edusei Jr., et al, 2013; Sonfield, & Kost, 2015), indicating an imminent public health concern and national public health priority. In fact, three of the 12 Leading Health Indicators (LHIs) of Healthy People Objectives for 2020 involve working to reduce problematic substance use and promote healthy sexual behaviors (Office of Disease Prevention and Health Promotion [ODPHP], 2017). The current study seeks to better understand trajectories of HRSB and substance use during young adulthood as well as the mechanisms underlying the initiation and progression of these behaviors. This information may inform preventive interventions as well as policy and promote the overall health of individuals, families, and communities.

**Trajectories of High-Risk Sexual Behavior and Substance Use**

A number of longitudinal studies have examined trajectory classes to better understand the developmental course of risk behaviors. Knowledge of the developmental course of risk behaviors is vital when attempting to understand the etiology and maintenance of these behaviors, and ultimately may inform treatment and prevention efforts. Trajectory studies have investigated patterns of variety of risk behaviors, including tobacco, alcohol, and marijuana use, as well as HRSB. Prior research suggests that, for tobacco, alcohol and marijuana use, there are on average between 4–6 different trajectory classes, with the number of trajectories varying based on differences in samples, methodology and measurement (e.g., Park, McCoy, Erausquin & Bartlett, R., 2018; Nelson et al., 2015; Chassin, Pitts & Prost, 2002; Chassin, Presson, Pitts & Sherman, 2000; Jackson, Sher & Schulenberg, 2008; Jackson & Sher, 2005; Hill, White, Chung, Hawkins & Catalano, 2000; Costello, Dierker, Jones, & Rose, 2008; Maggs & Schulenberg, 2004; Schulenberg et al., 2005; Ellickson, Martino & Collins, 2004). For substance use, most studies have identified a group categorized as stable low substance users, a group categorized as stable high substance users, a group categorized as increasing substance users and a group categorized as decreasing substance users. There are fewer studies investigating trajectories of HRSB (Huang, Murphy & Hser, 2012; Fergus, Zimmerman & Caldwell, 2007; Capaldi, Stoolmiller, Clark & Owen, 2002; Mahalik et al., 2013), though there appear to be multiple trajectory patterns, suggesting important variations in the developmental course of HRSB.

While the exact number of trajectories of risk behaviors varies across studies, they consistently indicate that there are multiple developmental trajectories that occur across individuals. Unfortunately, our knowledge of longer-term trajectories is limited as most studies investigating trajectories of health risk behaviors focus on a limited developmental time period, usually from around age 11-18 (e.g., Hill et al., 2000;) or age 18-25 (e.g., Schulenberg et al., 2005; Jackson et al., 2008), and occasionally spanning age 11-25 (e.g., Costello et al., 2008; Chassin et al., 2002). Very few studies have investigated trajectories of health risk behaviors beyond age 25, to my knowledge, no study has looked at trajectories of HRSB after age 24. The few studies that have started to look at trajectories of substance use beyond age 25, have also found multiple developmental trajectories (e.g., Jackson & Sher, 2005; Chassin et al., 2000). Thus, the current study aims to improve on prior research by looking at developmental trajectories of HRSB and substance use beyond age 25, as well as looking at the co-occurrence of substance use and HRSB across these critical developmental periods.

**Co-occurrence of High-Risk Sexual Behavior and Substance Use**

The vast majority of existing studies examine substance use and HRSB separately, despite substantial evidence that they often co-occur. Indeed, ample evidence demonstrates a high degree of covariation between HRSB and substance use. Cross sectional and short longitudinal studies have shown that adolescent use of cigarettes (Duncan, Strycker & Duncan, 1999; Biglan et al., 1990), alcohol (Leigh & Stall, 1993; Temple, Leigh & Schafer, 1993; Bailey, Pollock, Martin & Lynch, 1999; Cooper, Skinner & George, 1990; Hingson, Strunin, Berlin & Heeren, 1990; Baskin-Sommers & Sommers, 2006; Hutton, McCaul, Santora & Erbelding, 2008), marijuana, and other illicit drugs (Bryan, Schmiege & Magnan, 2012; Hingson et al., 1990; Lowry, et al., 1994; Shrier, Emans, Woods & DuRant, 1997; Baskin-Sommers & Sommers, 2006) are associated with a number of HRSBs, including earlier sexual debut, increased rates of sexual intercourse, having multiple sexual partners, and lower rates of condom use.

A few studies (e.g. Guo et al., 2002; Tapert, Aarons, Sedlar, & Brown, 2001; Wu, Witkiewitz, McMahon, Dodge, & Conduct Problems Prevention Research Group, 2010; King, Nguyen, Kosterman, Bailey, & Hawkins, 2012) have also investigated relations between these behaviors in prospective longitudinal studies. Guo et al., (2002) looked at how trajectories of adolescent substance use from age 13-18 predicted HRSB at age 21 years. They found that early binge-drinkers had significantly more sex partners than non-binge-drinkers and late onset binge-drinkers and marijuana users had significantly more sex partners and were less likely to use condoms consistently than those who did not binge drink or use marijuana. They also found that most cigarette smokers (with the exception of the "experimenters"), were less likely to use condoms consistently than nonsmokers. Finally, they found that illicit drugs in adolescence did not predict risky sexual behavior at age 21 (Guo et al., 2002).

In another study, Wu et al., 2010, using a parallel process growth mixture model, investigated concurrent conduct problems and substance use (tobacco, binge drinking, and marijuana use) trajectory classes during early adolescence and looked at how those classes predicted HRSB in 12th grade. They found that, for all substances, individuals classified into more problematic classes (i.e. higher or increasing levels of conduct problems and substance use) were at higher risk for early sexual intercourse, infrequent condom use, receiving money for sexual services, and ever contracting an STD. Specifically, they found that individuals in the class that was high on both substance use and conduct problems were approximately twice as likely to not use condoms during sex, five times as likely to receive money for sexual services during high school, and four times as likely to ever contract an STD, relative to the other three classes (Wu et al., 2010).

These studies provide important information about how early substance use influences later HRSB, but neither looked at trajectories of these behaviors concurrently. One innovative study took this additional step and looked at the co-occurrence of substance use (alcohol and drug use) and HRSB from age 21-30. King et al., (2012) investigated state and trait level difference for HRSB and substance use and found that drug use and risky sexual behaviors were associated at the trait, but not the state level, while alcohol use was associated with risky sexual behaviors at the state, but not the trait level. Taken together, these studies suggest that there is clearly a relationship between HRSB and substance use. However, this relation is complex, and more research on the simultaneous developmental relations between substance use and risky sexual behavior is needed.

**Etiological Mechanisms of Health Risk Behaviors[2]**

Several models have been proposed to explain the common psychological and behavioral etiologies of substance use and HRSB. For example, problem behavior theory suggests that HRSB and substance use are part of larger collection of problem behaviors engaged in by deviant youth (e.g. antisocial behavior, violence) and may actually be a part of a single behavioral syndrome (see Jessor & Jessor, 1977; Donovan, & Jessor, 1985; Donovan, Jessor, & Costa, 1988). Additionally, personality traits such as impulsivity, sensation seeking, and self-regulation difficulties have been linked to increased likelihood of experimenting with sex, substance use, and other illegal behaviors (Zuckerman, 1994; Crockett, Raffaelli & Shen, 2006; Piehler, Véronneau, & Dishion, 2012; Fosco, Caruthers & Dishion, 2012).

In addition to these intrapersonal factors there are environmental factors that seem to play a role in an individual's risk for engaging in these types of behaviors. Bronfenbrenner's (1979) Ecological systems theory provides a comprehensive framework to understand developmental precursors of HRBs. Ecological systems theory emphasizes the dynamic interaction among multiple levels of influence on a person's behavior. According to this perspective, there are both intrapersonal factors (e.g., temperament) and environmental factors that contribute to the decision to engage in HRBs. There is

[2] Note from this point on, HRSB and substance use will be collectively referred to as health-risk behaviors (HRBs).

substantial evidence suggesting that, during adolescence, environmental influences play a large role in risk for engaging in HRBs, and that adolescents' are particularly sensitive to environmental influences (e.g. Patterson & Dishion, 1985; Criss, Pettit, Bates, Dodge, & Lapp, 2002; Dishion & Tipsord, 2011; Piehler, et al., 2012; Gifford-Smith & Brownell, 2003; Rodgers, 1999; Van Ryzin, Johnson, Leve, & Kim, 2011; Mulye et al., 2009). Environmental influences include things such as family and peer relationships, exposure to traumatic events, school environment, and neighborhood.

**Trauma and Health Risk Behaviors**

Traumatic events (i.e. physical, sexual, emotional abuse) occur frequently among youth with epidemiological studies showing that between 58% and 90% of youth have experienced at least one trauma, with the majority experiencing multiple traumatic events (Fergusson, Horwood, & Lynskey, 1997; Breslau, Reboussin, Anthony, & Storr, 2005; Finkelhor, Turner, Shattuck, & Hamby, 2013). Greater trauma frequency, severity, and duration has been shown to result in worse outcomes (e.g. Ford, Elhai, Connor, & Frueh, 2010; Ford, Grasso, Hawke, & Chapman, 2013; Richmond, Elliot, Pierce, Aspelmeier, & Alexander, 2009; Thornberry, et al., 2001; Briere & Jordan, 2009). Exposure to trauma is associated with increased risk for academic difficulties, depression, anxiety, and posttraumatic stress disorder (e.g. Gamache Martin, Van Ryzin & Dishion, 2016; Ford et al., 2010; Briere & Jordan, 2009; Goldsmith, Chesney, Heath, & Barlow, 2013; Coker et al., 2002; MacMillan et al., 2001; Cichetti & Toth, 2005; Lansford et al., 2002; Thornberry, Ireland, & Smith, 2001; Breslau, et al., 2005; Richmond, et al., 2009). In addition, a history of trauma has been shown to affect the development of problem behaviors (Jessor & Jessor, 1977; Lansford et al., 2007; Lansford et al., 2002), including problematic substance use (e.g. Ford et al., 2010; Thornberry, et al., 2001; Bensley, Van Eenwyk, & Simmons, 2000; Ireland & Widom, 1994; Widom & White, 1997; Dembo, Dertke, Borders, Washburn, & Schmeidler, 1988; Dembo et al., 1990; Mullen, Martin, Anderson, Romans, & Herbison, 1993) and HRSB (Fergusson, et al., 1997; Arriola, Louden, Doldren, & Fortenberry, 2005; Senn, Carey, Vanable, Coury-Doniger, & Urban, 2007; Wilson & Widom, 2008; Thornberry, et al., 2001; Homma, Wang, Saewyc & Kishor, 2012; Noll, Shenk & Putnam, 2008). For example, in one prospective longitudinal study, Ha et al., (2016) found that higher levels of maltreatment (physical, sexual, emotional abuse) predicted increased likelihood of gang affiliation and higher sexual promiscuity at age 16-17.

In another study, Bensley, et al. (2000) looked at how retrospective self-report of childhood sexual and physical abuse was associated with HRSB and heavy drinking during adulthood and found that, for women who had experienced early and chronic trauma, there was a five-fold increase in risk for engaging in both heavy drinking and HRSB. For men, any sexual abuse was associated with an eight-fold increase in HRSB and physical abuse was associated with a three-fold increase in risk of HRSB and heavy drinking. They also reported that, although only 29% of the women and 19% of the men reported a history of abuse, these individuals accounted for 51% and 50% of those reporting HRSB, respectively. For heavy drinking, of the 25% of women and 23% of men who reported any abuse, those individuals accounted 45% and 33% of those reporting heavy drinking, respectively (Bensley, et al., 2000). Unfortunately, individuals who experience trauma have been shown to be more likely come from adverse family environments, characterized by things such high levels of family conflict and lower levels of parental monitoring (Fergusson, Lynskey, & Horwood, 1996; Gruber & Jones, 1983; Mullen, et al., 1993; Stern, Lynch, Oates, O'Toole, & Cooney, 1995), which has also been shown to increase risk for engaging in HRBs.

**Family Influence on Health Risk Behaviors**

Several theoretical models of human development recognize the influence of the family system as vital to the emotional, cognitive and relational socialization of children (Bronfenbrenner, 1979). Bronfenbrenner's model places the family system, thought to exert influence on the individual through shared genetics and family environment, within the innermost circle of influence (Bronfenbrenner, 1979). Family environment is a multidimensional construct comprised of many factors, including things such as family relationship quality, family conflict, coercive interactions, and parental monitoring, all of which have been identified as influencing youth development (e.g. DiClemente, Crosby, & Salazar, 2006; Dishion, & Stormshak, 2007; Kincaid, Jones, Sterrett, & McKee, 2012; Van Ryzin et al., 2011).

Parental monitoring is one of the most well studied constructs within the family domain. Defined as knowledge of youth whereabouts as well as oversight of youth activities (Stattin & Kerr, 2000), parental monitoring has been consistently linked to HRBs. By restricting youth’s opportunities to engage in HRBs, parental monitoring reduces vulnerability to both substance use (e.g. Steinberg, Fletcher, & Darling, 1994; Dishion & McMahon, 1998; Van Ryzin, Fosco & Dishion, 2012; Chassin, Pillow, Curran, Molina, & Barrera, 1993) and HRSB (e.g. Lansford et al. 2010; Kotchick, Shaffer, Miller, & Forehand, 2001; Wight, Williamson & Henderson, 2006; Buhi, & Goodson, 2007; DiClemente et al., 2006; Van Ryzin et al., 2011; Kincaid et al., 2012).

Additionally, increasing parental monitoring is a common target behavior in family prevention and intervention programs, which has been shown to decrease the likelihood of youth engagement in substance use (e.g. Dishion, Nelson & Kavanagh, 2003; Stormshak, & Dishion, 2009) and HRSB (e.g. Caruthers, Van Ryzin & Dishion, 2014). For example, two intervention studies investigating the effects of the Family Check-up (FCU) 1) on substance use (Dishion et al., 2003) and 2) on HRSB (Caruthers et al., 2014), found that the prevention effect on these outcomes was mediated by changes in parental monitoring.

Another family construct that has been shown to influence HRBs is family conflict. Family conflict includes behaviors such as intrusive and manipulative forms of control, excessive criticism, having arguments characterized by negative affect, using anger to get one's way, and escalating anger to acts of physical violence. Coercive interaction patterns are central mechanism linking family conflict to problem behaviors, such as HRBs, in youth (Patterson, Reid, & Dishion, 1992). Coercion theorists posit that youth in aversive family environments learn to intensify or escalate problem behaviors (i.e. substance use or HRSB) in order to reduce conflict (Patterson, 1982). Studies suggest that individuals who engage in HRSBs and substance use are more likely to live in homes in which interpersonal relationships, particularly with parents, tend to be more coercive, hostile, distant, non-supportive, or lacking in cohesion (e.g. Small & Luster, 1994; Miller, Forehand, & Kotchick, 1999; Rodgers, 1999; Kincaid, Jones, Cuellar & Gonzalez, 2011; Anderson & Henry, 1994). While it is clear that the family system plays a substantial role in the socialization of children, later in development, as children transition into adolescence and become more autonomous and independent from their families, there is a major interpersonal shift from families toward peers. Indeed, these family interactions can then function as a significant risk or protective factor in adolescence, as youth start navigating increasingly complex peer interactions (Buhrmester, 1990; Ladd, 1999).

**Peer Influence on Health Risk Behaviors**

In adolescence, peers become an important source of reinforcement, modeling, and value development and play a substantial role in promoting positive development or placing youth at risk for negative developmental outcomes (e.g., Criss et al., 2002; Dishion & Tipsord, 2011; Gifford-Smith & Brownell, 2003). Peer relationships can function to enhance academic progress (Veronneau, Vitaro, Brendgen, Dishion, & Tremblay, 2010) or contribute to a cycle of failure and amplify problem behavior, with considerable cost to the youth (e.g. Kiesner, Kerr, & Stattin, 2004). Many behaviors such as substance use and HRSB that are problematic in adulthood have their origins in adolescent peer relationships (Piehler, et al., 2012; Dishion, Ha & Veronneau, 2012). Studies have found that individuals with a history of engaging in risky behavior tend to self-organize into deviant peer groups in early adolescence (Dishion, Ha, & Véronneau, 2012; Dodge, Dishion & Lansford, 2006). This process of deviant peer contagion, whereby the peer group perpetuates, encourages, and normalizes risky or antisocial behaviors through modeling, peer pressure and positive reinforcement (Dishion & Owen, 2002; Patterson, Dishion, & Yoerger, 2000; Van Ryzin & Dishion, 2013) has been found to influence a number of different behaviors, including substance use (e.g. Steinberg et al., 1994; Chassin et al., 1993; Hawkins, Catalano, & Miller, 1992; Van Ryzin, et al., 2012; Van Ryzin & Dishion, 2014) and HRSB (e.g. Lansford, Dodge, Fontaine, Bates, &

Pettit, 2014; Dishion, Ha & Veronneau, 2012; Prinstein, Meade & Cohen, 2003; Kotchick et al., 2001; Brendgen, Wanner & Vitaro, 2007). Beyond simply promoting an amplification of deviant behavior, these deviant peer groups may begin to rely on engaging in risky behaviors as an essential component of social interaction (Dishion & Tipsord, 2011), which can ingrain risky behavior as a necessary prerequisite to social integration and acceptance. This social climate then increases the risk of negative outcomes, such as substance dependence during adulthood (Van Ryzin & Dishion, 2014) and having children at a young age (Dishion, Ha & Veronneau, 2012).

In some studies, deviant peer association emerged as the strongest predictor of HRBs in adolescence (e.g. Metzler, Noell, Biglan, Ary, & Smolkowski, 1994; French & Dishion, 2003; Van Ryzin et al., 2012). For example, French and Dishion (2003) found that, while earlier pubertal status, greater externalizing behavior, higher levels of delinquency, lack of monitoring, and deviant-peer involvement during early adolescence were all univariate predictors of earlier age of first sexual intercourse, deviant-peer involvement was the sole predictor of age of first intercourse in a multivariate analysis. Findings, such as these, make sense in the context of other studies showing that, once children reach adolescence, parents have significantly less influence on adolescents' decisions in certain behavioral domains, including substance use and sexual behavior (Baker, Thalberg, & Morrison, 1988; Kandel & Andrews, 1987; Wilks, 1986), and that interpersonal focus shifts from families toward peers as adolescents age (e.g., Criss et al., 2002; Dishion & Tipsord, 2011; Gifford-Smith & Brownell, 2003).

Better understanding the simultaneous influence of environmental factors, such as trauma and peer and family processes, on an individual’s decision to engage or not engage in risky behaviors is a complex issue that has important implications for prevention and intervention strategies. From early adolescence to adulthood, youth develop peer networks that compete with the influence of parents and family (e.g. Wilks, 1986; Steinberg & Monahan, 2007). For example, an adolescent who comes from a conflictual home environment and spends time with drug using peers may be more likely to escalate problem behavior, whereas an adolescent who spends time with academically engaged peers, may be less at risk for the development of serious problem behavior (see Van Ryzin & Dishion, 2012; Veronneau & Dishion, 2010). Unfortunately, despite the large volume of research investigating how environmental factors (i.e. trauma, family and peer processes) influences adolescent risk behavior, little effort has been made to integrate this literature into a conceptual framework that simultaneously considers multiple systems of influence and the complexity of their combined effects. The majority of extant research focuses on trauma and HRBs (e.g. Thornberry, et al., 2001), peers and HRBs (e.g. Landsford et al., 2014), and parenting and HRBs (e.g. Miller, et al., 1999) independent of the other factors. This study will attempt to better understand the dynamic interaction of multiple systems by looking at the simultaneous influence of environmental factors. Furthermore, even less effort has focused on exploring the prospective influence of these factors on developmental trajectories of these HRBs throughout young adulthood.

**Young Adulthood as a Critical Developmental Period**

The U.S. has historically focused much of its education and prevention funding on preventing or delaying adolescent HRSB and substance use (e.g. Kantor, Santelli, Teitler, & Balmer, 2008; Kirby, 2001) as there are many negative outcomes associated with early engagement in HRBs (e.g. Kotchick et al., 2001; Hawkins et al., 1997; Van Ryzin & Dishion, 2014; Nelson, et al., 2015). Additionally, epidemiologic data suggest that risk behaviors and associated consequences tend to peak in the early 20s, and then decline steadily (Satterwhite et al, 2013; Johnston, O'Malley, Bachman, Schulenberg & Miech, 2014; Mahalik et al., 2013). This change in risk taking behaviors is referred to as "maturing out" (e.g. Winick, 1962) and coincides with developmental and biological changes. Biologically, the prefrontal cortex, the area of the brain responsible for executive functions, such as risk assessment (e.g. Giedd et al., 1999) and self-regulation, finally reaches full maturation at age 26 (Sowell, Thompson, Holmes, Jernigan, & Toga, 1999). Thus, an individual's judgment and decision-making skills improve and they are better able to weigh risks and make sound decisions. Developmentally, researchers have proposed that young adults are less likely to engage in risk behaviors because they adopt new "adult-like" roles, and these behaviors are incompatible with their responsibilities (Bachman et al., 2014; Yamaguchi & Kandel, 1985). Work (Uggen, 2000), marriage (Eitle, Taylor & Eitle, 2010; Leonard & Rothbard, 1999), cohabitation (Duncan, Wilkerson & England, 2006) and, parenthood (Kerr, Capaldi, Owen, Wiesner & Pears, 2011; Oesterle, Hawkins & Hill, 2011) have all been identified as developmental milestones associated with decreases in problematic HRBs (Elder, 1985).

Although trajectories of HRBs during adolescence and processes leading from childhood to adolescent HRBs are already well defined, little is known about comorbidity and stability of HRSB and substance use throughout the 20's, more specifically beyond age 24. The scope of research on HRBs needs to be expanded to explore the differential trajectories of substance use and HRSB during young adulthood, as well as investigate the effects of environmental factors during adolescence on trajectories of these behaviors. Young adulthood, beyond age 24, is still a particularly important time developmentally. First, this is a more normative time for sexual activity (Diamond & Savin-Williams, 2009), so there are many more people engaging in sexual activities. A CDC survey of sexual behavior reported that by age 15, 18% of boys had ever had sexual intercourse whereas by age 30 it had increased to 96% (Martinez et al., 2006). For women, the pattern was similar, with 98% having engaged in sexual intercourse by age 30 (Chandra et al., 2005). Second, in recent decades, young adults in the U.S. have begun to delay developmental milestones such as marriage and having children and the proportion of people obtaining higher education after high school has risen steeply. In 1960, the median age of first marriage was 24 for men and 21 for women and by 2010 it had increased to 28 for men and 27 for women (Elliott, Krivickas, Brault & Kreider, 2012). From 1970 to 2006, the average age of first childbirth increased from 21 to 25 (Mathews & Hamilton, 2009), and obtaining higher education after high school rose steeply from 14% in 1940 to over 60% by the mid-1990s (Arnett & Taber, 1994; Bianchi & Spain, 1996). These sweeping demographic changes could influence the timeline over which young adults "mature out" of engaging in risky behaviors. It is now understood that the late teens and twenties are not simply a brief period of transition into adult roles, but instead characterized by dramatic changes in freedoms and responsibilities and exploration of possible life directions (Arnett, 2000). By limiting research on HRBs to adolescence and the early 20s, we are missing potentially vital information about developmental changes that might occur throughout the 20s, as well as both adaptive and maladaptive environmental factors related to HRBs during this developmental period.

## Gender Differences in HRBs

In addition to investigating developmental trajectories across young adulthood, it is important to explore potential gender differences in trajectories that may become especially notable during developmental period as young adults take on new roles (i.e., parenthood). National statistics suggest that men tend to have higher mean levels of risk behavior than woman (e.g., Johnston et al., 2013; Johnston et al., 2014; SAMHSA, 2015). Longitudinal studies, however, have found that rates of risk behavior for men and women may depend on developmental stage. For example, women tend to report higher levels of substance use and HRSB than men during early adolescence, while men have greater increases in these HRBs over time, and therefore exhibit higher levels of HRBs during middle adolescence and young adulthood (Mahalik et al., 2013; Chen & Jacobson, 2012).

These findings provide some evidence to suggest that there may be gender differences in trajectories of HRBs by developmental stage. Additionally, prior studies focused on the mean HRB trajectory over time and did not investigate the heterogeneity in HRB trajectories that might characterize these developmental stages or whether gender may influence the number of trajectories and/or patterns of trajectories. Thus, it is important that studies examining trajectories of HRBs and heterogeneity in these trajectories consider potential gender differences.

## The Present Study: Hypotheses

The present study sought to model the gender-specific trajectories of substance use and HRSB throughout young adulthood (age 22- age 30), as well as investigate the effects of early trauma, and peer and family factors on the trajectories of these behaviors (see Figure 1 for the proposed model). This study sought to answer lingering questions by modeling gender-specific, longitudinal associations of concurrent HRSB and substance use during young adulthood, an important yet understudied, developmental period. Additionally, trajectories of cigarette use, alcohol use, and marijuana use were modeled separately to examine whether there were differences between substance use trajectories and their associations with HRSB trajectories during young adulthood. Furthermore, the study examined how early family and peer influences, and trauma (separately and in combination), influenced trajectories of HRSB and substance use during young adulthood. Using data from a large, longitudinal, randomized-controlled field trial with intensive measurement of multiple problem behaviors, trauma, and peer and family processes, this study tested the following hypotheses.

**Hypothesis 1a:** Using growth mixture modeling (GMM), trajectories of HRSB and substance use, measured at four time points from age 22 through age 30, were explored separately for males and females. In addition, the association of the type of trajectories for substance use with the type of trajectories for HRSB were investigated. While this was an exploratory analysis, it was hypothesized that various trajectories of HRSB and substance use during young adulthood would emerge.

**Hypothesis 1b:** Growth mixture models were run separately for males and females to explore gender-specific developmental trajectories of HRSB and substance use and the relations among these trajectories throughout young adulthood. It was hypothesized that there would be gender differences regarding the patterns (or typologies) of growth trajectories for substance use and for HRSB.

**Hypothesis 2:** This study examined the independent and simultaneous influence of a history of trauma, and peer and familial factors during adolescence on the typologies of developmental trajectories of HRSB and substance use during young adulthood. These analyses tested the hypothesis that trauma, deviant peer associations (DP), family conflict (FC) and parental monitoring (PM) during adolescence would all influence developmental patterns of HRSB and substance use during young adulthood. It was thought that that youth who reported an extensive history of trauma, had higher levels of engagement with deviant peers, came from families with higher levels of conflict, and experienced less parental monitoring would be at higher risk for the persistent pattern of HRBs. Furthermore, when these factors were looked at simultaneously, it was hypothesized that DP associations in adolescence would have the strongest independent influence on trajectories of health risk behaviors during young adulthood.

# METHODOLOGY

## <u>**Participants**</u>

Participants included 998 individuals and their families, recruited when youth were in sixth grade, with an average age of 12.2 years (SD = .37), from three public middle schools in an ethnically diverse metropolitan community in the northwestern United States. Nine hundred ninety-nine youth and their families consented and were randomized, however one family decided to remove themselves. The remaining sample comprised 526 males and 472 females (47.3%). The ethnic distribution of the sample, based on self-identification, was as follows: 42.3% European American, 29.1% African American, 6.8% Latino, 5.2% Asian American, and 16.4% other ethnicities, including biracial. Annual family income ranged from less than $5,000 to more than $90,000, with the median being $30–$40,000. Primary caregivers' education ranged from "no formal schooling" to "graduate degree," with a median value corresponding to "partial college."

Biological fathers were present in 585 families (58.6%) and 35% were from single-parent families.

## Procedures

**Design Overview.** The proposed study used data from a larger longitudinal study, which began in 1996 when the youth were approximately 12 years old and were approached to participate in a randomized intervention trial of the Family Check-up (FCU) (Project Alliance 1 (PAL1); see Dishion and Kavanagh (2003) for full description of study procedures and more detail about the intervention model). Youth and families who agreed to participate were randomly assigned at the individual level to either control (n=498 youths) or intervention (n=500) classrooms. Using an encouragement design, families were offered the FCU in the seventh and eighth grade of middle school, and again in high school. The intervention effects were not central to the study hypotheses, but intervention status was included as a covariate in the models.

Since age 12, the full sample underwent nine assessments over the span of approximately 20 years during which a variety of survey instruments were given to youth, their families, peers, and teachers. When individuals were age 16-17, they also completed videotaped observation tasks with their family (i.e., Family Assessment Task; FAST) (n=649) and with a friend (i.e., Peer Interaction Task; PIT) (n=721) (see below for a more detailed description of all measurement procedures). On average, at wave 1 youth were 11-12 years old; wave 2: 12–13, wave 3: 13–14, wave 4: 15-16, wave 6: 16–17, wave 7: 18–19, wave 8: 22–23, wave 9: 24–25, wave 10: 26–27, and wave 11: 29–30. Note, there was no wave 5. The proposed study utilized youth, peer and family reports and coded direct observation data collected when participants were **age 16-17** as well as self- report data when participants were **ages 18-19, 22-23, ages 24-25, ages 26-27, and age 29-30**.

**Recruitment and informed consent.** All procedures adhered to ethical guidelines for the conduct of human subjects' research and were reviewed and approved by the Institutional Review Board of University of Oregon and Arizona State University (#00009102). There were no exclusion criteria for the study. When youth were in sixth grade (around age 12), parents of all students enrolled in the participating public schools in regular education classes, were approached for participation in the original intervention study, and 90% consented. Standardized scripts and procedures were used to gather informed consent from all the participants. The informed consent stated that interviews were voluntary, that all data would be confidential, and described the limits of confidentiality. Research assistants and intervention staff were trained in consent procedures and had specialized training in managing any exceptions that occurred during the informed consent process. Participants' who refused to participate were also given the option of declining further contact.

**Retention.** Using well-established protocols for maintaining high levels of retention in longitudinal studies, such as hiring research staff representative of the sample demographics, reasonable reimbursement for participation in assessments, collecting detailed tracking information, and careful training and support for research staff (Capaldi, Chamberlain, Fetrow, & Wilson, 1997; Capaldi & Patterson, 1987), the retention rate was strong with approximately 80% of youth retained across the longitudinal span of the study (86% at age 13; 83% at age 14; 82% at age 15; **80% at age 16-17**; **81% at age 18-19; 82% at age 22-23**; **86% at age 24-25; 80% at age 26-27; and 79% at age 29-30**).

There was no covariation between retention rates and random assignment to the intervention condition or prior patterns of intervention engagement. Thus, there was no threat to the internal validity of this study associated with nonrandom retention as a function of the intervention condition.

**Procedure for survey assessment.** In general, each wave consisted of multi-agent, multi-method information and participants were paid for each completed assessment. Completion and retention rates were similar for the intervention and the control groups. Different combinations of the assessment battery were administered depending on the wave, including standardized clinical interviews, parent, teacher, peer and youth surveys, videotaped observation, and procurement of school, police and DMV records.

During the earlier waves (ages 12-17), youth and their teachers were primarily surveyed in their schools, and other family members were primarily surveyed through mailed questionnaires. If students moved out of their original schools, they were assessed at their new location. **At age 16-17 and 18-19** parents and children were administered a battery of survey instruments, developed by colleagues at the Oregon Research Institute, assessing parenting practices, family dynamics, peer dynamics, substance use, psychological health, self-regulation, and behavior problems (Metzler, Biglan, Rusby, & Sprague, 2001). At **age 18-19** youth also filled out a questionnaire about trauma history. As the youth got older and moved more regularly (i.e. for college) the assessments were sent through the mail (age 22-25) or, more recently (age 26-30), administered over a secure Internet survey or via text message. Assessments were developmentally sensitive, thus the questions changed slightly as the sample aged to address common developmental processes that occur during early adolescence, adolescence, and young adulthood. Individuals from **age 22-30** were administered the Young Adult Interview (Capaldi, Patterson, Dishion, & Wilson, 1996). This interview is an extension of the child interview used in the early and middle adolescent waves of the PAL1 study. The interview includes detailed sections on substance use, as well as sexual behavior, including risk behavior items.

**Procedure for Video Observation Tasks.** When individuals were **age 16-17,** they were invited to participate in videotaped observation tasks with their family (FAST) and with a same-sex, self-nominated friend (PIT). The participant received compensation for completing the interaction tasks (as did the peer for completing the PIT). An interviewer introduced each topic and the dyad was provided with a card that contained a description of the topic to be discussed. At the end of each topic of discussion, the interviewer entered the room and provided the next topic, along with a card that contained a description of the new topic. Participants could decline participation in any specific task; thus, the completion rates varied slightly by task.

Once the interaction was completed, trained research assistants, blind to study hypotheses and participants' experimental condition, coded the full video. Each video was coded with both a macro rating scale and a micro coding system. Macro ratings summarized behavior over an entire observation period, whereas micro coding systems captured behaviors as they unfolded in real time, during each second of the observation. Noldus Observer XT version 11 (Noldus Information Technology, 2012) was the micro coding system used to code the interactions in real time. This study used the macro coding procedure for the FAST to measure family processes (family conflict and parental monitoring) and the micro coding procedure for the PIT to measure deviant peer affiliation. These procedures are described in more detail below.

**Family Assessment Task (FAST).** Six-hundred forty-nine participants took part in the FAST (Dishion & Kavanagh, 1997), a structured 43-minute videotaped observation task in which youth and their parents were asked to discuss a total of 8 different topics, 5 to 8 minutes in length. The first task was a warm-up task in which parents were asked to discuss areas of growth for their child. This task was not coded. The seven tasks that were subsequently coded included (1) a teen-led discussion of an area in which they would like to grow; (2) a monitoring task, during which parents and adolescents discussed a time when the adolescent was with friends and away from adult supervision; (3) a family conflict task, involving a discussion of a time when the parent and adolescent experienced conflict with each other; (4) a problem-solving task, when the parent and youth were asked to solve a problem that both had identified as a "hot topic" on a previously administered questionnaire; (5) a substance-use task, during which the parent and child discussed norms and expectations for adolescent substance use; (6) a family activity task that involved the parent and adolescent discussing a fun activity they could potentially do in the next week; and (7) a positive recognition task, when the parent and adolescent were asked to express appreciation for each family member present.

**Macro coding procedure for FAST**. The Coder Impressions Questionnaire (CIQ; Dishion & Kavanagh, 2003; Forgatch, Fetrow, & Lathrop, 1984) was used to code the interactions between parents and youth. The CIQ measures various aspects of the family management process and problem-solving skills. Undergraduate and graduate research assistants were trained to a kappa criterion of 0.70. Coder drift was addressed through regular random reliability checks on 20% of the final data with inter rater reliability reaching 84%.

**Peer Interaction Task (PIT).** Seven hundred twenty-one participants took part in the PIT. Youth were instructed to bring a close or “best,” same-sex friend to the research office, who was between 14 and 21 years old, and had no familial relationship to the adolescent. The parents of the friend were contacted to obtain informed consent if he/she was younger than 18. Eight different topics were discussed for 5 minutes each including (1) planning an activity (2) a currently nominated problem of the adolescent (3) a currently nominated problem of the peer (4) drug and alcohol use (5) goals for the next year (6) peer groups (7) dating and (8) planning a party. The first topic, planning an activity, was considered a warm up discussion and was not coded.

**Micro coding procedure for PIT.** Twenty trained research assistants, who were blind to information about the participants and study hypotheses, coded videotapes. Approximately 15% of the data were randomly sampled and coded by two individual coders to assess reliability. Percent agreement between coders was 82%. Coders used the Topic Code (Piehler & Dishion, 2005; Poe, Dishion, Griesler, & Andrews, 1990), which focused on measuring durations of deviant talk (See measures section below for more detail on measurement procedures).

## Measures

### Dependent Variables

**High Risk Sexual Behavior (age 22-23, age 24-25, age 26-27, age 29-30).** At age 22-23, age 24-25, age 26-27, age 29-30, individuals reported the degree to which they engaged in various types of HRSB**.** This score is based on other studies that used similar measures of HRSB (Guo et al., 2002, King et al., 2012, Caruthers et al, 2014). Each item below was asked once about heterosexual sexual activity and once about homosexual sexual activity. Two items requested a count of the number of sex partners **over the past 3 months**; theses item were dichotomized such that two or more partners was considered high risk. Six items requested counts of 1) the number of times they had sex with people who were IV-drug users, 2) the number of times they had sex with people who were also having sexual intercourse with other people, and 3) the number of times they had sex with someone who they didn't know very well **over the past 3 months**; these items were dichotomized such that any response other than "0" was considered to be high-risk behavior. Two items asked about the propensity **in general** to have sex under influence of drugs/alcohol (0=never to 4=every time); these items were dichotomized such that any response other than "never" indicated high-risk behavior. These ten (five regarding heterosexual sexual activity and five regarding homosexual sexual activity) dichotomous items were summed to arrive at a final HRSB score at each assessment point, with higher scores indicating more high-risk sexual behavior. Table 2 shows significant positive correlations between the HRSB sum score at each time point and substance use at each time point, supporting criterion validity of this score.

**Substance Use (age 22-23, age 24-25, age 26-27, age 29-30).** At age 22-23, age 24-25, age 26-27, age 29-30, individuals reported the degree to which they engaged in substance use (tobacco, alcohol, and marijuana). For tobacco, alcohol and marijuana, participants were asked how frequently they used each substance **over the past 3 months**. Frequency was measured on an 8-point scale ranging from never to 2–3 times a day or more for each substance, with higher scores indicating more frequent use.

## Predictor Variables

**Trauma History (before age 18).** At age 18-19, participants filled out a modified version of the Brief Betrayal Trauma Survey (BBTS; Goldberg & Freyd, 2006), which was used to assess the frequency of trauma exposure before age 18. The measure was modified in that participants self-reported trauma frequency on a 4-point scale: 0 (never), 1 (once), 2 (2–5 times), and 3 (6–10 times), and an item assessing the death of a child was modified to assess the death of a caregiver. A trauma exposure score was created based on the adolescent's report of the frequency of physical, emotional, and sexual abuse before the age of 18. Physical abuse was measured with three questions that assessed the number of times they (1) were attacked by someone close, (2) witnessed someone very close injured by another person, and (3) witnessed someone very close attack a family member, with all three occurrences resulting in bruises, burns, or physical injury. Emotional abuse was measured with four questions that assessed the number of times (1) they were emotionally or psychologically mistreated for a significant period of time, (2) a family member betrayed their trust, (3) they were abandoned or rejected by a parent or caregiver, and (4) they witnessed someone close committing suicide or being killed. Sexual abuse was measured with two questions that assessed the number of times (1) they were forced to have some form of sexual contact, such as touching, oral sex, or penetration, with someone close, and (2) they were forced to have some form of sexual contact, such as touching, oral sex, or penetration, with someone not close. Scores on these nine items were summed to arrive at a final trauma exposure score, with higher scores indicating more chronic exposure to traumatic events. The BBTS has good construct and convergent validity (DePrince & Freyd, 2001; Martin, Cromer, DePrince, & Freyd, 2013) and test–retest reliability (Goldberg & Freyd, 2006).

Note, the trauma history variable was used at age 18, rather than at an earlier time-point, simply because this measure was only gathered at this time-point.

**Family Conflict (ages 16–17).** The family conflict composite was made up of: 1) mother report (5 item composite), 2) father report (5 item composite), 3) youth report (5 item composite), and 4) direct observation (3 items). Previously, within the same dataset, these above indicators were used in a confirmatory factor analysis (CFA) and emerged as a reliable latent variable, which significantly predicted related problem behaviors (see Fosco, Caruthers & Dishion, 2012 for more information on the family conflict latent variable). This increases the confidence that together these indicators tap into the intended construct. Thus, each of the composite scores were standardized and then averaged to create an overall family conflict score. For single parent families, scores of the single parent's report, the youth's report, and the direct observation score were still standardized and averaged and used to create an overall family conflict score. See below for more specific detail on the individual composites that were combined to create the overall family conflict composite.

*Parent report of family conflict:* Negative family climate was assessed using mother and father report measures of family conflict. The Family Conflict scale (Child & Family Center, 2001a) was used to assess the degree to which family members got angry with each other, had arguments, used anger to get their way, and escalated anger to acts of physical violence (e.g. "We got angry at each other" and "Child got way by being angry"). Each of five items was rated to capture how often these behaviors had occurred during the past week, using a six-point scale (0=never to 6=more than 7 times). Scale reliabilities were adequate with α=. 68 for fathers and α=.74 for mothers.

*Youth report of family conflict:* The Family Conflict scale (Child & Family Center, 2001b) listed above for parents was also completed by adolescents (Scale reliability, α=. 75) and used to assess the degree to which youth perceived family members got angry with each other, had arguments, used anger to get their way, and escalated anger to acts of physical violence. Each of five items was rated to capture how often these behaviors had occurred during the past week, using a six-point scale (0=never to 6=more than 7 times). Sample items include "We got angry at each other" and "I got my way by being angry."

Direct observation of family conflict: In the conflict task, family members talked about a disagreement they had in the past month and how it was resolved. If the disagreement was ongoing, they were asked to talk about how they might resolve it. Three observational ratings of mothers, fathers, and youth were obtained to capture the degree to which each participant expressed 1) criticism, 2) contempt or 3) escalated conflict during the task. Each macro rating was made on a scale ranging from 1 (not at all) to 9 (very much). Codes were aggregated to create an overall family conflict composite score. Cronbach's alpha (.88) revealed good internal consistency for the three codes.

**Parental Monitoring (ages 16–17).** The parental monitoring composite was made up of: 1) mother-report (4 item composite), 2) father report (4 item composite), 3) youth report (5 item composite), and 4) direct observation (7 item composite). Previously, within the same dataset, these above indicators were used in a CFA and emerged as a reliable latent variable, which significantly predicted related problem behaviors (see Van Ryzin & Dishion, 2012 for more information on the parental monitoring latent variable). This increases the confidence that together these indicators tap into the intended construct. Thus, each of the composite scores were standardized and then averaged to create an overall parental monitoring score. For single parent families, scores of the single parent's report, the youth's report, and the direct observation score were still standardized and averaged and used to create an overall parental monitoring score. See below for more specific detail on the individual composites that were combined to create the overall parental monitoring composite.

*Parent report of monitoring:* Mother and father report of monitoring was measured via four items about the degree to which they were aware (0=never or almost never to 5=always or almost always) of the youth's location and activities over the past week. The four questions included 1) knowledge of what youth was doing when away from home, 2) knowledge of what youth was doing after school, 3) knowledge about youth's plans for the coming day and 4) knowledge of youth's interests and activities (Scale reliabilities, $\alpha$=0.89 for mothers and $\alpha$=0.88 for fathers).

*Youth report of monitoring:* Youth report of parental monitoring was measured using five items. Items reflected the degree to which parents were aware (0=never or almost never to 5=always or almost always) of the youth's location, their activities, and their companions during free time activities (e.g., "How often does at least one of your parents know where you are after school?" and "How often does at least one of your parents know what you are doing when you are away from home?"). This scale showed good internal reliability with $\alpha$ = .84.

*Direct observation of monitoring:* A Parental Monitoring scale was based on seven macro-ratings of family behavior during the monitoring task and reflected the coder's impression that the child received adult supervision, involvement, structure, and rules. The coded questions included: 1) child spends time away from adult supervision, 2) child indicates being with friends in settings without adult supervision, 3) there seems to be a lack of adult involvement in child's daily life, 4) there is little structure or lax rules with respect to child's daily routine, 5) is there any mention of the child's peers planning or engaging in deviant behavior? 6) child volunteers important information about activities and companions, and 7) child does or says anything to indicate avoidance of adult supervision. Each macro rating was made on a scale ranging from 1 (not at all) to 9 (very much). Cronbach's alpha (.77) revealed good internal consistency for the seven codes.

**Deviant Peer Involvement (ages 16–17).** The deviant peer involvement composite was made up of: 1) mother-report (4 item composite), father report (4 item composite), youth report (4 item composite), and direct observation (duration proportion). In another paper using the same dataset, these above deviant peer involvement indicators were used in a CFA and emerged as a reliable latent variable, which significantly predicted substance dependence at age 19 (see Van Ryzin & Dishion, 2014 for more information on the deviant peer involvement latent variable). This increases the confidence that together these indicators tap into the intended construct. Thus, each of the composite scores were standardized and then averaged to create an overall deviant peer involvement score. For single parent families, scores of the single parent's report, the youth's report, and the direct observation score were still standardized and averaged and used to create an overall deviant peer involvement score. See below for more specific detail on the individual composites that were combined to create the overall deviant peer involvement composite.

*Parent report of deviant peer involvement*: Mothers and fathers reported on their child's deviant peer involvement by answering four items on the percentage (1=very few, less than 25% to 5=almost all, more than 75%) of the youth's friends that 1) behaved well in school (reverse coded), 2) misbehaved or broke rules, 3) experimented with smoking or other substances, and 4) dressed or acted like gang member (Scale reliabilities, α=.69 for mothers and α=.71 for fathers).

*Youth report of deviant peer involvement:* Youth reported on deviant peer involvement by answering four items assessing frequency (0=never to 6=more than seven times) in the past week they had spent time with peers who 1) get into trouble, 2) fight a lot, 3) take things that don't belong to them, and 4) engage in substance use (tobacco, marijuana, alcohol) (Scale reliability, α=. 81).

*Direct observation of deviant peer affiliation:* Deviant peer affiliation was measured based on the concept of "deviancy training," which hypothesizes that positive reinforcement by a peer for deviant behavior makes those deviant behaviors more likely to occur (e.g. Dishion, Andrews, & Crosby, 1995; Dishion, Spracklen, Andrews & Patterson, 1996; Dishion, Eddy, Haas, Li, & Spracklen, 1997). Prior research has shown that duration of a deviancy-training episode provides a normally distributed index for the deviancy training process (Van Ryzin & Dishion, 2014; Dishion, 2000; Granic & Dishion, 2003). Deviancy training was measured using a percent duration score, which refers to the percentage of the total time a dyad engaged in conversation about deviant topics (i.e. deviant talk). Deviant talk with friends was coded for all verbal and nonverbal behavior that was not appropriate to the setting or task or that violated community or societal rules (Dishion, et al., 1996), including things such as references to illegal activities (e.g. substance use) or causing purposeful physical or emotional harm to someone else. The percent duration scores for each member of the dyad were averaged to form an overall percent duration score for the dyad. A larger percentage of the interaction devoted to discussing deviant topics was thought to reflect more extensive deviant influence within the dyad.

Note, the family conflict, parental monitoring, and deviant peer involvement variables were used at age 16-17, rather than at an earlier time-point, because this time-point included direct observation and thus provided an opportunity to create a strong measure by using multi-method and multi-informant data. In addition, as mentioned above, previous studies (Fosco, et al., 2012; Van Ryzin & Dishion, 2014; Van Ryzin & Dishion, 2012) showed these as reliable latent variables, which increases the confidence that they tap into the intended constructs.

## Control Variables

**Socio-economic status (SES) (age 16–17).** SES was measured using a combination of parents reports of their employment status, education, income, housing status, and financial aid to the family. When data were available from both parents, the highest level of each variable among the two parents was chosen for employment and education. Employment was coded as follows: 4 = full-time or self-employed; 3 = part time; 2 = seasonal; 1 = disabled, unemployed, temporary layoff, homemaker, retired, or student. Education was coded as follows: 5 = graduate degree or college degree; 4 =

junior college or partial college; 3 = high school graduate; 2 = partial high school or junior high completed; 1 = 7th grade or less or no formal schooling. For the rest of the indicators, one global score was used. Family housing was coded as follows: 5 = own your home; 4 = rent your home; 3 = motel/temporary; 2 = live with a friend or live with a relative; 1 = emergency shelter or homeless. Household income was coded as follows: 7 = $90K or more; 6 = between $70K and $90K; 5 = between $50K and $70K; 4 = between $30K and $50K; 3 = between $20K and $30K ; 2 = between $10K and $20K; 1 = less than $10K. Financial aid was measured as a sum of dichotomous indicators including, whether the family received food stamps, Aid to Dependent Children, other welfare, medical assistance, and Social Security death benefits, reverse coded. These variables were then standardized and averaged (Scale reliability, α=. 71). This composite has been used to represent SES in numerous other studies using this dataset, and has emerged as a reliable variable, which significantly predicts related outcomes (e.g., see Van Ryzin & Dishion, 2014; Van Ryzin, Fosco & Dishion, 2012; Dishion, Ha & Véronneau, 2012 for more information on the SES variable).

**Intervention Status.** Random assignment to control group was coded as 0 and intervention group as 1.

**Race.** The race variable was dummy coded into four separate variables with European American being the reference group. The four variables thus represent African American vs. European American, Hispanic vs. European American, Asian American vs. European American, and Native American and mixed race vs. European American (note: this last group is labelled as “other” in all tables).

**Gender.** Males were coded as 1 and females were coded as 0.

**Analytic Plan. The hypothesized model is shown in Figure 1.**

**Software and missing data handling.** The proposed analyses were carried out using SPSS 23 (IBM Corp, 2015) and Mplus version 7 (Muthén & Muthén, 2012). Due to the longitudinal nature of the study, missing data was present on both the predictor and outcome variables. All models that included missing data were fit in Mplus using full information maximum likelihood (FIML) estimation (Muthén & Muthén, 2012). Please note that, while FIML was used to handle missing data, participants who did not have scores on any of the variables that were used in the growth mixture models (GMM; Muthén & Shedden, 1999) (see below for more information in trajectory analyses) were automatically excluded from the analyses. For all subsequent multinomial logistic regression analyses, the full sample of 998 was used, with FIML estimation handling any missing data.

**Preliminary Analyses.** Prior to conducting main analyses, distributions of all variables were examined for non-normality. Based on recommendations from West, Finch, and Curran (1995) skewness below 2.0 and kurtosis below 7.0 was deemed acceptable. Second, data were examined for potential influential data using multilevel outlier analysis using DFFITS, DFBETAS, and Cook's distance as criterion (Neter, Wasserman, & Kutner, 1989). Additionally, correlations were inspected to assess relations among study variables.

**Trajectory analyses.** Next, growth mixture modeling (GMM; Muthén & Shedden, 1999) was used to model HRSB and substance use (tobacco, alcohol, and marijuana) from age 22 to 30. GMM is a person-centered analytic approach that attempts to classify individuals into distinct groups based on response patterns, such that individuals within a group will have more similar patterns of response than individuals between groups (Muthén & Asparouhov, 2008; Muthén & Shedden, 1999; Jung & Wickrama, 2008; Reinecke & Seddig, 2011). In this study, we used GMM to classify individuals based on levels of HRSB, tobacco use, alcohol use and marijuana use over time. Models for HRSB, Tobacco, Alcohol and Marijuana were modeled separately. Within each of these models' males and females were also modeled separately, because they may have different numbers of typologies and shapes of trajectories. For each model two forms of growth trajectories, linear and quadratic, were fit to the data to determine which growth trajectory best fit the data. Both linear and quadratic GMMs were conducted with a one-class solution with classes iteratively increased until the best solution was indicated. With GMMs, there is not a single statistical indicator of good model fit, and thus a combination of statistical indicators, interpretability, and parsimony of the solution were considered when determining the best fitting model (e.g., Nagin & Odgers, 2010; Marsh, Lüdtke, Trautwein, & Morin, 2009; Muthén, 2004).

Model fit was evaluated with five common indices (Bauer and Curran, 2003; Muthén & Muthén, 2012): (a) Bayesian information criterion (BIC; Schwartz, 1978), (b) sample-size adjusted BIC (SSABIC; Sclove, 1987), (c) Lo–Mendell–Rubin adjusted likelihood ratio (LMR-LR) test, (d) bootstrapped likelihood ratio test (BLRT; McLachlan & Peel, 2000), and (e) entropy. Lower values of BIC and SSABIC indicate a better fitting model (Tein, Coxe, & Cham, 2013; Muthén, 2004). Lo, Mendell, and Rubin (2001), developed the Lo–Mendell–Rubin adjusted likelihood ratio (LMR-LR) test, which compares the improvement in fit between neighboring class models and provides a p-value that can be used to determine whether there is a statistically significant improvement in fit with the inclusion of one more class. A significant BLRT $\chi 2$ value ($p < .05$) indicates that the specified model fits the data better than the specified model with one less class (Nylund, Asparouhov & Muthén, 2007). Entropy, which is a measure of the quality of classification, uses higher values to indicate better classification of individuals into their most likely trajectory class. Entropy values range from 0 to 1, with values of .70 or higher indicating good classification accuracy (Reinecke, 2006). Considering this information, to select the optimal number of classes, a primary weight was placed on the following values: **1) BIC and SSABIC; 2) LMR-LR; 3) BLRT; 4) interpretability, and parsimony of the solution; and 5) entropy.** Finally, because the local maximum is often encountered in likelihood estimation, multiple different sets of starting values were used (Muthén, 2004).

After determining the optimal number of latent classes, means and slopes on the growth factors were used to characterize the classes, and trajectories for males and females for each risk behavior were assessed for similarities in number of classes and trajectory patterns. If it was determined that male and female participants had the same optimal number of classes, based on the five model fit indices listed above, as well as similar trajectory patterns, then they were combined into one sample. GMMs were then run with the full sample, using the same procedures and fit criteria from above, to assure that the model fit was still appropriate, and the trajectory patterns remained similar. Please note that during these trajectory analyses, to prevent typologies and shapes of trajectories from being influenced by demographic and psychosocial variables (i.e., SES, trauma exposure), trajectories were created independently. Demographic and psychosocial factors were subsequently included in the multinomial logistic regression models to determine differences in trajectories on these variables.

**Extraction of the classes.** Once the optimal number of classes was determined for each risk behavior using growth mixture modeling, posterior probabilities were used to assign youth to their most likely class based on their risk behavior trajectory and to extract the classes. This extracted group information, in this case the most probable risk behavior trajectory, was then used to compare these groups on the various predictors in subsequent analyses. The GMM solution provides posterior probabilities of membership, ranging from 0 to1, in each class for each individual in the sample. When the GMM solution fits the data well, most individuals will have a posterior probability of close to 1 for the one profile that represents the "most likely" class to which they are assigned, and a probability of close to 0 for the other classes. This "classify and analyze" approach has been used successfully in other studies (Agrawal, Lynskey, Madden, Bucholz & Heath, 2007; Varvil-Weld, Scaglione, Cleveland, Mallett, Turrisi & Abar, 2014). Classes were then exported to SPSS 23 (IBM Corp, 2015) as a variable, which represented each individual's most probable trajectory of HRSB, tobacco use, alcohol use and marijuana use. These classes of trajectories of HRSB, tobacco use, alcohol use and marijuana use were then used within subsequent analyses.

**Creation of co-occurring high-risk sexual behavior and substance use classes.** After classes for trajectories of HRSB, tobacco use, alcohol use and marijuana use were exported, three new variables were created, using these exported GMM classes, to create co-occurring HRSB and substance use classes. These new classes represent an individual's joint HRSB and substance use trajectories. One variable was created to represent joint HRSB and tobacco use, another to represent joint HRSB and alcohol use, and a final variable to represent joint HRSB and marijuana use. In other words, the class an individual ends up in depends on which class they were categorized in for HRSB as well as which class they were categorized in for substance use (tobacco, alcohol or marijuana). For example, all individuals who, based on the GMMs, were deemed most likely to be in the *low* HRSB class and the *low* tobacco use would be classified in one class, and all individuals who, based on the GMMs, were deemed most likely to be in the *low* HRSB class and the *high* tobacco use, would be classified in another class. If after creating the co-occurring classes, the n of any of the classes was below 20, these classes were excluded from subsequent analyses because the sample size would be too small for the associations between predictors and class membership to be estimated reliably.

**Prediction of individual risk behavior latent classes.** Next, multinomial logistic regressions were used to examine whether DP, FC, PM, and trauma were independently predictive of the individual risk behavior latent classes that emerged (i.e., HRSB, tobacco use, alcohol use, and marijuana use, one at a time). Finally, multinomial logistic regression was again used to examine whether DP, FC, PM, and trauma were simultaneously predictive of the individual risk behavior latent classes that emerged. The correlations among predictors ranged from r =.09 - .41 (see Table 2). All analyses controlled for youth-reported ethnic/racial background (African American vs. European American, Hispanic vs. European American, Asian American vs. European American, Native American and mixed race vs. European American), socio-economic status, intervention status and gender. All possible pairwise comparisons of classes were conducted. P values were corrected for multiple testing using the false discovery rate

(FDR) correction (Benjamini & Hochberg, 1995). The correction was applied to all p values of the key predictors of interest (DP, FC, PM, and trauma) within each outcome (e.g. alcohol use trajectory classes).

**Prediction of co-occurring high-risk sexual behavior and substance use classes.** The last step was to use multinomial logistic regressions to examine whether DP, FC, PM, and trauma were 1) independently and 2) simultaneously predictive of all of the co-occurring high-risk sexual behavior and substance use latent classes that emerged. Again, all analyses controlled for youth-reported ethnic/racial background (African American vs. European American, Hispanic vs. European American, Asian American vs. European American, Native American and mixed race vs. European American), socio-economic status, intervention status and gender. To reduce the multiplicity of comparisons, only the low HRSB, low substance use (tobacco, alcohol or marijuana) class was used as the referent class. In addition, P values were again corrected for multiple testing using the FDR correction (Benjamini & Hochberg, 1995). The correction was applied to all p values of the key predictors of interest (DP, FC, PM, and trauma) within each outcome (e.g. co-occurring HRSB and alcohol use trajectory classes).

# RESULTS

## **Preliminary Analyses**

Data were examined for potential influential data using multilevel outlier analysis using DFFITS, DFBETAS, and Cook's distance as criterion (Neter et al., 1989) and no influential points were identified. The descriptive statistics for the study variables are reported in Table 1. Skewness and kurtosis of the study variables fell within the acceptable range (skewness $\leq 2$ and kurtosis $\leq 7$; West, et al., 1996). Growth mixture modeling assumes that variables are normally distributed, so the MLR estimator in Mplus was used to enhance robustness against non-normality (Grimm, Ram, Estabrook, 2016). Correlations among study variables are reported in Table 2.

**Trajectory Analyses**

All models were tested using 500 different random starts. As was suggested by Muthén & Muthén (2012), the number profiles and patterns of fluctuations in log likelihood values were examined to verify that the final model had reached a stable trustworthy solution. If a stable trustworthy solution was not obtained with 500 random starts, then the model was fit with 5000 random starts. If the model still did not converge with 5000 starting values, then the model was not considered a stable trustworthy solution. All GMMs were first fit with a one-class solution with classes iteratively increased until the number of classes was indicated by various fit indices, interpretability, and parsimony of the solution (e.g., Nagin & Odgers, 2010; Marsh et al, 2009). As mentioned above, while FIML was used to handle missing data, participants who did not have scores on any of the variables that were used in the GMM were automatically excluded from the analyses. The final trajectory analyses for HRSB included 908 participants and the trajectory analyses of each of the substances included 921 participants.

**Results for GMMs of male and female risk behaviors.** As mentioned above, trajectory models were first run separately by gender for each risk behavior. Analyses suggested that for each risk behavior the best fitting model for men and women consisted of the same number of classes as well as consistent trajectories. Thus, only the combined, full-sample models are presented below and used in the subsequent analyses. More information about gender specific model fit indices and trajectories for all risk behaviors can be found in Appendix C.

### High Risk Sexual Behavior Trajectory Analyses

**Results for GMMs in the full sample for HRSB.** Table 3 presents the result of the systematic GMM fitting process for HRSB in the full sample. Consistent with the findings for males and females (see Table S1), for full sample HRSB the three-class quadratic solution emerged as the best fitting model (BIC = 8955.71; SSABIC = 8898.55; LMR-LR = 262.53, $p < .00$; BLRT = 270.24, $p = 1.0$). Model fit indices (BIC and SSABIC) continued to decrease up until the three-class model quadratic model and then started to increase again in the linear and quadratic four-class solutions, thus suggesting that the three-class solution was a better fit. In addition, the LMR-LR confirmed that the three-class solution provided a better fit for the data relative to the two-class solution. Although the non-significant BLRT suggests the fit of the three-class model is not necessarily better than the two-class model, all the other fit indices suggest that it is, and therefore we decided that overall the quadratic three-class model was the best fit for HRSB. Separation among the three classes was found to be high with entropy = .85 (Clark & Muthén, 2009).

Full sample HRSB trajectory classes are shown in Figure 2. Consistent with the findings for males and females (see Figure S1), the three classes included: (1) a **stable, low HRSB** class, (2) an **increasing HRSB** class, and (3) a **deceasing HRSB** class. The **stable, low HRSB** class, comprised 74.7% (n = 700) of the sample, and was characterized by low levels of HRSB from age 22 through age 30. At each time point during young adulthood, the **stable, low HRSB** class, on average, endorsed engaging in less than 1 of the HRSBs measured over the past three months. The **increasing HRSB** class comprised 11.5% (n = 95) of the sample and was characterized by moderate levels of HRSB at age 22 and then steadily increased to high levels of HRSB during the mid and late 20s. The **increasing HRSB** class, from around age 22-25 endorsed engaging in, on average, 1.5 HRSBs over the past three months, which then increased to around 2 by age 26-27 and then 3 by age 29-30. The **decreasing HRSB** class comprised 13.7% (n = 113) of the sample and was characterized by high levels of HRSB during the early to mid-20s and then decreased from the mid to late 20s to low levels of HRSB. The **decreasing HRSB** class, started out, at age 22-23, by endorsing engaging in, on average, 3 HRSBs over the past three months, which then decreased to around 2 by age 24-25, 1 by age 26-27 and less than 1, by age 29-30.

**Tobacco Use Trajectory Analyses**

**Results for GMMs in the full sample for tobacco use.** Table 4 presents the result of the systematic GMM fitting process for tobacco use in the full sample. Consistent with the findings for males and females (see Table S2), for full sample tobacco use the four-class quadratic solution emerged as the best fitting model (BIC = 11964.13; SSABIC = 11903.78; LMR-LR = 849.47, $p < .00$; BLRT = 880.59, $p = 1.0$). The BIC and SSABIC steadily decreased through the five-class solutions. Although the BIC and SSABIC were lowest in the five-class solutions, other fit indices suggested that the four-class model was a better fit than the five-class model. First, the LMR-LR was significant for the four-class quadratic solution, confirming that the four-class solution provided a better fit to the data relative to the three-class solution. Second, both the LMR-LR and the BLRT were not significant for the linear and quadratic five-class solutions, suggesting that the five-factor model did not improve fit relative to the more parsimonious four-factor model. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the fit of the four-class model was not necessarily better than the three-class model, all of the other fit indices suggested better fit for the four-factor model. Therefore, the quadratic four-class model was selected as providing the best overall fit for tobacco use in the full sample. Separation among the four classes was found to be extremely high with entropy = .95 (Clark & Muthén, 2009).

Full sample tobacco use trajectory classes are shown in Figure 3. Consistent with the findings for males and females (see Figure S2), the four classes that emerged included: (1) a **stable, low tobacco use** class**,** (2) an **increasing tobacco use** class, (3) a **decreasing tobacco use** class, and (4) a **stable, high tobacco use** class. The **stable, low tobacco use** class comprised 56.9% (n = 531) of the sample and was characterized by consistently low levels of tobacco use from age 22 through age 30. At each time point during young adulthood, the **stable, low tobacco use** class, on average, endorsed "never" using tobacco over the past three months. The **increasing tobacco use** class comprised 7.3% (n = 60) of the sample and was characterized by low levels of tobacco use during the early to mid-20s and then steadily increased use to moderate and then high levels of tobacco use during the mid and late 20s. The **increasing tobacco use** class, started out, at age 22-23, "never" using tobacco over the past three months, but increased to around "once a month" by age 24-25, around "2/3 times a week" by age 26-27, and around "once per day" by age 29-30. The **decreasing tobacco use** class comprised 10.8% (n = 96) of the sample and was characterized by high levels of tobacco use during the early to mid-20s and then decreased use from the mid to late 20s from moderate to low levels of tobacco use. The **decreasing tobacco use** class, started out, at age 22-23, using tobacco around “once per day” over the past three months, but decreased to around “once a week” by age 24-25, around “every 2-3 weeks” by age 26-27, and “never” by age 29-30. The **stable, high tobacco use** class comprised 24.9% (n = 234) of the sample and was characterized by consistently high levels of tobacco use from age 22 through age 30. At each time point during young adulthood, the **stable, high tobacco use** class, on average, endorsed using tobacco “2-3 times a day or more” over the past three months.

**Alcohol Use Trajectory Analyses**

**Results for GMMs in the full sample for alcohol use.** Table 5 presents the result of the systematic GMM fitting process for alcohol use in the full sample. Consistent with the findings for males and females (see Table S3), the four-class quadratic solution emerged as the best fitting model (BIC = 12859.83; SSABIC = 12799.49; LMR-LR = 180.02, $p < .00$; BLRT = 186.61, $p = 1.0$). The BIC and SSABIC steadily decreased through the five-class solutions. Although the BIC and SSABIC were lowest in the five-class solution, other fit indices suggested that the four-class model was a better fit than the five-class model. First, the LMR-LR was significant for the four-class quadratic solution, confirming that the four-class solution provided a better fit to the data relative to the three-class solution. Second, both the LMR-LR and the BLRT were not significant for the linear and quadratic five-class solutions, suggesting that the five-factor model did not improve fit relative to the more parsimonious four-factor model. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the fit of the four-class model was not necessarily better than the three-class model, all of the other fit indices suggest better fit for the four-factor model. Therefore, the quadratic four-class model was selected as providing the best overall fit for alcohol use in the full sample. Separation among the four classes was found to be fair with entropy = .74 (Clark & Muthén, 2009).

Full sample alcohol use trajectory classes are shown in Figure 4. Consistent with the findings for males and females (see Figure S3), the four classes included: (1) a **stable, low alcohol use,** (2) an **increasing alcohol use** class, (3) a **decreasing alcohol use** class, and (4) a **stable, high alcohol use** class. The **stable, low alcohol use** class comprised 21.6% (n = 205) of the sample and was characterized by low levels of alcohol use from age 22 through age 30. At each time point during young adulthood, the **stable, low alcohol use** class, on average, endorsed using alcohol "once or twice" over the past three months. The **increasing alcohol use** class comprised 22.9% (n = 206) of the sample and was characterized by low levels of alcohol use during the early to mid-20s and then steady increases to moderate levels of alcohol use during the mid and late 20s. The **increasing alcohol use** class, started out, at age 22-25, using alcohol around "once a month" over the past three months, but increased to around "once a week" from age 26-30. The **decreasing alcohol use** class comprised 17.3% (n = 140) of the sample and was characterized by moderate/high levels of alcohol use during the early to mid-20s and then decreases in the mid-20s to moderate levels of use and finally low levels of alcohol use during the late-20s. The **decreasing alcohol use** class, started out, at age 22-25, using alcohol around "once a week" over the past three months, but decreased to around "once every 2-3 weeks" by age 26-27, and "once or twice over the past three months" by age 29-30. The **stable, high alcohol use** class comprised 38.1% (n = 370) of the sample and was characterized by consistently high levels of alcohol use from age 22 through age 30.

At each time point during young adulthood, the **stable, high alcohol use** class, on average, endorsed using alcohol "2-3 times a week" over the past three months.

### Marijuana Use Trajectory Analyses

**Results for GMMs in the full sample for marijuana use.** Table 6 presents the result of the systematic GMM fitting process for marijuana use in the full sample. Consistent with the findings for males and females (see Table S4), the four-class quadratic solution emerged as the best fitting model (BIC = 11699.33; SSABIC = 11638.99; LMR-LR = 822.46, $p < .00$; BLRT = 852.59, $p = 1.0$). The BIC and SSABIC steadily decreased through the five-class quadratic solution. The five-class linear solution did not converge and was thus not considered to be a trustworthy solution. Although the BIC and SSABIC was lowest in the five-class quadratic solution, other fit indices suggested that the four-class model provided better fit. First, the LMR-LR was significant for the four-class quadratic solution, confirming that the four-class solution provided a better fit to the data relative to the three-class solution. Second, both the LMR-LR and the BLRT were not significant for the quadratic five-class solution, suggesting that the five-factor model did not improve fit relative to the more parsimonious four-factor model. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the fit of the four-class model was not necessarily better than the three-class model, all of the other fit indices suggested better fit for the four-factor model. Therefore, the quadratic four-class model was selected as providing the best overall fit for marijuana use in the full sample. Separation among the four classes was found to be very high with entropy = .94 (Clark & Muthén, 2009).

Full sample marijuana use trajectory classes are shown in Figure 5. Consistent with the findings for males and females (see Figure S4), the four classes included: (1) a **stable, low marijuana use,** (2) an **increasing marijuana use** class, (3) a **decreasing marijuana use** class, and (4) a **stable, high marijuana use** class. The **stable, low marijuana use** class comprised 65% (n = 610) of the sample and was characterized by low levels of marijuana use from age 22 through age 30. At each time point during young adulthood, the **stable, low marijuana use** class, on average, endorsed "never" using marijuana over the past three months. The **increasing marijuana use** class, comprised 12% (n = 101) of the sample, and was characterized by low levels of marijuana use during the early to mid-20s and then steady increases to moderate and then high levels of marijuana use during the mid and late 20s. The **increasing marijuana use** class, started out, at age 22-25, using marijuana around "once or twice" over the past three months, which then increased to around "once a week" by age 26-27, and around "once a day" by age 29-30. The **decreasing marijuana use** class comprised 9.1% (n = 81) of the sample and was characterized by moderate levels of marijuana use during the early to mid-20s and then decreases from moderate to low levels of marijuana use in the late 20s. The **decreasing marijuana use** class, started out, at age 22-25, using marijuana around "once a week" over the past three months, and then decreased to around "once a month" by age 26-27, and around "never" by age 29-30. The **stable, high marijuana use** class, comprised 13.9% (n = 129) of the sample, and was characterized by high levels of marijuana use from age 22 through age 30. At each time point during young adulthood, the **stable, high marijuana use** class, on average, endorsed using marijuana around "once a day" over the past three months.

## Creation of Co-occurring HRSB *and* Substance Use Trajectory Classes

Once the total number of classes for each risk behavior was determined and the classes were exported, co-occurring HRSB and substance use classes were created. For HRSB the three-class quadratic solution provided the best fit and for all the substances (tobacco, alcohol and marijuana) the four-class quadratic solution provided the best fit. Thus, there were 12 possible combinations of classes when crossing HRSB with each substance. As mentioned above, any of the co-occurring classes with an n of below 20 were excluded from subsequent analyses as the sample size would be too small to reliably estimate associations between predictors and class membership.

**Co-occurring HRSB *and* tobacco use trajectory classes.** For HRSB and tobacco use the following 12 classes were created (see Table 7): 1) **Low HRSB, Low TOB** (47.7%, n = 433), 2) **Increasing HRSB, Low TOB** (4.8%, n = 44), 3) **Decreasing HRSB, Low TOB** (4.8%, n = 44), 4) **Low HRSB, Increasing TOB** (4.5%, n = 41), 5) **Increasing HRSB, Increasing TOB** (1.4%, n = 13), 6) **Decreasing HRSB, Increasing TOB** (0.6%, n = 5), 7) **Low HRSB, Decreasing TOB** (7.5%, n = 68), 8) **Increasing HRSB, Decreasing TOB** (0.9%, n = 8), 9) **Decreasing HRSB, Decreasing TOB** (2.2%, n = 20), 10) **Low HRSB, High TOB** (17.4%, n = 158), 11) **Increasing HRSB, High TOB** (3.3%, n = 30), and 12) **Decreasing HRSB, High TOB** (4.8%, n = 44). Three classes were excluded due to class sizes less than 20, including, 1) Increasing HRSB, Increasing TOB (n = 13), 2) Decreasing HRSB, Increasing TOB (n = 5), and 3) Increasing HRSB, Decreasing TOB (n = 8).

**Co-occurring HRSB *and* alcohol use trajectory classes.** For RSB and alcohol use the following 12 classes were created (see Table 8): 1) **Low HRSB, Low ALC**

(19.3%, n = 175), 2) **Increasing HRSB, Low ALC** (1.3%, n = 12), 3) **Decreasing HRSB, Low ALC** (1.5%, n = 14), 4) **Low HRSB, Increasing ALC** (17.8%, n = 162), 5) **Increasing HRSB, Increasing ALC** (3.1%, n = 28), 6) **Decreasing HRSB, Increasing ALC** (1.7%, n = 15), 7) **Low HRSB, Decreasing ALC** (11.3%, n = 103), 8) **Increasing HRSB, Decreasing ALC** (0.9%, n = 8), 9) **Decreasing HRSB, Decreasing ALC** (3.1%, n = 28), 10) **Low HRSB, High ALC** (28.6%, n=260), 11) **Increasing HRSB, High ALC** (5.2%, n = 47), and 12) **Decreasing HRSB, High ALC** (6.2%, n = 56). Four classes were excluded due to class sizes smaller than 20, including, 1) Increasing HRSB, Low ALC (n = 12), 2) Decreasing HRSB, Low ALC (n = 14), 3) Decreasing HRSB, Increasing ALC (n = 15), and 4) Increasing HRSB, Decreasing ALC (n = 8).

**Co-occurring HRSB *and* marijuana use trajectory classes.** For HRSB and marijuana use the following 12 classes were created (see Table 9): 1) **Low HRSB, Low MJ** (55.3%, n = 502), 2) **Increasing HRSB, Low MJ** (5.9%, n = 54), 3) **Decreasing HRSB, Low MJ** (4.8%, n = 44), 4) **Low HRSB, Increasing MJ** (7.7%, n = 70), 5) **Increasing HRSB, Increasing MJ** (1.4%, n = 13), 6) **Decreasing HRSB, Increasing MJ** (1.8%, n = 16), 7) **Low HRSB, Decreasing MJ** (6.1%, n = 55), 8) **Increasing HRSB, Decreasing MJ** (0.6%, n = 5), 9) **Decreasing HRSB, Decreasing MJ** (2.3%, n = 21), 10) **Low HRSB, High MJ** (8.0%, n = 73), 11) **Increasing HRSB, High MJ** (2.5%, n = 23), and 12) **Decreasing HRSB, High MJ** (3.5%, n = 32). Three classes were excluded from subsequent analyses due to class sizes smaller than 20, including, 1) Increasing HRSB, Increasing MJ (n = 13), 2) Decreasing HRSB, Increasing MJ (n = 16), and 3) Increasing HRSB, Decreasing MJ (n = 5).

**Demographic and Psychosocial Description of Trajectory Classes**

For all subsequent multinomial logistic regression analyses, the full sample of 998 was used, with FIML estimation handling any missing data.

**Description of the HRSB Trajectory Classes**

As stated above, using GMM, three unique developmental trajectories of HRSB emerged among the sample during young adulthood; *1) a low HRSB class, 2) an increasing HRSB class and 3) a decreasing HRSB class.*

**Demographic characteristics of the HRSB trajectory classes.** Table 10 provides more information about the characteristics of the HRSB trajectory classes. Overall, there were no significant differences between HRSB trajectory classes on gender, treatment group, or SES. There were some significant differences between HRSB trajectory classes on ethnic/racial backgrounds. In comparison with European Americans, there were fewer African Americans (27% African American) in the *stable, low HRSB class* than the other two classes, and more Asian Americans (7% Asian American) in the *stable, low HRSB class* than the other two classes. Differences between the HRSB trajectory classes on the family, peer and trauma variables will be discussed in more detail below.

**Results for prediction of the HRSB trajectory classes.** Multinomial logistic regression was used to assess whether developmental trajectories for HRSB could be predicted by levels of *deviant peer association (DP), family conflict (FC) and parental monitoring (PM)*, measured at age 16, and *exposure to trauma* before the age of 18. Models were first run with each factor separate from the other factors (e.g., exposure to trauma without including DP, FC, and PM in the model). Then, in a final model, factors were combined to look at prediction of the HRSB trajectory classes with all predictors in the same model. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. All possible pairwise comparisons of trajectories were conducted and corrected for using the FDR correction (Benjamini & Hochberg, 1995).

When looked at independently, each of the predictor variables, except DP affiliation, distinguished between the distinct HRSB developmental trajectories (see Table 11). First, lower levels of FC predicted membership in the *stable, low HRSB* class relative to the *increasing HRSB* class. Additionally, higher levels of PM and lower levels trauma exposure, predicted greater likelihood of being in the *stable, low HRSB* class relative to both the *increasing* and *decreasing HRSB* classes. There were no significant differences between the *increasing HRSB* class and the *decreasing HRSB* class on any of the predictors.

When the predictors were examined simultaneously in the same model, some of the significant findings were no longer significant (see Table 12). When entered in the same model, FC and PM no longer predicted membership in the distinct HRSB developmental trajectories. Trauma exposure findings stayed the same, with lower levels trauma exposure still predicting greater likelihood of being in the *stable, low HRSB* class relative to both the *increasing* and *decreasing HRSB* classes.

**Description of the Tobacco Use Trajectory Classes**

As stated above, using GMM, four distinct developmental trajectories of tobacco use emerged during young adulthood; *1) a stable, low tobacco use class, 2) an increasing tobacco use class, 3) a decreasing tobacco use class and 4) a stable, high tobacco use class.*

**Demographic characteristics of the tobacco use trajectory classes.** Table 13 provides more information about the characteristics of the tobacco use trajectory classes. Overall, there were no significant differences between tobacco use trajectory classes on gender, treatment group, or ethnic/racial backgrounds. There were some significant differences by SES, with lower mean SES in the *stable, high tobacco use class* than the other three classes. Differences between the tobacco use trajectory classes on the family, peer and trauma variables will be discussed in more detail below.

**Results for prediction of the tobacco use trajectory classes.** Multinomial logistic regression was used to assess whether distinct developmental trajectories of tobacco use could be predicted by levels of *deviant peer association (DP), family conflict (FC) and parental monitoring (PM),* measured at age 16, and *exposure to trauma* before the age of 18. Models were first run with each factor separately (e.g., exposure to trauma without including DP, FC, and PM in the model). Then, in a final model, factors were combined to look at prediction of the tobacco use trajectory classes with all predictors in the same model. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. All possible pairwise comparisons of trajectories were conducted and corrected for using the FDR correction (Benjamini & Hochberg, 1995).

When examined independently, several predictors were significantly related to distinct tobacco use developmental trajectories (see Table 14). Regarding DP affiliation, individuals who exhibited lower levels of DP affiliation were more likely to be in the *stable, low tobacco use* class relative to the *decreasing tobacco use* class and the *stable, high tobacco use* class, and more likely in the *increasing tobacco use* class relative to the *stable, high tobacco use* class. Additionally, higher levels of PM predicted greater likelihood of being in the *stable, low tobacco use* class relative to both the *decreasing tobacco use* class and the *stable, high tobacco use* class, and lower levels of trauma exposure predicted greater likelihood of being in the *stable, low tobacco use* class relative to the *stable, high tobacco use* class. There were no significant differences between the *decreasing tobacco use* class and the *increasing tobacco use* class on any of the predictors, and there were no significant differences between the various tobacco use trajectories with respect to FC.

When the predictors were examined simultaneously in the same model, many of the significant findings were no longer significant (see Table 15). For example, when including all the predictors in the model, the significant findings for PM were no longer significant. In fact, there were no significant differences between any of the various tobacco use trajectories on level of FC or PM. In addition, there were no longer significant differences between the *increasing tobacco use* class and the *stable, high tobacco use* class with respect to DP affiliation.

**Description of the Alcohol Use Trajectory Classes**

As stated above, using GMM, four distinct developmental trajectories of alcohol use emerged during young adulthood; *1) a stable, low alcohol use class, 2) an increasing alcohol use class, 3) a decreasing alcohol use class and 4) a stable, high alcohol use class.*

**Demographic characteristics of the alcohol use trajectory classes.** Table 16 provides more information about the characteristics of the alcohol use trajectory classes. Overall, there were no significant differences between alcohol use trajectory classes on treatment group. There were some significant differences between alcohol use trajectory classes on ethnic/racial backgrounds and gender, with fewer African Americans (23% African American) compared with European Americans, and more males (64% male) in the *stable*, *high alcohol use class* than the other three classes. There were also significant differences related to SES, with higher mean SES in the *stable, high alcohol use class* than the other three classes. Differences between the alcohol use trajectory classes on the family, peer and trauma variables will be discussed in more detail below.

**Results for prediction of the alcohol use trajectory classes.** Multinomial logistic regression was used to assess whether distinct developmental trajectories could be predicted by levels of *deviant peer association (DP), family conflict (FC) and parental monitoring (PM)* measured at age 16, and *exposure to trauma* before the age of 18. Models were first estimated separately for each factor (e.g., exposure to trauma without including DP, FC, and PM in the model). Then, in a final model, factors were entered simultaneously in the same model to look at prediction of the alcohol use trajectory classes. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. All possible pairwise comparisons of trajectories were conducted and corrected for using the FDR correction (Benjamini & Hochberg, 1995).

When examined independently, few predictors were significantly associated with membership in the distinct alcohol use developmental trajectories (see Table 17). The only two significant findings were that higher levels of FC and lower levels of PM predicted greater likelihood of being in the *decreasing alcohol use* class relative to the *stable, low alcohol use* class. There were no significant differences between any of the various alcohol use developmental trajectories based on DP affiliation or level of trauma exposure. Furthermore, when the predictors were examined simultaneously in the same model, there were no significant differences between the various alcohol use developmental trajectories based on any of the predictors (see Table 18).

**Description of the Marijuana Use Trajectory Classes**

As stated above, using GMM, four distinct developmental trajectories of marijuana use emerged during young adulthood; *1) a stable, low marijuana use class, 2) an increasing marijuana use class, 3) a decreasing marijuana use class and 4) a stable, high marijuana use class.*

**Demographic characteristics of the marijuana use trajectory classes.** Table 19 provides more information about the characteristics of the marijuana use trajectory classes. Overall, there were no significant differences between marijuana use trajectory classes on treatment group. There were some significant differences between marijuana use trajectory classes on ethnic/racial backgrounds and gender, with more Asian Americans (9% Asian American) compared with European Americans, and fewer males (46% male) in the *stable, low marijuana use class* and more males (68% male) in the *stable, high marijuana use class*. There were also some significant differences with respect to SES, with higher mean SES in the *decreasing marijuana use class* than the other three classes. Differences between the marijuana use trajectory classes on the family, peer and trauma variables will be discussed in more detail below.

**Results for prediction of the marijuana use trajectory classes.** Multinomial logistic regression was used to assess whether distinct developmental trajectories could be predicted by levels of *deviant peer association (DP), family conflict (FC) and parental* *monitoring (PM),* measured at age 16, and *exposure to trauma* before the age of 18. Models were first run with each factor separately (e.g., exposure to trauma without including DP, FC, and PM in the model). Then, in a final model, the factors were entered simultaneously in a single model to look at prediction of the marijuana use trajectory classes. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. All possible pairwise comparisons of trajectories were conducted and corrected for using the FDR correction (Benjamini & Hochberg, 1995).

When looked at independently, a number of these predictors were significantly related with membership in the distinct marijuana use developmental trajectories (see Table 20). Individuals with lower levels of DP affiliation and lower levels of trauma exposure were more likely to be in the *stable, low marijuana use* class relative to the *increasing marijuana use* class, the *decreasing marijuana use* class, and the *stable, high marijuana use* class. In addition, individuals with higher levels of DP affiliation, were more likely to be in the *stable, high marijuana use* class than the *decreasing marijuana use* class. It was also found that lower levels of FC and higher levels of PM predicted greater likelihood of being in the *stable, low marijuana use* class relative to the *stable, high marijuana use* class. There were no significant differences between the *decreasing marijuana use* class and the *increasing marijuana use* class on any of the predictors.

When the predictors were examined simultaneously in the same model, many of the significant findings were no longer significant (see Table 21). For example, when including all the predictors in the model, the significant findings for FC and PM were no longer significant. In fact, there were no significant differences between any of the marijuana use trajectories on level of FC or PM.  Regarding trauma exposure, most of the significant findings were no longer significant when including all predictors in the same model.  The one exception is that individuals with lower levels of trauma exposure were still more likely to be in the *stable, low marijuana use* class then *the decreasing marijuana use* class. There were also no longer significant differences, with respect to DP affiliation, between the *decreasing marijuana use* class and the *stable, low marijuana use* class or the *stable, high marijuana use* class.

**Description of the Co-occurring HRSB *and* Tobacco Use Trajectory Classes**

As detailed above, 12 distinct co-occurring HRSB and tobacco use (TOB) trajectories were created and 9 were used in following analyses; *1) Low HRSB, Low TOB, 2) Increasing HRSB, Low TOB, 3) Decreasing HRSB, Low TOB, 4) Low HRSB, Increasing TOB, 5) Increasing HRSB, Increasing TOB* (not included in analyses due to small class size), *6) Decreasing HRSB, Increasing TOB* (not included in analyses due to small class size), *7) Low HRSB, Decreasing TOB, 8) Increasing HRSB, Decreasing TOB* (not included in subsequent due to small class size), *9) Decreasing HRSB, Decreasing TOB, 10) Low HRSB, High TOB, 11) Increasing HRSB, High TOB, and 12) Decreasing HRSB, High TOB.*

**Demographic characteristics of the co-occurring HRSB *and* tobacco use trajectory classes.** Table 22 provides more information about the characteristics of the co-occurring HRSB and tobacco use trajectory classes. Overall, there were no significant differences between co-occurring HRSB and tobacco use trajectory classes on gender, treatment group, SES, or ethnic/racial backgrounds, with the exception of a significant difference between classes for African Americans in comparison with European

Americans. African Americans were overrepresented in the *Decreasing HRSB, Low TOB class* (48% African American), the *Decreasing RSB, Increasing TOB class* (60%) and the *Increasing RSB, High TOB class* (43%). Differences between the co-occurring HRSB and tobacco use trajectory classes on the family, peer and trauma variables will be discussed in more detail below.

**Results for prediction of co-occurring HRSB *and* tobacco use trajectory classes.** Multinomial logistic regression was used to assess whether distinct developmental trajectories could be predicted by levels of *deviant peer association (DP), family conflict (FC) and parental monitoring (PM),* measured at age 16, and *exposure to trauma* before the age of 18. Models were first run with each factor separately followed by a model in which factors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. To reduce the multiplicity of comparisons only the *Low HRSB, Low TOB* class was used as the referent class. All comparisons were corrected for using the FDR correction (Benjamini & Hochberg, 1995).

When looked at independently, several predictors were associated with membership in the distinct co-occurring HRSB and tobacco use developmental trajectories (see Table 23). First, with regard to DP affiliation, individuals were significantly more likely to be in the *stable, Low HRSB, Low TOB* class, when they exhibited lower levels of DP affiliation at age 16, than any of the other co-occurring HRSB and tobacco use classes, **except for** the *1) Increasing HRSB, Low TOB and the 2)Decreasing RSB, Low TOB classes*. Second, regarding FC, individuals were significantly more likely to be in the *stable, Low HRSB, Low TOB* class than the *1)*

*Increasing HRSB, High TOB and the 2) Decreasing HRSB, High TOB,* when they exhibited lower levels of FC. There were no other significant differences between the *stable, Low HRSB, Low TOB* class and any of the other co-occurring HRSB and tobacco use classes on FC. Third, individuals with higher levels of PM were significantly more likely to be in the *stable, Low HRSB, Low TOB* class than any of the other co-occurring HRSB and tobacco use classes, **except for** the 1) *Decreasing HRSB, Low TOB class, 2) Low HRSB, Increasing TOB class and 3) Decreasing HRSB, Decreasing TOB class*. Finally, regarding trauma exposure, individuals were significantly more likely to be in the *stable, Low HRSB, Low TOB* class than the 1) *Low HRSB, High TOB class, 2) Increasing HRSB, High TOB class, and 3) Decreasing HRSB, High TOB class,* when they exhibited lower levels of trauma exposure. There were no other significant differences between the *stable, Low HRSB, Low TOB class* and any of the other co-occurring HRSB and tobacco use classes on trauma exposure.

When the predictors were examined simultaneously, prediction of membership of the co-occurring HRSB and tobacco use developmental trajectories changed moderately (see Table 24). Exposure to trauma and DP affiliation were similarly predictive of membership in the various classes, except that there were no longer significant differences, regarding DP affiliation, between the *Low HRSB, Low TOB* class and the 1) *Decreasing HRSB, Decreasing TOB and 2) Low HRSB, Increasing TOB classes*. Additionally, regarding trauma exposure, there were no longer significant differences between the *Low HRSB, Low TOB class* and the *Low HRSB, High TOB class*. Finally, all the significant findings for PM and FC, were no longer significant when including all predictors in the same model.

**Description of the Co-occurring HRSB *and* Alcohol Use Trajectory Classes**

As detailed above, 12 distinct co-occurring HRSB and alcohol use (ALC) trajectories were created and 8 were used in following analyses; *1) Low HRSB, Low ALC, 2) Increasing HRSB, Low ALC (*not included in analyses due to small class size*), 3) Decreasing HRSB, Low ALC (*not included in analyses due to small class size*), 4) Low HRSB, Increasing ALC, 5) Increasing HRSB, Increasing ALC, 6) Decreasing HRSB, Increasing ALC (*not included in analyses due to small class size*), 7) Low HRSB, Decreasing ALC, 8) Increasing HRSB, Decreasing ALC (*not included in analyses due to small class size*), 9) Decreasing HRSB, Decreasing ALC, 10) Low HRSB, High ALC), 11) Increasing HRSB, High ALC, and 12) Decreasing HRSB, High ALC.*

**Demographic characteristics of the co-occurring HRSB *and* alcohol use trajectory classes.** Table 25 provides more information about the characteristics of the co-occurring HRSB and alcohol use trajectory classes. Overall, there were no significant differences between co-occurring HRSB and alcohol use trajectory classes on treatment group. There were some significant differences by gender, SES and race. Compared with European Americans, African Americans were overrepresented in the *Decreasing HRSB, Low ALC class* (43% African American), the *Decreasing RSB, Increasing ALC class* (53%), the *Decreasing RSB, Decreasing ALC class* (50%), and the *Increasing RSB, High ALC class* (49%), and underrepresented in the *Low RSB, High ALC class* (17%). Males were overrepresented in the *Low RSB, High ALC class* (64% male) and the *Decreasing RSB, High ALC class* (70%), and underrepresented in the *Low RSB, Low ALC class* (42%) and the *Low RSB, Decreasing ALC class* (37%). SES was particularly low in the *Decreasing RSB, Low ALC class*. Differences between the co-occurring HRSB and alcohol use trajectory classes on the family, peer and trauma variables will be discussed in more detail below.

**Results for prediction of co-occurring HRSB *and* alcohol use trajectory classes.** Multinomial logistic regression was used to assess whether the distinct developmental trajectories could be predicted by levels of *deviant peer association (DP), family conflict (FC) and parental monitoring (PM),* measured at age 16, and *exposure to trauma* before the age of 18. Models were first run with each factor separately followed by a model in which the factors were entered simultaneously in the same model. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. To reduce the multiplicity of comparisons only the *Low HRSB, Low ALC* class was used as the referent class. All comparisons were corrected for using the FDR correction (Benjamini & Hochberg, 1995).

It was very difficult to predict the distinct co-occurring HRSB and alcohol use developmental trajectories (see Table 26 and 27). The only significant finding when predictors were examined both independently and simultaneously was that individuals who exhibited lower levels of FC were significantly more likely to be in the *stable, Low HRSB, Low ALC* class relative to the *Increasing RSB, Increasing ALC class*. There were no other significant differences between the *stable, Low HRSB, Low ALC* class and any of the other co-occurring HRSB and alcohol use classes on FC, DP, PM or exposure to trauma.

**Description of the Co-occurring HRSB *and* Marijuana Use Trajectory Classes**

As detailed above, 12 distinct co-occurring HRSB and marijuana use (MJ) trajectories were created and 9 were used in following analyses; *1) Low HRSB, Low* MJ, *2) Increasing HRSB, Low* MJ, *3) Decreasing HRSB, Low* MJ, *4) Low HRSB, Increasing* MJ, *5) Increasing HRSB, Increasing* MJ (not included in analyses due to small class size), *6) Decreasing HRSB, Increasing* MJ (not included in analyses due to small class size), *7) Low HRSB, Decreasing* MJ, *8) Increasing HRSB, Decreasing* MJ (not included in subsequent due to small class size), *9) Decreasing HRSB, Decreasing* MJ, *10) Low HRSB, High* MJ, *11) Increasing HRSB, High* MJ, *and 12) Decreasing HRSB, High* MJ.

**Demographic characteristics of the co-occurring HRSB *and* marijuana use trajectory classes.** Table 28 provides more information about the characteristics of the co-occurring HRSB and marijuana use trajectory classes. Overall, there were no significant differences between co-occurring HRSB and marijuana use trajectory classes on treatment group. However, there were significant differences based on gender, SES and race. Compared with European Americans, African Americans were overrepresented in the *Decreasing RSB, Increasing MJ class* (44% African American), the *Increasing RSB, Decreasing MJ class* (40%), the *Decreasing RSB, Decreasing MJ class* (52%), and the *Increasing RSB, High MJ class* (57%), and underrepresented in the *Low RSB, High MJ class* (18%); Asian Americans were overrepresented in the *Low RSB, Low MJ class* (10% Asian American) and underrepresented in the *Increasing RSB, Increasing MJ class* (0%), the *Increasing RSB, Decreasing MJ class* (0%), the *Decreasing RSB, Decreasing MJ class* (0%), and the *Increasing RSB, High MJ class* (0%). Males were overrepresented in the *Increasing RSB, Decreasing MJ class* (80% male), the *Low RSB, High MJ class* (73%), and the *Decreasing RSB, High MJ class* (75%). Regarding SES, low SES was associated with membership in the *Increasing RSB, High MJ class* and high SES was associated with membership in the *Low RSB, High MJ class*. Differences between the co-occurring HRSB and marijuana use trajectory classes on the family, peer and trauma variables will be discussed in more detail below.

**Results for prediction of co-occurring HRSB *and* marijuana use trajectory classes.** Multinomial logistic regression was used to assess whether distinct developmental trajectories of HRSB and marijuana use could be predicted by levels of *deviant peer association (DP), family conflict (FC) and parental monitoring (PM),* measured at age 16, and *exposure to trauma* before the age of 18. Models were first run with each factor separately followed by a final model in which the factors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. To reduce the multiplicity of comparisons only the *Low HRSB*, *Low* MJ class was used as the referent class. All comparisons were corrected for using the FDR correction (Benjamini & Hochberg, 1995).

When examined independently, several predictors significantly related to membership in the distinct co-occurring HRSB and marijuana use developmental trajectories (see Table 29). First, with regard to DP affiliation, individuals were significantly more likely to be in the *stable, Low HRSB, Low MJ* class than the *1) Low HRSB, Increasing MJ class, the 2) Low HRSB, High MJ class, the 3) Increasing HRSB, High MJ class, and the 4) Decreasing HRSB, High MJ class,* when they exhibited lower levels of DP affiliation. Second, with regard to FC, individuals were significantly more likely to be in the *stable, Low HRSB, Low MJ* class than the *1) Low HRSB, High MJ class, the 2) Increasing HRSB, High MJ class, and the 3) Decreasing HRSB, High MJ class,* when they exhibited lower levels of FC. Third, regarding PM, individuals were significantly more likely to be in the *stable, Low HRSB, Low MJ* class than the *Decreasing HRSB, High MJ class* when they exhibited higher levels of PM. Finally, individuals with a lower levels of trauma exposure were significantly more likely to be in the *stable*, *Low HRSB, Low MJ* class than any of the other co-occurring HRSB and marijuana use classes, **except for** the 1) *Increasing HRSB, Low MJ class, 2) Decreasing HRSB, Low MJ class, 3) Low HRSB, Increasing MJ class and the 4) Low HRSB, High MJ class.*

When the predictors were examined simultaneously (see Table 30), many of the findings were no longer significant. First, all the significant findings for PM and FC were no longer significant when the predictors were entered simultaneously. Second, there were no longer significant differences, regarding DP affiliation, between the *Low HRSB, Low MJ* class and the 1) *Increasing HRSB, High MJ and 2) Decreasing HRSB, High MJ classes*. Finally, regarding exposure to trauma, there were no longer significant differences between the *Low HRSB, Low MJ* class and the 1) *Low HRSB, Decreasing MJ and 2) Increasing HRSB, High MJ classes*.

# DISCUSSION

Using data from a large, longitudinal, randomized-controlled field trial with intensive measurement of problem behavior, and peer and family processes, this study sought to model gender-specific trajectories of substance use and HRSB throughout young adulthood, as well as investigate the effects of early trauma, and peer and family factors on the trajectories of these behaviors. First, to better understand trajectories of risk behaviors during young adulthood, an important yet understudied developmental period, this study used GMM to model gender-specific trajectories of HRSB and substance use (tobacco, alcohol, marijuana) independently, as well as look at HRSB and substance use concurrently, from age 22 through age 30. While this was an exploratory analysis, it was hypothesized that various trajectories of HRSB and substance use would emerge during young adulthood and that men and women would differ in the optimal number of classes or patterns (typologies) of trajectories. Results of the GMM suggested that, in fact, there were varying trajectories of all risk behaviors during young adulthood. However, there were no differences in the number of classes or trajectory patterns between men and women.

The second part of the study sought to better understand the role early environmental influences play in risk for engaging in HRBs during young adulthood. Multinomial logistic regression was used to examine how family and peer factors, and trauma exposure during adolescence, both separately and in combination, influence trajectories of HRSB and substance use. These analyses tested the hypothesis that youth who reported an extensive history of trauma, had higher levels of engagement with deviant peers (DP), came from families with higher levels of conflict (FC), and experienced less parental monitoring (PM) would be at higher risk for persistent patterns of HRBs. In addition, it tested the hypothesis that, when including all these factors simultaneously in the same model, there would be overlapping effects among the predictors, and DP associations would have the strongest influence on trajectories of HRBs during young adulthood. Results of the multinomial logistic regressions were complex. In general, there were several robust predictors of membership in distinct trajectories of HRBs, all of which were in the expected direction. Further, when including all predictors in one model, there were overlapping effects among the predictors, and it seemed that, for certain risk behaviors, DP associations and exposure to trauma had the most robust effects. DP association had the most robust effects on the tobacco and marijuana use trajectory classes, and history of trauma had the most robust effects on the HRSB trajectory classes. Taken together, results suggest that young adults are still at risk for engaging in HRBs, and there are risk and protective factors in adolescence that influence persistent risk and changes in patterns of HRBs during this developmental period.

**Health Risk Behavior Trajectory Analyses**

As indicated above, it was hypothesized that various trajectories of HRSB and substance use would emerge during young adulthood. This hypothesis was supported for HRSB and all substances. The three-class quadratic solution emerged as the best fitting model for trajectories of HRSB during young adulthood. These three meaningfully distinct trajectory classes included: (1) a **stable, low HRSB class** (74.7% of the sample), (2) an **increasing HRSB class** (11.5% of the sample) and (3) a **decreasing HRSB class** (13.7% of the sample). While the three-class solution was the best fitting model for HRSB trajectories, the four-class solution appeared to fit best for substance use. The four-class quadratic solution emerged as the best fitting model for trajectories of tobacco use, alcohol use, and marijuana use during young adulthood. These four meaningfully distinct substance use trajectory classes included: (1) a **stable, low substance use class** (tobacco, 56.9%; alcohol, 21.6%; marijuana, 65%)**,** (2) an **increasing substance use class** (tobacco, 7.3%; alcohol, 22.9%; marijuana, 12%), (3) a **decreasing substance use class** (tobacco, 10.8%; alcohol, 17.3%; marijuana, 9.1%), and (4) a **stable, high substance use class** (tobacco, 24.9%; alcohol, 38.1%; marijuana, 13.9%). While the same four trajectory patterns emerged for all substances, the distributions of individuals the four classes were somewhat difference depending on substance. Percentages of individuals in the tobacco and marijuana use trajectory classes were more similar than those in the alcohol use classes. For example, the largest proportion of individuals were in the stable, low use class, for both tobacco and marijuana use (56.9% and 65% respectively), while a much lower proportion of individuals were in the stable, low alcohol use class (21.6%). In fact, for alcohol use, the largest proportion of individuals were in the stable, high alcohol use class (38.1%). This may be related to the measurement of substance use in this study and is discussed below.

These findings provide further evidence that there are distinct developmental trajectories of HRBs that extend across young adulthood. This study was also the first to my knowledge, to look at varying trajectories of HRSB beyond the age of 24. Three distinct trajectories of HRSB were identified. Prior research has typically identified 4 to 6 different types of substance use trajectories, with most studies identifying a group categorized as stable low substance users, a group categorized as stable high substance users, a group categorized as increasing substance users and a group categorized as decreasing substance users (e.g., Jackson & Sher, 2005; Costello et al., 2008; Jackson et al., 2008). Trajectory classes in the current study included the same four substance use trajectory patterns despite extending assessments into the late 20s.

Taken together these findings suggest that young adulthood is still a critical developmental time-period for studying and targeting HRBs for intervention. While prior research has found that adolescence and earlier adulthood pose the highest risk for engaging in HRBs, and that HRBs tend to decrease thereafter (i.e. individuals "mature out" of those behaviors) (e.g., Winick, 1962; Satterwhite et al, 2013; Johnston et al., 2014; Mahalik et al., 2013), the findings in this study suggest that this is not the case for all individuals. In fact, for substance use, there appears to be a group that continues to persist at stable high levels of substance use, even after the age when these behaviors tend to decrease. Additionally, there are other groups characterized by increases in substance use and HRSB across young adulthood. These classes may represent individuals who are a part of what prior research has called a "late onset" group (e.g. Chassin et al., 2000; Jackson & Sher, 2005; Jackson et al., 2008; Costello et al., 2008). In order words, a group that during adolescence seems to engage in low levels of risk behavior but may be at risk for engaging in risky behaviors at a later age. Alternatively, they may represent a group of individuals who previously engaged in higher levels of health risk behaviors, decreased at some point, and increased again during young adulthood. In either case, there are still clearly individuals who have not "matured out" of these behaviors. This may be evidence of the influence recent demographic shifts in developmental milestones, such as increased age of first marriage (Elliott et al., 2012) and first childbirth (Mathews & Hamilton, 2009), have had on the timeline over which young adults "mature out" of engaging in risky behaviors. Given how recent demographic shifts in these milestones might influence trajectories of HRBs, future research would benefit from HRB trajectory research that investigates more recent cohorts of individuals, over a longer duration of time, to better understand dynamic generational trends of developmental trajectories of risk behaviors. Furthermore, future studies should more thoroughly investigate the effects of factors such as marriage, cohabitation, parenthood and years of education on trajectories of HRBs. The current study provides evidence that there are clearly developmental changes regarding HRBs that continue beyond age 25, and thus young adulthood is still an important developmental stage to include when investigating the developmental course of risk behaviors. Such studies may have important implications for who to target in prevention and intervention efforts.

**Gender Differences in Health Risk Behavior Trajectory Analyses**

It was also hypothesized that men and women would differ in the optimal number of classes or patterns (typologies) of trajectories, but this hypothesis was not supported. Analyses suggested that, for each HRB, the best fitting model for men and women included the same number of classes as well as consistent trajectories (see Appendix C). It is important to note that, while the number of classes was chosen based on strongest model fit, and resulted in the same number of classes for both genders, the patterns of trajectories between genders were only examined descriptively and were not formally tested for statistical differences. Nonetheless, these findings suggest that, during young adulthood, men and women seem to have similar developmental variation in HRB trajectories. While this was not originally predicted, this finding is in line with Brodbeck, Bachmann, Croudace & Brown, 2013. Brodbeck et al. (2013) used a longitudinal cohort-sequential approach to look at the developmental trajectories of various risky behaviors (alcohol use, drunkenness, cannabis use, deviance, smoking and HRSB), from age 16 to 29. Their study found no gender differences in the course of most risk behaviors (alcohol use, drunkenness, cannabis use, smoking and HRSB), except for deviance, where women showed a slower decrease. While Brodbeck et al. (2013) only considered the mean trajectory by gender, the current study went a step further by considering gender differences in the heterogeneity of HRB trajectories, within a latent class framework. In both cases men and women tended to have similar developmental variation regarding HRB trajectories, suggesting that, when looking at trajectories of HRBs during young adulthood, men and women may not have to be analyzed separately. It is important to remember, however, that this study only looked at a limited time-period between ages 22-30. Thus, it is unclear what trajectories looked like prior to age 22 and after age 30, or the extent to which men and women may have differed.

**Independent Prediction of HRB Trajectories**

To my knowledge, the second part of the study expanded upon prior research by being the first study to prospectively investigate the effects of trauma and peer and family influences in adolescence on trajectories of HRBs across young adulthood. It was hypothesized that, youth with a more extensive history of trauma, higher levels of deviant peer affiliation and family conflict, and less parental monitoring would be at higher risk for persistent patterns of HRBs. First, when considering DP, FC, PM and exposure to trauma as univariate predictors, all significant findings were in the expected direction, with higher levels of DP, FC, and trauma, and lower levels of PM distinguishing trajectories with higher levels of risk behavior. The findings in this study reinforce prior research that highlights the impact of peer and family factors, and exposure to trauma on the development and maintenance of HRBs (e.g., Ha et al., 2016; Bensley, et al. 2000; Van Ryzin et al., 2012; Caruthers et al., 2014; Kincaid et al., 2011; Piehler, et al., 2012; Dishion, Ha & Veronneau, 2012), and it extends these findings to show that these risk and protective factors assessed in adolescence can have distal effects across young adulthood.

Interestingly, all univariate predictors tended to most effectively differentiate between the stable low classes versus the increasing, decreasing and stable high classes, and were much less likely to differentiate between the increasing, decreasing and high stable classes. In fact, there were only two instances in which a predictor significantly distinguished between classes not including the stable low class. Higher levels of DP affiliation predicted a greater likelihood of being in the stable high tobacco use class relative to the increasing tobacco use class and a greater likelihood of being in the stable high marijuana use class relative to the decreasing marijuana use class. These findings suggest that there may be other prominent etiologic factors not investigated in this study that explain the nuances and variation in the developmental trajectories of HRBs during young adulthood. For example, it may be that more trait-like characteristics, such as impulsivity, sensation seeking, and self-regulation difficulties, which have also been associated with risk for engaging in HRBs (e.g., Zuckerman, 1994; Crockett et al., 2006; Piehler et al., 2012; Fosco et al., 2012), may be better than environmental factors at distinguishing variation in long-term risk for engaging in HRBs. Or, it may be that more proximal developmental milestones, such as marriage (Eitle et al., 2010; Leonard & Rothbard, 1999), cohabitation (Duncan et al., 2006), and parenthood (Kerr et al., 2011; Oesterle et al., 2011), which have been linked with “maturing out” (e.g. Winick, 1962), of engagement in HRBs, could more effectively distinguish between the HRB trajectory classes. These are important questions that merit further research.

Another finding of interest is that certain types of HRBs were more predictable than others. For example, HRSB, tobacco use and marijuana use trajectories were all more predictable than alcohol use trajectories. In fact, the univariate model was only able to predict membership in the stable low alcohol use class relative to the decreasing alcohol use class with lower levels of FC and higher levels of PM in the stable low alcohol use class. When the predictors were examined simultaneously, they were unable to predict membership in any of the alcohol use trajectory classes.

There are many possible explanations for why alcohol use trajectories during young adulthood were more difficult to predict. One reason may be related to the measurement and make-up of the trajectory classes. This study used frequency to measure all substances and used a risk behavior inventory to measure HRSB. For tobacco and marijuana use, the stable high use class represented individuals who reported daily tobacco or marijuana use over the past three months, while, the stable high alcohol use class endorsed using alcohol “2-3 times a week” on average over the past three months. Thus, the tobacco and marijuana use classes may have represented more variety in terms of severity of use and more problematic use, while the alcohol use classes may have represented a spectrum of more “normative” use. In fact, for alcohol use, a greater proportion of individuals were in the trajectory classes characterized by higher levels of substance use than for both the other substances (78.4% for alcohol compared to 43.1% for tobacco and 35% for marijuana), which is consistent with the idea that the trajectory classes for tobacco and marijuana use were more extreme. These findings suggest that frequency of substance use may be sufficient to capture variation in severity for substances like marijuana and tobacco, whereas alternative measures (e.g., quantity X frequency or problems associated with alcohol use) may be necessary to best capture variation in severity of alcohol use.

Finally, it appeared that certain types of HRBs were more or less sensitive to specific predictors. For the univariate prediction of membership in HRSB trajectory classes, PM and exposure to trauma were the most robust predictors, for tobacco use trajectory classes, DP affiliation and PM were the most robust predictors, and for marijuana use trajectory classes, DP affiliation and exposure to trauma were the most robust predictors. FC appeared to be the least robust predictor for all of the HRBs. Collectively, these findings suggest that DP affiliation may have a stronger influence on tobacco and marijuana use, while a history of trauma may have a stronger influence on HRSB during young adulthood. Furthermore, FC in adolescence may have less influence on HRBs during young adulthood. As mentioned above, it was difficult to predict membership in alcohol use trajectory classes and there were no predictors that robustly distinguished between these trajectories. Better understanding the underlying factors that contribute to the development and maintenance of HRBs during young adulthood is vital when considering the most fruitful targets of intervention or prevention efforts to reduce risk of engaging in HRBs. As the underlying etiologic and maintaining factors may vary depending on specific risk behaviors, future research should consider investigating risk behaviors separately, rather than combining them.

**Simultaneous Prediction of HRB Trajectories**

This study also tested the hypothesis that, when combining all of the risk and protective factors as predictors in the same model, there would be overlapping effects among the predictors, and DP affiliation would have the strongest unique influence on trajectories of HRBs during young adulthood. This hypothesis was partially supported. In the full multivariate models predicting membership in tobacco and marijuana use trajectory classes, nearly all significant predictors from the univariate models were no longer significant, except for those related to DP affiliation. This finding is in line with several other studies showing that deviant peer affiliation emerges as the strongest predictor of HRBs in adolescence (e.g. Metzler, Noell, Biglan, Ary, & Smolkowski, 1994; French & Dishion, 2003; Van Ryzin et al., 2012), and extends this finding through young adulthood. This highlights the importance of targeting deviant peer relationships within prevention and intervention programs working to reduce risk for tobacco and marijuana use.

In addition, the results suggest that PM and FC may indirectly predict young adult trajectories of tobacco and marijuana use through affiliation with deviant peers given that effects of these predictors were no longer significant when accounting for DP. This is in line with prior research suggesting that the family environment can exert an indirect effect on substance use through peers (Nash, McQueen, & Bray, 2005; Van Ryzin et al., 2012). Van Ryzin et al. (2012), for example, found that PM at age 12 was indirectly associated with decreased likelihood of tobacco use at age 15 through deviant peer associations at age 13. They also found that PM at age 13 was indirectly linked with decreased likelihood of tobacco and alcohol use at age 17 through deviant peer associations at 15. Overall, the findings of the current study provide further evidence that an important aspect of the family context may be its influence on peer group composition, and that indirect effects of family influences through deviant peer associations may continue into young adulthood.

While DP affiliation seemed to be the most robust predictor for tobacco use and marijuana use trajectory classes, there was a slightly different story when predicting

HRSB and alcohol use trajectory classes. First, as discussed above, in the full multivariate model, none of the risk and protective factors, including DP affiliation, successfully predicted membership in the alcohol use trajectory classes. Second, in the full multivariate model predicting membership in HRSB trajectory classes, all significant findings related to family context became non-significant, whereas effects of trauma history remained. This was contrary to the study hypothesis that, when considering predictors simultaneously, DP affiliation would emerge as the strongest predictor. This means that a history of trauma is a particularly robust predictor of HRSB trajectories throughout young adulthood and highlights the importance of assessing for HRSB when individuals present with a history of trauma. This is consistent with prior research demonstrating strong links between a history of trauma and HRSB. For example, a meta-analysis of 46 studies of adult women found statistically significant effects of childhood abuse on increased likelihood of having unprotected sexual intercourse ($r$ = 0.05, range = .01 - .20) and having multiple sexual partners ($r$ = 0.14, range = -.16 - .61) (Arriola et al., 2005). Another meta-analysis of 21 studies found that women who experienced sexual abuse were 2.2 times more likely than those without an abuse history to report pregnancy during adolescence (Noll et al., 2008). A third meta-analysis of 10 independent samples, from nine studies found that sexually abused boys were significantly more likely than non-abused boys to report having unprotected intercourse (odds ratio = 1.91), multiple sexual partners (odds ratio = 2.91), and pregnancy involvement (odds ratio = 4.81) (Homma et al., 2012).

Taken together, the findings of the current study provide further support for Bronfenbrenner's Ecological systems theory (Bronfenbrenner, 1979), which emphasizes the dynamic relationship among multiple levels of influence on a person's behavior. They highlight the importance of integrating these multiple systems of influence into a conceptual framework that considers the complexity of their combined effects to better understand all of the factors that play a role in the etiology and maintenance of HRBs.

**Co-occurring HRSB and Substance Use Trajectories and their Independent and Simultaneous Prediction**

Finally, the current study created co-occurring HRSB and substance use trajectories, based on the findings from the GMMs, and prospectively investigated the independent and simultaneous effects of trauma, and peer and family factors in adolescence, on co-occurring HRSB and substance use trajectories across young adulthood. Twelve distinct co-occurring HRSB and substance use (tobacco, alcohol, or marijuana) classes (36 overall) were created, crossing the three HRSB classes with the four classes for each substance. Unfortunately, given the high number of classes and limited sample size, certain classes were too small ($n < 20$) for the associations between predictors and class membership to be estimated reliably, and were thus excluded from subsequent multinomial logistic regression analyses. Fortunately, given the large overall sample size, most classes were retained. Most of the excluded classes (six) involved increases in HRSB and decreases in substance use or increases in substance use and decreases in HRSB. It is not particularly surprising that classes involving movement in opposite directions for HRSB and substance use were sparsely populated. The other excluded classes included increasing HRSB and increasing TOB; increasing HRSB and Low ALC; decreasing HRSB and Low ALC; and increasing HRSB and Increasing MJ.

Similar to the independent HRB trajectories, it was hypothesized that youth with a more extensive history of trauma, higher levels of deviant peer affiliation and family conflict, and less parental monitoring in adolescence would be at higher risk for persistent patterns of co-occurring HRSB and Substance Use. Furthermore, when considering all these factors in the same model, it was hypothesized that DP affiliation would have the strongest independent influence on trajectories of co-occurring HRSB and Substance Use during young adulthood. It is important to note that, to reduce the multiplicity of comparisons only the Low HRSB, Low substance use class was used as the referent class in these analyses.

In general, when looking at the overall findings of these analyses, a few things stood out. First, similar to the findings from the individual HRSB and substance use trajectory models, certain types of co-occurring trajectories were more predictable than others. Both the co-occurring HRSB and tobacco use trajectories and the co-occurring HRSB and marijuana use trajectories were much more sensitive to the predictors than the co-occurring HRSB and alcohol use trajectories. In fact, in both the univariate and multivariate models for HRSB and alcohol use, there was only one significant finding, with individuals from families with higher levels of conflict more likely to be in the increasing HRSB and increasing alcohol use trajectory group than the low HRSB and low alcohol use trajectory group. As mentioned above, one factor that may play a role in this finding is the composition of the alcohol use trajectory classes. It appears that the alcohol use trajectory classes may represent a spectrum of “normative use,” rather than problematic use, and thus may be less sensitive to these predictors. However, it is notable that, even when including co-occurring HRSB, these co-occurring HRSB and alcohol use trajectories were very difficult to predict. In fact, when combining these two trajectory classes, the predictors that were previously able to predict HRSB trajectories were no longer significant. This may be related to mixing a more risky behavior (i.e., HRSB) with a less risky one (i.e., alcohol use), or to lower statistical power after splitting the HRSB trajectory classes into smaller sub classes in the cross classification.

The second notable finding was that, similar to the findings with separate HRB trajectories as outcomes, trauma and deviant peer affiliation stood out as the most robust predictors of trajectories of risk behavior in young adulthood. In the univariate models predicting membership of both the co-occurring HRSB and tobacco and co-occurring HRSB and marijuana use trajectories, DP, FC, PM and exposure to trauma all predicted membership in the low HRSB and low substance use class relative to a number of the other classes. However, in the multivariate models, the only variables that predicted membership in these co-occurring trajectory classes were deviant peer affiliation and exposure to trauma. This suggests that deviant peer affiliation and a history of trauma are particularly robust predictors of co-occurring HRSB and tobacco use trajectories and co-occurring HRSB and marijuana use trajectories during young adulthood, and that there are likely overlapping effects among these predictors. Given the significant correlations between PM and DP ($r = -.41$) and FC and DP ($r = .21$), it may be that PM and FC indirectly predict young adult trajectories of HRBs by affecting an individual's likelihood of engaging with deviant peers. Once again, this highlights the importance of simultaneously considering multiple systems of influence to better understand the etiology and maintenance of HRBs.

**Strengths**

This study has multiple strengths related to the original study design, measurement of variables, and analytic approach. Regarding the original study design, strengths include the large sample size (N = 998), prospective design, and extended period of follow-up (nine measurements over the span of 20 years). The prospective design of the study (as opposed to retrospective designs) helps establish temporal precedence (i.e. predictor variables are measured before outcome variables) and minimizes the impact of recall bias (e.g., Coughlin, 1990; Moffitt et al., 2010; Simon & VonKorff, 1995). In addition, this was a community sample recruited from three public middle schools in an ethnically diverse metropolitan area, which significantly improves generalizability of the findings (Dishion & Kavanagh, 2003).

With respect to measurement, a unique strength of this study is that peer and family variables were measured using multi-informant (mother, father, child) report, and multi-method approaches, including direct observation. Many studies examining parenting and peer factors, such as parental monitoring or deviant peer associations, use only self-report questionnaires (parent or child), which poses risks of informant biases (e.g., Patterson et al., 1992).

A strength of the analytic approach is that the analyses considered both the independent as well as simultaneous influences of the environmental predictors on trajectories of HRBs during young adulthood. Thus, rather than only looking at these factors as separate influences, which has been common in prior research, (e.g., Thornberry, et al., 2001; Landsford et al., 2014; Miller, et al., 1999), this study provided a more comprehensive understanding of the multiple systems of influence and the complexity of their combined effects on HRBs. This study also modeled trajectories of both individual HRBs and the co-occurrence of HRSB and substance use throughout young adulthood. The strengths of this approach are twofold. First, the analyses extended the modeling of trajectories of HRBs to include an important yet understudied developmental stage, especially regarding HRBs. Second, it enabled us to compare trajectories of the various HRBs and look at differences and similarities related to their prediction, as well the prediction of co-occurring HRSB and substance use trajectories.

**Limitations**

Despite these strengths and the potential importance of the study, the findings must be considered within the context of study limitations. First, while one of the study strengths includes the broad scope of questions addressed, this breadth came at a cost. First, it was challenging to balance reducing both type one and type two errors within this study, especially within the co-occurring HRSB and substance use trajectory classes (Cohen, 2013). Crossing the classes led to 12 different classes for each co-occurring HRSB and substance use class, for a total of separate 36 classes. To reduce the multiplicity of comparisons only the low HRSB, low substance use (tobacco, alcohol or marijuana) classes were used as the referent class to reduce the total number of comparisons. While this reduced the chances of type one error, potentially interesting differences between classes were not investigated. In addition, to further mitigate the likelihood of type one error, p values were corrected for multiple testing using the FDR correction (Benjamini & Hochberg, 1995). While this was not a limitation in and of itself, it may have unintentionally increased type two error, especially because crossing the HRSB and substance use classes created large discrepancies between class sizes, and some classes had very small sample sizes. In fact, some of the classes were excluded because they were too small (n < 20) to reliably estimate associations between predictors and class membership. Even for the larger classes, differences were difficult to detect given large discrepancies in class sizes. For example, it is likely that PM was not a statistically significant predictor of membership in the decreasing HRSB and decreasing tobacco use class relative to the stable low HRSB and low tobacco use class (logit = -.604; see Table 23) because the class sizes were 20 and 433, respectively. In summary, efforts to limit Type I errors may have resulted in important Type II errors.

Second, measurement of all HRBs could have been stronger. The primary measures used to define HRB trajectories were participants self-reports about their behavior over the past three months. There are three potential limitations of such measures. First, participant recall might not be accurate and may be subject to informant biases (e.g., Davis, Thake & Vilhena, 2010; Schroder, Carey & Vanable, 2003). Second, because there was at least 1 year between assessments, participants' HRBs in the past three months might not be representative of their HRBs since the last assessment. Third, measurement of substance use relied on only one item asking individuals about frequency of use at each time point, and did not include information about quantity consumed on days on which a given substance was used, or problems associated with use of the substance (i.e., tolerance, withdrawal). This issue was discussed previously with respect to alcohol use but may also pose issues for the other substances. Patterns of use may differ significantly depending on whether frequency, quantity, or other combinations of variables are measured (Jackson & Sher, 2005). Thus, future prospective studies during young adulthood would benefit from more robust measures of HRBs.

Another limitation is that all predictors were time invariant, so we were unable to see how changes in the predictors impacted changes in trajectories of HRBs. Lastly, this study only examined trajectories of HRB during a discrete period of time, age 22-30. Thus, it is unclear what trajectories for these individuals looked like before age 22 and after age 30. To best understand varying developmental trends of HRBs it is important for future studies to investigate HRBs from childhood through young adulthood.

**Future Directions**

While prior research, and the current study, have advanced the field significantly in terms of understanding the etiology and developmental course of HRBs, there are still lingering questions to be answered and vital contributions to be made. First, finding more accurate and frequent ways to prospectively measure HRBs and factors that influence HRBs (i.e., deviant peer affiliation, parental monitoring), is vital to better understand the development and maintenance of these behaviors. Fortunately, significant improvements in technology have provided novel approaches to capturing HRBs in real time. In the field of alcohol research, for example, wrist-worn alcohol biosensors have been used to provide real-time, continuous, objective, noninvasive data for monitoring alcohol use patterns (e.g., Barnett, Meade, & Glynn, 2014; Bond, Greenfield, Patterson, & Kerr, 2014; Greenfield, Bond, & Kerr, 2014; Sakai, Mikulich-Gilbertson, Long, & Crowley, 2006; Simons, Wills, Emery, & Marks, 2015). Ecological momentary assessment (EMA) and direct observation represent additional methods to assess factors that influence health risk behaviors while reducing measurement bias (e.g., Shiffman, Stone & Hufford, 2008; Patterson et al., 1992). Identifying or developing similar technology that can be used to more effectively assess all types of HRB (i.e., HRSB, hard drug use) and factors that prospectively influence these behaviors is an important goal for future research.

It is also important to expand our understanding of the developmental course of HRBs across the full lifespan. Existing research on HRBs has focused on the period through early adulthood, which is commonly understood to convey high risk for HRBs (e.g., Kotchick et al., 2001; Nelson et al., 2015; Satterwhite et al, 2013; Johnston et al., 2014; Mahalik et al., 2013). However, other life stages have been neglected. There have been important societal changes regarding the ages at which important developmental milestones (e.g., marriage, parenthood, home ownership) take place (e.g., Elliott et al., 2012; Mathews & Hamilton, 2009; Arnett & Taber, 1994; Bianchi & Spain, 1996) that may extend risk for substance use and HRSB into the late 20s and early 30s. Furthermore, divorce, losing a job, retirement, and other mid-to-late life events may also convey high risk for HRBs (e.g., Stall & Catania, 1994; Maes & Louis, 2003; Brody, 1982; Kuerbis, Sacco, Blazer & Moore, 2014; Benshoff, Harrawood & Koch, 2003). Extending developmental trend research to include the full lifespan would allow for a more thorough understanding of these behaviors as well as provide opportunities for intervention or prevention programs during later life stages.

Finally, the factors implicated in the development and maintenance of HRBs are complex, influencing not only HRBs but also other risk and protective factors. This study moved in the right direction by looking at the simultaneous influence of trauma and family and peer factors on HRBs. Future studies would benefit from investigating an even more comprehensive model, including additional risk and protective factors at the individual, school, neighborhood and community levels. HRBs comprise major public health risks, and fully addressing them will require better understanding of the dynamic effects of an array of risk and protective factors.

**Conclusions**

This study modeled gender-specific trajectories of substance use and HRSB throughout young adulthood and investigated the independent and simultaneous effects of early trauma, and peer and family factors on the trajectories of these behaviors. The results provide further evidence that the period of young adulthood is a critical time to investigate HRBs. This developmental stage was characterized by four unique trajectories for substance use and three for HRSB. These trajectories included a stable high-risk class (for substance use) and an increasing class (for both substance use and HRSB), suggesting that vulnerability to HRBs remains high for a substantial number of individuals during this period. Thus, prevention and intervention programs targeting individuals in their late 20s are needed, and better understanding factors that lead to vulnerabilities specific to this developmental period may inform targeted interventions.

This study also provides new insights regarding effects of adolescent trauma exposure and peer and family influences on distinct trajectories of HRBs across young adulthood. The results demonstrated that deviant peer affiliation, family conflict, parental monitoring and trauma exposure impacted trajectories of tobacco and marijuana use and HRSB during young adulthood, but that the most salient influences were deviant peer affiliation and exposure to trauma. Effects of family influences tended to diminish when considering all factors simultaneously, suggesting that family context may impact HRBs indirectly via deviant peer associations. It was difficult to predict alcohol use trajectories and differences between the increasing, decreasing and stable, high classes for the other

HRBs, suggesting that there may be other prominent or more proximal etiologic factors not investigated in this study. These findings further emphasize the need for more integrated models of risk and protective factors associated with the etiology and maintenance of HRBs. Such models may enable more effective prevention and intervention programs, including those targeting young adults.

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# APPENDIX A

# TABLES

Table 1

*Frequency, Means, Standard Deviations, Skewness and Kurtosis of the Study Variables*

| | N | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|
| **Male** | 998 | 0.53 | n/a | n/a | n/a |
| **Intervention** | 997 | 0.50 | n/a | n/a | n/a |
| **Black** | 998 | 0.29 | n/a | n/a | n/a |
| **Hispanic** | 998 | 0.07 | n/a | n/a | n/a |
| **Asian** | 998 | 0.06 | n/a | n/a | n/a |
| **Other** | 998 | 0.15 | n/a | n/a | n/a |
| **SES** | 730 | 0.00 | 0.72 | -0.78 | -0.05 |
| **Family Conflict (age 16)** | 796 | -0.01 | 0.73 | 1.17 | 1.39 |
| **Parental Monitoring (age 16)** | 796 | -0.03 | 0.77 | -0.69 | 0.36 |
| **Deviant Peer Affiliation (age 16)** | 801 | 0.02 | 0.77 | 1.19 | 1.46 |
| **Trauma Exposure before age 18** | 806 | 2.58 | 3.86 | 2.12 | 4.76 |
| **HRSB (age 22-23)** | 817 | 1.07 | 1.18 | 1.39 | 2.24 |
| **HRSB (age 24-25)** | 856 | 1.13 | 1.23 | 1.53 | 3.02 |
| **HRSB (age 26-27)** | 760 | 0.82 | 1.05 | 1.70 | 3.27 |
| **HRSB (age 29-30)** | 768 | 0.81 | 1.08 | 1.69 | 2.61 |
| **TOB (age 22-23)** | 817 | 2.35 | 3.02 | 0.68 | -1.38 |
| **TOB (age 24-25)** | 856 | 2.36 | 3.04 | 0.68 | -1.39 |
| **TOB (age 26-27)** | 763 | 2.44 | 3.06 | 0.63 | -1.46 |
| **TOB (age 29-30)** | 780 | 2.20 | 2.97 | 0.81 | -1.19 |
| **ALC (age 22-23)** | 818 | 3.16 | 2.13 | -0.01 | -0.97 |
| **ALC (age 24-25)** | 856 | 3.21 | 2.18 | -0.02 | -0.98 |
| **ALC (age 26-27)** | 763 | 3.13 | 1.83 | -0.31 | -0.90 |
| **ALC (age 29-30)** | 779 | 3.13 | 2.16 | -0.02 | -1.12 |
| **MJ (age 22-23)** | 818 | 1.57 | 2.49 | 1.26 | -0.09 |
| **MJ (age 24-25)** | 856 | 1.44 | 2.44 | 1.38 | 0.24 |
| **MJ (age 26-27)** | 763 | 1.57 | 2.47 | 1.28 | 0.02 |
| **MJ (age 29-30)** | 780 | 1.67 | 2.58 | 1.15 | -0.41 |

Note: descriptive statistics above are based on the original sample; full information maximum likelihood estimation was not used.

Table 2

*Correlations among the Study Variables*

| | Male | Intervention | Black | Hispanic | Asian | Other | SES | FamCon | ParMon | DevPeer | Trauma | RSB (22) | RSB (24) | RSB (26) | RSB (28) | TOB (22) | TOB (24) | TOB (26) | TOB (28) | ALC (22) | ALC (24) | ALC (26) | ALC (28) | MJ (22) | MJ (24) | MJ (26) | MJ (28) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Male | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Intervention | 0.02 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Black | 0.02 | 0.02 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| Hispanic | -0.02 | -0.02 | -0.17** | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Asian | -0.02 | -0.01 | -0.16** | -0.07* | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Other | -0.01 | -0.01 | -0.27** | -0.12** | -0.11** | 1 | | | | | | | | | | | | | | | | | | | | | |
| SES | 0.04 | 0.06 | -0.34** | -0.15** | -0.01 | -0.02 | 1 | | | | | | | | | | | | | | | | | | | | |
| FamCon | -0.05 | -0.05 | -0.01 | -0.06 | -0.06 | -0.01 | -0.05 | 1 | | | | | | | | | | | | | | | | | | | |
| ParMon | -0.12** | 0.04 | -0.03 | -0.03 | -0.06 | -0.06 | 0.21** | -0.21** | 1 | | | | | | | | | | | | | | | | | | |
| DevPeer | 0.19** | -0.04 | 0.01 | -0.02 | -0.06 | 0.03 | -0.13** | 0.21** | -0.41** | 1 | | | | | | | | | | | | | | | | | |
| Trauma | -0.08* | -0.03 | -0.02 | 0.09** | 0.01 | 0.11** | -0.06 | 0.09* | -0.14** | 0.15** | 1 | | | | | | | | | | | | | | | | |
| RSB (22) | 0.11** | -0.00 | 0.06 | -0.02 | -0.14** | 0.03 | -0.05 | 0.14** | -0.20** | 0.19** | 0.16** | 1 | | | | | | | | | | | | | | | |
| RSB (24) | 0.08* | 0.02 | 0.05 | -0.03 | -0.11** | -0.02 | 0.03 | 0.15** | -0.13** | 0.18** | 0.14** | 0.51** | 1 | | | | | | | | | | | | | | |
| RSB (26) | 0.06 | 0.06 | 0.08* | -0.08* | -0.10** | 0.10** | 0.02 | 0.07 | -0.07 | 0.15** | 0.07 | 0.30** | 0.32** | 1 | | | | | | | | | | | | | |
| RSB (28) | 0.08* | 0.03 | 0.08* | -0.06 | -0.09* | 0.06 | -0.01 | 0.10* | -0.11** | 0.08* | 0.11** | 0.25** | 0.27** | 0.46** | 1 | | | | | | | | | | | | |
| TOB (22) | 0.06 | 0.04 | -0.05 | -0.07* | -0.01 | 0.05 | -0.10** | 0.14** | -0.20** | 0.36** | 0.15** | 0.26** | 0.24** | 0.18** | 0.12** | 1 | | | | | | | | | | | |
| TOB (24) | 0.08* | 0.02 | -0.02 | -0.09** | -0.06 | 0.05 | -0.11** | 0.11** | -0.19** | 0.36** | 0.16** | 0.25** | 0.28** | 0.14** | 0.12** | 0.81** | 1 | | | | | | | | | | |
| TOB (26) | 0.10** | 0.04 | 0.01 | -0.10** | -0.05 | 0.10** | -0.12** | 0.11** | -0.22** | 0.43** | 0.14** | 0.19** | 0.19** | 0.22** | 0.13** | 0.72** | 0.70** | 1 | | | | | | | | | |
| TOB (28) | 0.09** | 0.03 | 0.02 | -0.09* | -0.03 | 0.08* | -0.13** | 0.08* | -0.15** | 0.34** | 0.14** | 0.19** | 0.18** | 0.21** | 0.19** | 0.66** | 0.68** | 0.82** | 1 | | | | | | | | |
| ALC (22) | 0.19** | -0.05 | -0.10** | -0.04 | -0.07* | -0.10** | 0.22** | 0.11** | -0.05 | 0.08* | -0.04 | 0.36** | 0.34** | 0.22** | 0.13** | 0.25** | 0.21** | 0.14** | 0.12** | 1 | | | | | | | |
| ALC (24) | 0.15** | -0.01 | -0.08* | -0.06 | -0.06 | -0.06 | 0.24** | 0.06 | 0.03 | 0.06 | -0.02 | 0.27** | 0.39** | 0.21** | 0.17** | 0.20** | 0.26** | 0.14** | 0.14** | 0.61** | 1 | | | | | | |
| ALC (26) | 0.14** | 0.07* | -0.08* | -0.06 | 0.00 | 0.01 | 0.18** | 0.05 | -0.03 | 0.13** | 0.01 | 0.12** | 0.19** | 0.34** | 0.26** | 0.20** | 0.16** | 0.20** | 0.17** | 0.39** | 0.44** | 1 | | | | | |
| ALC (28) | 0.17** | 0.04 | -0.09* | -0.09* | -0.04 | -0.03 | 0.24** | -0.01 | 0.11** | -0.02 | -0.05 | 0.10** | 0.16** | 0.24** | 0.30** | 0.10** | 0.07* | 0.06 | 0.11** | 0.41** | 0.45** | 0.55** | 1 | | | | |
| MJ (22) | 0.13** | -0.07 | -0.02 | -0.07* | -0.08* | -0.01 | 0.09* | 0.15** | -0.13** | 0.26** | 0.10** | 0.37** | 0.27** | 0.19** | 0.21** | 0.35** | 0.31** | 0.29** | 0.28** | 0.38** | 0.30** | 0.18** | 0.23** | 1 | | | |
| MJ (24) | 0.15** | -0.03 | -0.01 | -0.07* | -0.12** | -0.05 | 0.12** | 0.14** | -0.07 | 0.19** | 0.10** | 0.31** | 0.34** | 0.21** | 0.17** | 0.29** | 0.31** | 0.26** | 0.26** | 0.34** | 0.38** | 0.18** | 0.17** | 0.74** | 1 | | |
| MJ (26) | 0.12** | 0.00 | 0.09* | -0.06 | -0.11** | 0.02 | -0.05 | 0.06 | -0.12** | 0.26** | 0.07 | 0.23** | 0.20** | 0.28** | 0.22** | 0.36** | 0.33** | 0.35** | 0.34** | 0.23** | 0.16** | 0.21** | 0.15** | 0.54** | 0.49** | 1 | |
| MJ (28) | 0.16** | 0.01 | 0.02 | -0.05 | -0.12** | 0.04 | 0.02 | 0.06 | -0.09* | 0.27** | 0.09* | 0.21** | 0.17** | 0.16** | 0.25** | 0.34** | 0.34** | 0.31** | 0.31** | 0.22** | 0.21** | 0.15** | 0.21** | 0.57** | 0.52** | 0.71** | 1 |

Table 3

*Model Fit Indices of Growth Mixture Models for Full Sample Risky Sexual Behavior During Young Adulthood*

| | Full Sample Risky Sexual Behavior | | | | |
|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 9501.32 | 9479.09 | - | - | - |
| **1Q** | 9507.35 | 9481.95 | - | - | - |
| **2L** | 9267.91 | 9232.97 | 251.43, p < .00 | 260.66, p < .00 | .88 |
| **2Q** | 9191.90 | 9150.61 | 339.54, p < .00 | 349.51, p < .00 | .88 |
| **3L** | 9024.67 | 8977.03 | 260.90, p < .00 | 270.48, p = 1.0 | .84 |
| **3Q** | 8955.71 | 8898.55 | 262.53, p < .00 | 270.24, p = 1.0 | .85 |
| **4L** | 8986.6 | 8926.28 | 62.97, p = .07 | 65.28, p = 1.0 | .85 |
| **4Q** | 8906.37 | 8833.33 | 81.01, p = .18 | 83.39, p = 1.0 | .85 |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

Table 4

*Model Fit Indices of Growth Mixture Models for Full Sample Tobacco Use During Young Adulthood*

| | Full Sample Tobacco Use | | | | |
|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 16282.86 | 16263.80 | - | - | - |
| **1Q** | 16288.43 | 16266.20 | - | - | - |
| **2L** | 13450.54 | 13421.96 | 2719.95, p <.00 | 2852.79, p < .00 | .97 |
| **2Q** | 13452.64 | 13417.71 | 2761.92, p <.00 | 2863.08, p < .00 | .97 |
| **3L** | 12819.90 | 12781.79 | 620.80, p <.00 | 651.11, p = 1.0 | .97 |
| **3Q** | 12817.42 | 12769.78 | 639.11, p < .00 | 662.52, p = 1.0 | .97 |
| **4L** | 11967.17 | 11919.53 | 832.54, p < .00 | 873.20, p = 1.0 | .95 |
| **4Q** | 11964.13 | 11903.78 | 849.47, p < .00 | 880.59, p = 1.0 | .95 |
| **5L** | 11665.23 | 11608.07 | 307.40, p = .23 | 322.41, p = 1.0 | .95 |
| **5Q** | 11645.22 | 11572.18 | 307.62, p = .62 | 318.89, p = 1.0 | .95 |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

Table 5

*Model Fit Indices of Growth Mixture Models for Full Sample Alcohol Use During Young Adulthood*

| | Full Sample Alcohol Use | | | | |
|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 13853.03 | 13833.98 | - | - | - |
| **1Q** | 13859.73 | 13837.50 | - | - | - |
| **2L** | 13116.45 | 13087.87 | 721.80, p < .00 | 757.05, p < .00 | .75 |
| **2Q** | 13129.35 | 13094.41 | 730.91, p < .00 | 757.68, p < .00 | .75 |
| **3L** | 13009.15 | 12971.04 | 121.83, p < .00 | 127.78, p = 1.0 | .68 |
| **3Q** | 13019.14 | 12971.51 | 132.65, p < .00 | 137.50, p = 1.0 | .69 |
| **4L** | 12871.18 | 12823.54 | 151.06, p < .00 | 158.44, p = 1.0 | .72 |
| **4Q** | 12859.83 | 12799.49 | 180.02, p < .00 | 186.61, p = 1.0 | .74 |
| **5L** | 12856.09 | 12798.93 | 33.90, p = .37 | 35.56, p = 1.0 | .65 |
| **5Q** | 12839.34 | 12766.29 | 46.10, p = .40 | 47.79, p = 1.0 | .71 |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

Table 6

*Model Fit Indices of Growth Mixture Models for Full Sample Marijuana Use During Young Adulthood*

| | Full Sample Marijuana Use | | | | |
|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 15046.88 | 15027.83 | - | - | - |
| **1Q** | 15052.04 | 15029.81 | - | - | - |
| **2L** | 12969.57 | 12940.99 | 2000.11, p< .00 | 2097.79, p < .00 | .97 |
| **2Q** | 12940.66 | 12905.73 | 2063.11, p< .00 | 2138.68, p < .00 | .97 |
| **3L** | 12569.09 | 12530.98 | 401.35, p < .00 | 420.95, p = 1.0 | .95 |
| **3Q** | 12524.6 | 12476.98 | 427.67, p < .01 | 443.34, p = 1.0 | .96 |
| **4L** | 11860.26 | 11812.63 | 695.34, p < .00 | 729.30, p = 1.0 | .94 |
| **4Q** | 11699.33 | 11638.99 | 822.46, p < .00 | 852.59, p = 1.0 | .94 |
| **5L** | Did | Not | Converge | | |
| **5Q** | 11615.05 | 11542.01 | 107.63, p = .15 | 111.57, p = 1.0 | .94 |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

Table 7

*Risky Sexual Behavior Trajectory by Tobacco Use Trajectory*

| | | Risky Sexual Behavior Trajectory | | |
|---|---|---|---|---|
| Tobacco Use Trajectory | | Low | Increasing | Decreasing |
| | Low | N = 433 (47.7%) | N = 44 (4.8%) | N = 44 (4.8%) |
| | Increasing | N = 41 (4.5%) | N = 13 (1.4%) | N = 5 (0.6%) |
| | Decreasing | N = 68 (7.5%) | N = 8 (0.9%) | N = 20 (2.2%) |
| | High | N = 158 (17.4%) | N = 30 (3.3%) | N = 44 (4.8%) |

Table 8

*Risky Sexual Behavior Trajectory by Alcohol Use Trajectory*

| | | Risky Sexual Behavior Trajectory | | |
|---|---|---|---|---|
| Alcohol Use Trajectory | | Low | Increasing | Decreasing |
| | Low | N = 175 (19.3%) | N = 12 (1.3%) | N = 14 (1.5%) |
| | Increasing | N = 162 (17.8%) | N = 28 (3.1%) | N = 15 (1.7%) |
| | Decreasing | N = 103 (11.3%) | N = 8 (0.9%) | N = 28 (3.1%) |
| | High | N = 260 (28.6%) | N = 47 (5.2%) | N = 56 (6.2%) |

Table 9

*Risky Sexual Behavior Trajectory by Marijuana Use Trajectory*

| | | Risky Sexual Behavior Trajectory | | |
|---|---|---|---|---|
| Marijuana Use Trajectory | | Low | Increasing | Decreasing |
| | Low | N = 502 (55.3%) | N = 54 (5.9%) | N = 44 (4.8%) |
| | Increasing | N = 70 (7.7%) | N = 13 (1.4%) | N = 16 (1.8%) |
| | Decreasing | N = 55 (6.1%) | N = 5 (0.6%) | N = 21 (2.3%) |
| | High | N = 73 (8.0%) | N = 23 (2.5%) | N = 32 (3.5%) |

Table 10

*Comparison of Risky Sexual Behavior Trajectory Classes on Demographic, Family, Peer, and Trauma Variables*

| ***RSB Class*** | **N** | **Male** | **Treatment Group** | **African American** | **Hispanic** | **Asian American** | **Other** | **SES** | **Family Conflict** | **Parental Monitoring** | **Deviant Peer Association** | **Trauma History** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stable, Low** | 700 | 50% | 50% | 27% | 7% | 7% | 15% | .029 (.71) | -.05 (.71) | .037 (.71) | .02 (.76) | 2.28 (3.6) |
| **Increasing** | 95 | 51% | 52% | 39% | 4% | 2% | 19% | -.039 (.69) | .20 (.86) | -.23 (.89) | .04 (.65) | 3.61 (4.3) |
| **Decreasing** | 113 | 58% | 51% | 38% | 4% | 2% | 12% | -.045 (.75) | .05 (.75) | -.17 (.91) | .12 (.80) | 3.44 (4.8) |
| **Significance Test** | | $\chi^2$ (2) = 2.67, ns | $\chi^2$(2) = 0.30, ns | $\chi^2$ (2) = 10.12, p < .00 | $\chi^2$ (2) = 1.74, ns | $\chi^2$ (2) = 8.41, p < .00 | $\chi^2$ (2) = 1.78, ns | F (2, 697) = .65, ns | F (2, 761) = 4.77, p < .00 | F (2, 761) = 6.66, p < .00 | F (2, 766) = 1.54, ns | F (2, 778) = 7.28, p < .00 |

Note: Significance tests are chi-square tests of independence for categorical variables and analysis of variance for continuous variables

Table 11

*Predictors (Entered Independently) of Membership in Risky Sexual Behavior Trajectory Classes*

| **Predictors** | | **LOW RSB Referent Class** | | | | **DECR RSB Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | .119 | .140 | 1.13 | .850(.395) | -.057 | .182 | .945 | -.312(.824) |
| | **DECR** | .176 | .144 | 1.19 | 1.22(.222) | | | | |
| Family Conflict | **INCR** | **.439** | **.147** | **1.55** | **2.99(.003)*** | .251 | .189 | 1.29 | 1.33(.333) |
| | **DECR** | .188 | .147 | 1.21 | 1.28(.201) | | | | |
| Parental Monitoring | **INCR** | **-.476** | **.162** | **.621** | **-2.94(.003)*** | -.115 | .209 | .892 | -.549(.700) |
| | **DECR** | **-.362** | **.155** | **.696** | **-2.33(.020)*** | | | | |
| Trauma History | **INCR** | **.082** | **.026** | **1.09** | **3.11(.002)*** | -.004 | .032 | .996 | -.120(.904) |
| | **DECR** | **.085** | **.025** | **1.09** | **3.37(.001)*** | | | | |

Note: This table presents unstandardized model results when predictors were entered independently of one another. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 12

*Predictors (Entered Simultaneously) of Membership in Risky Sexual Behavior Trajectory Classes*

| **Predictors** | | **LOW RSB Referent Class** | | | | **DECR RSB Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | -.198 | .164 | .821 | -1.20(.229) | -.155 | .203 | .857 | -.761(.670) |
| | **DECR** | -.043 | .151 | .958 | -.284(.776) | | | | |
| Family Conflict | **INCR** | **.350** | **.151** | **1.42** | **2.32(.020)*** | .269 | .192 | 1.31 | 1.41(.320) |
| | **DECR** | .080 | 152 | 1.08 | .527(.598) | | | | |
| Parental Monitoring | **INCR** | **-.437** | **.177** | **.646** | **-2.47(.014)*** | -.140 | .232 | .869 | -.604(.718) |
| | **DECR** | -.297 | .176 | .743 | -1.67(.092) | | | | |
| Trauma History | **INCR** | **.072** | **.027** | **1.07** | **2.67(.008)*** | -.007 | .032 | .993 | -.228(.819) |
| | **DECR** | **.079** | **.025** | **1.08** | **3.15(.002)*** | | | | |

Note: This table presents unstandardized model results when predictors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 13

*Comparison of Tobacco Use Trajectory Classes on Demographic, Family, Peer, and Trauma Variables*

| ***TOB Class*** | **N** | **Male** | **Treatment Group** | **African American** | **Hispanic** | **Asian American** | **Other** | **SES** | **Family Conflict** | **Parental Monitoring** | **Deviant Peer Association** | **Trauma History** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stable, Low** | 531 | 48% | 49% | 31% | 8% | 7% | 13% | .06 (.68) | -.07 (.72) | .09 (.73) | -.19 (.65) | 2.13 (3.5) |
| **Increasing** | 60 | 53% | 50% | 32% | 3% | 2% | 25% | .00 (.78) | -.04 (.72) | -.06 (.84) | .03 (.66) | 2.40 (3.7) |
| **Decreasing** | 96 | 52% | 56% | 21% | 4% | 7% | 15% | .12 (.69) | .06 (.62) | -.14 (.72) | .14 (.74) | 2.82 (4.0) |
| **Stable, High** | 234 | 58% | 50% | 29% | 4% | 6% | 18% | -.15 (.76) | .11 (.81) | -.23 (.81) | .42 (.83) | 3.61 (4.5) |
| **Significance Test** | | $\chi^2$ (3) = 6.23, ns | $\chi^2$(3) = 1.73, ns | $\chi^2$ (3) = 4.40, ns | $\chi^2$ (3) = 6.06, ns | $\chi^2$ (3) = 2.65, ns | $\chi^2$ (3) = 7.52, ns | F (3, 703) = 4.23, p < .00 | F (3, 767) = 2.98, p <.03 | F (3, 767) = 9.08, p < .00 | F (3, 772) = 35.58, p < .00 | F (3, 784) = 6.79, p < .00 |

Note: Significance tests are chi-square tests of independence for categorical variables and analysis of variance for continuous variables

Table 14

*Predictors (Entered Independently) of Membership in Tobacco Use Trajectory Classes*

| | | **LOW TOB Referent Class** | | | | **HIGH TOB Referent Class** | | | | **DECR TOB Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | **.474** | **.223** | **1.61** | **2.13(.033)*** | **-.604** | **.216** | **.340** | **-2.80(.005)*** | -.250 | .244 | .779 | -1.03(.304) |
| | **DECR** | **.724** | **.170** | **2.06** | **4.26(.000)*** | **-.354** | **.165** | **.547** | **-2.14(.032)*** | | | | |
| | **HIGH** | **1.08** | **.141** | **2.94** | **7.66(.000)*** | | | | | | | | |
| Family Conflict | **INCR** | .044 | .210 | 1.05 | .210(.833) | -.258 | .217 | .773 | -1.19(.234) | -.166 | .231 | .847 | -.717(.473) |
| | **DECR** | .210 | .146 | 1.23 | 1.44(.150) | -.092 | .153 | .912 | -.603(.546) | | | | |
| | **HIGH** | **.302** | **.124** | **1.35** | **2.43(.015)*** | | | | | | | | |
| Parental Monitoring | **INCR** | -.242 | .226 | .785 | -1.08(.282) | .242 | .235 | 1.27 | 1.03(.304) | .216 | .251 | 1.24 | .861(.389) |
| | **DECR** | **-.459** | **.150** | **.632** | **-3.06(.002)*** | .025 | .161 | 1.03 | .156(.876) | | | | |
| | **HIGH** | **-.484** | **.124** | **.616** | **-3.91(.000)*** | | | | | | | | |
| Trauma History | **INCR** | .025 | .045 | 1.03 | .553(.580) | -.077 | .044 | .926 | -1.75(.081) | -.038 | .050 | .963 | -.755(.450) |
| | **DECR** | **.062** | **.032** | **1.06** | **1.98(.048)*** | -.039 | .032 | .961 | -1.25(.211) | | | | |
| | **HIGH** | **.102** | **.024** | **1.11** | **4.33(.000)*** | | | | | | | | |

Note: This table presents unstandardized model results when predictors were entered independently of one another. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 15

*Predictors (Entered Simultaneously) of Membership in Tobacco Use Trajectory Classes*

| | | **LOW TOB Referent Class** | | | | **HIGH TOB Referent Class** | | | | **DECR TOB Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | .443 | .244 | 1.56 | 1.82(.070) | **-.548** | **.239** | **.578** | **-2.29(.022)*** | -.158 | .272 | .854 | -.579(.562) |
| | **DECR** | **.600** | **.193** | **1.82** | **3.11(.002)*** | **-.390** | **1.89** | **.677** | **-2.06(.039)*** | | | | |
| | **HIGH** | **.990** | **.159** | **2.69** | **6.24(.000)*** | | | | | | | | |
| Family Conflict | **INCR** | -.049 | .212 | .952 | -.230(.818) | -.107 | .221 | .899 | -.481(.630) | -.086 | .234 | .918 | -.367(.714) |
| | **DECR** | .037 | .151 | 1.04 | .246(.806) | -.021 | .160 | .980 | -.128(.898) | | | | |
| | **HIGH** | .058 | .133 | 1.06 | .433(.665) | | | | | | | | |
| Parental Monitoring | **INCR** | -.098 | .239 | .906 | -.412(.681) | -.028 | .252 | .972 | -.111(.912) | .107 | .272 | 1.11 | .394(.693) |
| | **DECR** | -.205 | .169 | .814 | -1.21(.225) | -.135 | .187 | .874 | -.721(.471) | | | | |
| | **HIGH** | -.070 | .143 | .932 | -.491(.623) | | | | | | | | |
| Trauma History | **INCR** | .014 | .047 | 1.01 | .307(.759) | -.064 | .047 | .938 | -1.37(.170) | -.032 | .052 | .969 | -.612(.540) |
| | **DECR** | .046 | .033 | 1.05 | 1.41(.157) | -.032 | .033 | .969 | -.971(.332) | | | | |
| | **HIGH** | **.078** | **.026** | **1.08** | **2.97(.003)*** | | | | | | | | |

Note: This table presents unstandardized model results when predictors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 16

*Comparison of Alcohol Use Trajectory Classes on Demographic, Family, Peer, and Trauma Variables*

| ***ALC Class*** | **N** | **Male** | **Treatment Group** | **African American** | **Hispanic** | **Asian American** | **Other** | **SES** | **Family Conflict** | **Parental Monitoring** | **Deviant Peer Association** | **Trauma History** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stable, Low** | 205 | 43% | 52% | 37% | 9% | 7% | 17% | -.29 (.75) | -.15 (.66) | .03 (.79) | -.04 (.76) | 2.63 (4.3) |
| **Increasing** | 206 | 44% | 49% | 35% | 7% | 6% | 18% | -.06 (.67) | .05 (.85) | -.04 (.81) | - .10 (.73) | 2.86 (4.1) |
| **Decreasing** | 140 | 39% | 48% | 30% | 7% | 8% | 15% | -.13 (.71) | .12 (.78) | -.20 (.78) | .11 (.81) | 2.89 (4.2) |
| **Stable, High** | 370 | 64% | 51% | 23% | 5% | 5% | 13% | .23 (.65) | -.01 (.68) | .03 (.73) | .06 (.73) | 2.27 (3.4) |
| **Significance Test** | | $\chi2$ (3) = 43.15, p < .00 | $\chi2$(3) = .60, ns | $\chi2$ (3) = 16.28, p < .00 | $\chi2$ (3) = 4.13, ns | $\chi2$ (3) = 3.52, ns | $\chi2$ (3) = 3.33, ns | F (3, 703) = 22.05, p < .00 | F (3, 767) = 3.45, p <.01 | F (3, 767) = 2.81, p < .04 | F (3, 772) = 2.55, p < .05 | F (3, 784) = 1.25, ns |

Note: Significance tests are chi-square tests of independence for categorical variables and analysis of variance for continuous variables

Table 17

*Predictors (Entered Independently) of Membership in Alcohol Use Trajectory Classes*

| | | **LOW ALC Referent Class** | | | | **HIGH ALC Referent Class** | | | | **DECR ALC Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | -.063 | .172 | .939 | -.366(.714) | -.267 | .144 | .766 | -1.85(.064) | **-.392** | **.179** | **.675** | **-2.19(.028)*** |
| | **DECR** | .330 | .175 | 1.39 | 1.89(.059) | .126 | .150 | 1.13 | .838(.402) | | | | |
| | **HIGH** | .204 | .149 | 1.23 | 1.37(.170) | | | | | | | | |
| Family Conflict | **INCR** | **.417** | **.165** | **1.52** | **2.53(.011)*** | .090 | .142 | .721 | ..629(.529) | -.067 | .163 | .936 | -.410(.682) |
| | **DECR** | **.484** | **.169** | **1.62** | **2.86(.004)*** | .156 | .144 | 1.09 | 1.08(.279) | | | | |
| | **HIGH** | **.328** | **.150** | **1.39** | **2.18(.029)*** | | | | | | | | |
| Parental Monitoring | **INCR** | -.211 | .152 | .810 | -1.39(.165) | -.064 | .139 | .938 | -.463(.643) | .253 | .153 | 1.29 | 1.65(.098) |
| | **DECR** | **-.464** | **.156** | **.629** | **-2.97(.003)*** | **-.317** | **.143** | **.728** | **-2.22(.027)*** | | | | |
| | **HIGH** | -.146 | .142 | .864 | -1.03(.303) | | | | | | | | |
| Trauma History | **INCR** | .022 | .030 | 1.02 | .731(.465) | .017 | .025 | 1.02 | .684(.494) | .001 | .029 | 1.00 | .041(.967) |
| | **DECR** | .021 | .033 | 1.02 | .627(.530) | .016 | .027 | 1.02 | .585(.558) | | | | |
| | **HIGH** | .005 | .031 | 1.00 | .149(.881) | | | | | | | | |

Note: This table presents unstandardized model results when predictors were entered independently of one another. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 18

*Predictors (Entered Simultaneously) of Membership in Alcohol Use Trajectory Classes*

| | | **LOW ALC Referent Class** | | | | **HIGH ALC Referent Class** | | | | **DECR ALC Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | -.228 | .194 | .796 | -1.17(.241) | **-.378** | **.167** | **.685** | **-2.26(.024)*** | -.357 | .200 | .700 | -1.78(.074) |
| | **DECR** | .130 | .188 | 1.14 | .691(.490) | -.021 | .167 | .979 | -.126(.900) | | | | |
| | **HIGH** | .151 | .162 | 1.16 | .932(.351) | | | | | | | | |
| Family Conflict | **INCR** | **.418** | **.173** | **1.52** | **2.42(.016)*** | .115 | .153 | 1.12 | .751(.453) | .035 | .166 | 1.04 | .213(.832) |
| | **DECR** | **.383** | **.172** | **1.47** | **2.22(.026)*** | .079 | .149 | 1.08 | .534(.593) | | | | |
| | **HIGH** | **.304** | **.159** | **1.36** | **1.90(.050)*** | | | | | | | | |
| Parental Monitoring | **INCR** | -.192 | .164 | .825 | -1.17(.241) | -.165 | .161 | .848 | -1.03(.305) | .152 | .169 | 1.16 | .899(.369) |
| | **DECR** | **-.344** | **.164** | **.709** | **-2.09(.036)*** | **-.316** | **.159** | **.729** | **-1.99(.046)*** | | | | |
| | **HIGH** | -.028 | .156 | .973 | -.176(.860) | | | | | | | | |
| Trauma History | **INCR** | .019 | .031 | 1.02 | .605(.545) | .024 | .026 | 1.02 | .910(.363) | .015 | .030 | 1.02 | .512(.609) |
| | **DECR** | .004 | .035 | 1.00 | .103(.918) | .009 | .028 | 1.00 | .306(.759) | | | | |
| | **HIGH** | -.005 | .032 | .995 | -.157(.875) | | | | | | | | |

Note: This table presents unstandardized model results when predictors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 19

*Comparison of Marijuana Use Trajectory Classes on Demographic, Family, Peer, and Trauma Variables*

| ***MJ Class*** | **N** | **Male** | **Treatment Group** | **African American** | **Hispanic** | **Asian American** | **Other** | **SES** | **Family Conflict** | **Parental Monitoring** | **Deviant Peer Association** | **Trauma History** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stable, Low** | 610 | 46% | 50% | 29% | 7% | 9% | 15% | -.03 (.72) | -.05 (.72) | .03 (.76) | -.13 (.70) | 2.20 (3.5) |
| **Increasing** | 101 | 59% | 51% | 36% | 7% | 2% | 20% | -.07 (.74) | -.02 (.80) | -.13 (.83) | .26 (.79) | 3.37 (4.7) |
| **Decreasing** | 81 | 57% | 58% | 31% | 3% | 1% | 14% | .20 (.65) | -.01 (.67) | -.01 (.69) | .05 (.66) | 3.66 (4.9) |
| **Stable, High** | 129 | 68% | 45% | 29% | 4% | 1% | 14% | .11 (.68) | .21 (.76) | -.19 (.77) | .41 (.80) | 3.01 (3.8) |
| **Significance Test** | | $\chi2$ (3) = 26.42, p < .00 | $\chi2$(3) = 3.43, ns | $\chi2$ (3) = 2.13, ns | $\chi2$ (3) = 4.48, ns | $\chi2$ (3) = 19.04, p < .00 | $\chi2$ (3) = 2.08, ns | F (3, 703) = 2.96, p < .03 | F (3, 767) = 4.08, p <.00 | F (3, 767) = 3.22, p < .02 | F (3, 772) = 21.71, p < .00 | F (3, 784) = 5.23, p < .00 |

Note: Significance tests are chi-square tests of independence for categorical variables and analysis of variance for continuous variables

Table 20

*Predictors (Entered Independently) of Membership in Marijuana Use Trajectory Classes*

| | | **LOW MJ Referent Class** | | | | **HIGH MJ Referent Class** | | | | **DECR MJ Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | **.682** | **.155** | **1.98** | **4.39(.000)*** | -2.10 | .158 | .811 | -1.33(.183) | .237 | .200 | 1.27 | 1.19(.235) |
| | **DECR** | **.445** | **.178** | **1.56** | **2.50(.012)*** | **-.447** | **.181** | **.640** | **-2.46(.014)*** | | | | |
| | **HIGH** | **.892** | **.139** | **2.44** | **6.43(.000)*** | | | | | | | | |
| Family Conflict | **INCR** | .080 | .179 | 1.08 | .446(.656) | **-.390** | **.199** | **.677** | **-1.96(.050)*** | -.001 | .237 | .999 | -.004(.997) |
| | **DECR** | .081 | .182 | 1.08 | .443(.658) | **-.389** | **.196** | **.678** | **-1.99(.047)*** | | | | |
| | **HIGH** | **.469** | **.130** | **1.60** | **3.61(.000)*** | | | | | | | | |
| Parental Monitoring | **INCR** | -.275 | .170 | .760 | -1.62(.105) | .166 | .199 | 1.18 | .833(.405) | -.080 | .226 | .923 | -.352(.724) |
| | **DECR** | -.195 | .171 | .823 | -1.14(.253) | .245 | .200 | 1.28 | 1.23(.221) | | | | |
| | **HIGH** | **-.440** | **.138** | **.644** | **-3.18(.001)*** | | | | | | | | |
| Trauma History | **INCR** | **.087** | **.028** | **1.09** | **3.05(.002)*** | -.003 | .032 | .997 | -.090(.928) | -.030 | .035 | .971 | -.843(.399) |
| | **DECR** | **.116** | **.030** | **1.12** | **3.82(.000)*** | .027 | .031 | 1.03 | .867(.386) | | | | |
| | **HIGH** | **.090** | **.026** | **1.10** | **3.40(.001)*** | | | | | | | | |

Note: This table presents unstandardized model results when predictors were entered independently of one another. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 21

*Predictors (Entered Simultaneously) of Membership in Marijuana Use Trajectory Classes*

| | | **LOW MJ Referent Class** | | | | **HIGH MJ Referent Class** | | | | **DECR MJ Referent Class** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | Class | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) | Logit | SE | OR | t(p) |
| Deviant Peer Affiliation | **INCR** | **.641** | **.169** | **1.90** | **3.79(.000)*** | -.150 | .175 | .861 | -.857(.392) | .263 | .229 | 1.30 | 1.15(.250) |
| | **DECR** | .378 | .205 | 1.46 | 1.84(.066) | **-.413** | **.209** | **.662** | **-1.98(.048)*** | | | | |
| | **HIGH** | **.791** | **.148** | **2.21** | **2.14(.000)*** | | | | | | | | |
| Family Conflict | **INCR** | -.063 | .179 | .939 | -.351(.726) | -.354 | .200 | .702 | -1.76(.078) | -.047 | .243 | .954 | -.193(.846) |
| | **DECR** | -.016 | .191 | .984 | -.083(.934) | -.307 | .206 | .736 | -1.49(.137) | | | | |
| | **HIGH** | **.291** | **.137** | **1.34** | **2.13(.033)*** | | | | | | | | |
| Parental Monitoring | **INCR** | -.026 | .177 | .974 | -.148(.883) | -.024 | .220 | .976 | -1.08(.914) | -.031 | .262 | .970 | -.116(.907) |
| | **DECR** | .004 | .210 | 1.00 | .021(.983) | .007 | .242 | 1.01 | .028(.978) | | | | |
| | **HIGH** | -.002 | .160 | .998 | -.014(.989) | | | | | | | | |
| Trauma History | **INCR** | **.072** | **.029** | **1.08** | **2.53(.011)*** | .013 | .033 | 1.01 | .393(.694) | -.035 | .036 | .966 | -.971(.332) |
| | **DECR** | **.107** | **.031** | **1.11** | **3.42(.001)*** | .048 | .033 | 1.05 | 1.46(.145) | | | | |
| | **HIGH** | **.059** | **.028** | **1.06** | **2.14(.032)*** | | | | | | | | |

Note: This table presents unstandardized model results when predictors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 22

*Comparison of Co-occurring Risky Sexual Behavior and Tobacco Use Trajectory Classes on Demographic, Family, Peer, and Trauma Variables*

| ***RSB and TOB Class*** | **N** | **Male** | **Treatment Group** | **African American** | **Hispanic** | **Asian American** | **Other** | **SES** | **Family Conflict** | **Parental Monitoring** | **Deviant Peer Association** | **Trauma History** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low RSB, Low TOB** | 433 | 47% | 49% | 29% | 9% | 7% | 13% | .07 (.69) | -.09 (.68) | .13 (.70) | -.22 (.64) | 1.97 (3.3) |
| **Increasing RSB, Low TOB** | 44 | 48% | 48% | 39% | 2% | 5% | 14% | -.06 (.71) | .15 (.97) | -.17 (.90) | -.14 (.48) | 2.78 (4.2) |
| **Decreasing RSB, Low TOB** | 44 | 57% | 41% | 48% | 7% | 2% | 9% | .12 (.62) | -.07 (.81) | .12 (.77) | -.11 (.83) | 2.83 (4.5) |
| **Low RSB, Increasing TOB** | 41 | 49% | 49% | 29% | 0% | 2% | 17% | .14 (.77) | -.03 (.73) | -.04 (.82) | .07 (.66) | 2.29 (4.1) |
| **Increasing RSB, Increasing TOB** | 13 | 62% | 54% | 31% | 15% | 0% | 46% | -.19 (.57) | .03 (.63) | .01 (.74) | .07 (.76) | 2.67 (3.0) |
| **Decreasing RSB, Increasing TOB** | 5 | 80% | 60% | 60% | 0% | 0% | 20% | -.17 (1.1) | -.59 (.14) | -.12 (1.2) | -.23 (.49) | 3.00 (2.8) |
| **Low RSB, Decreasing TOB** | 68 | 52% | 53% | 19% | 6% | 9% | 15% | .10 (.64) | -.02 (.59) | -.11 (.67) | .19 (.73) | 2.55 (3.7) |
| **Increasing RSB, Decreasing TOB** | 8 | 63% | 63% | 38% | 0% | 0% | 13% | .36 (.65) | .39 (.78) | -.29 (.46) | -.34 (.29) | 4.25 (4.3) |
| **Decreasing RSB, Decreasing TOB** | 20 | 50% | 65% | 20% | 0% | 5% | 15% | .10 (.85) | .19 (.61) | -.18 (.95) | .17 (.84) | 3.13 (5.1) |
| **Low RSB, High TOB** | 158 | 59% | 49% | 25% | 4% | 8% | 18% | -.13 (.76) | .05 (.83) | -.13 (.71) | .43 (.88) | 3.11 (4.2) |
| **Increasing RSB, High TOB** | 30 | 47% | 55% | 43% | 3% | 0% | 17% | -.04 (.73) | .31 (.79) | -.42 (1.0) | .46 (.73) | 5.39 (4.8) |
| **Decreasing RSB, High TOB** | 44 | 61% | 55% | 34% | 5% | 0% | 14% | -.25 (.77) | .19 (.75) | -.48 (.93) | .38 (.72) | 4.29 (5.1) |
| **Significance Test** | | $\chi2$ (11) = 12.51, ns | $\chi2$(11) = 5.21, ns | $\chi2$ (11) = 20.68, p < .04 | $\chi2$ (11) = 13.40, ns | $\chi2$ (11) = 12.07, ns | $\chi2$ (11) = 13.86, ns | F (11, 688) = 1.58, ns | F (11, 752) = 2.05, p <.02 | F (11, 752) = 3.92, p < .00 | F (11, 757) = 10.35, p < .00 | F (11, 769) = 3.13, p < .00 |

Note: Significance tests are chi-square tests of independence for categorical variables and analysis of variance for continuous variables

Table 23

*Predictors (Entered Independently) of Membership in Co-occurring Risky Sexual Behavior and Tobacco Use Trajectory Classes*

| **Predictor** | Class | **LOW HRSB/LOW TOB Referent Class** Logit | SE | OR | t(p) |
|---|---|---|---|---|---|
| Deviant Peer Affiliation | **Increasing HRSB, Low TOB** | .169 | .225 | 1.18 | .750(.453) |
| | **Decreasing HRSB, Low TOB** | .191 | .379 | 1.21 | .504(.614) |
| | **Low HRSB, Increasing TOB** | **.645** | **.261** | **1.91** | **2.47(.014)*** |
| | **~~Increasing RSB, Increasing TOB~~** | | | | |
| | **~~Decreasing RSB, Increasing TOB~~** | | | | |
| | **Low HRSB, Decreasing TOB** | **.866** | **.190** | **2.38** | **4.55(.000)*** |
| | **~~Increasing RSB, Decreasing TOB~~** | | | | |
| | **Decreasing HRSB, Decreasing TOB** | **.850** | **.333** | **2.34** | **2.55(.011)*** |
| | **Low HRSB, High TOB** | **1.14** | **.165** | **3.13** | **6.93(.000)*** |
| | **Increasing HRSB, High TOB** | **1.32** | **.212** | **3.76** | **6.24(.000)*** |
| | **Decreasing HRSB, High TOB** | **1.01** | **.210** | **2.75** | **4.82(.000)*** |

| **Predictor** | Class | **LOW HRSB/LOW TOB Referent Class** Logit | SE | OR | t(p) |
|---|---|---|---|---|---|
| Family Conflict | **Increasing HRSB, Low TOB** | .435 | .232 | 1.55 | 1.87(.061) |
| | **Decreasing HRSB, Low TOB** | .072 | .296 | 1.08 | .244(.807) |
| | **Low HRSB, Increasing TOB** | .110 | .257 | 1.12 | .427(.669) |
| | **~~Increasing RSB, Increasing TOB~~** | | | | |
| | **~~Decreasing RSB, Increasing TOB~~** | | | | |
| | **Low HRSB, Decreasing TOB** | .121 | .174 | 1.13 | .696(.487) |
| | **~~Increasing RSB, Decreasing TOB~~** | | | | |
| | **Decreasing HRSB, Decreasing TOB** | **.473** | **.228** | **1.61** | **2.08(.038)*** |
| | **Low HRSB, High TOB** | .265 | .151 | 1.30 | 1.76(.079) |
| | **Increasing HRSB, High TOB** | **.648** | **.223** | **1.91** | **2.91(.004)*** |
| | **Decreasing HRSB, High TOB** | **.476** | **.205** | **1.61** | **2.32(.020)*** |

| Predictor | Class | **LOW HRSB/LOW TOB Referent Class** | | | |
|---|---|---|---|---|---|
| | | Logit | SE | OR | t(p) |
| | **Increasing HRSB, Low TOB** | **-.554** | **.241** | **.575** | **-2.29(.022)*** |
| | **Decreasing HRSB, Low TOB** | -.023 | .289 | .977 | -.081(.936) |
| | **Low HRSB, Increasing TOB** | -.367 | .283 | .693 | -1.29(.194) |
| | ~~**Increasing RSB, Increasing TOB**~~ | | | | |
| | ~~**Decreasing RSB, Increasing TOB**~~ | | | | |
| Parental Monitoring | **Low HRSB, Decreasing TOB** | **-.473** | **.176** | **.623** | **-2.68(.007)*** |
| | ~~**Increasing RSB, Decreasing TOB**~~ | | | | |
| | **Decreasing HRSB, Decreasing TOB** | -.604 | .326 | .547 | -1.85(.064) |
| | **Low HRSB, High TOB** | **-.383** | **.142** | **.682** | **2.70(.007)*** |
| | **Increasing HRSB, High TOB** | **-.983** | **.294** | **.347** | **-3.34(.001)*** |
| | **Decreasing HRSB, High TOB** | **-.957** | **.227** | **.384** | **-4.21(.000)*** |

| Predictor | Class | **LOW HRSB/LOW TOB Referent Class** | | | |
|---|---|---|---|---|---|
| | | Logit | SE | OR | t(p) |
| | **Increasing HRSB, Low TOB** | .075 | .049 | 1.08 | 1.55(.122) |
| | **Decreasing HRSB, Low TOB** | .081 | .051 | 1.08 | 1.61(.108) |
| | **Low HRSB, Increasing TOB** | .048 | .063 | 1.05 | .768(.443) |
| | ~~**Increasing RSB, Increasing TOB**~~ | | | | |
| | ~~**Decreasing RSB, Increasing TOB**~~ | | | | |
| Trauma History | **Low HRSB, Decreasing TOB** | .056 | .039 | 1.06 | 1.45(.145) |
| | ~~**Increasing RSB, Decreasing TOB**~~ | | | | |
| | **Decreasing HRSB, Decreasing TOB** | .102 | .062 | 1.11 | 1.65(.099) |
| | **Low HRSB, High TOB** | **.089** | **.028** | **1.09** | **3.21(.001)*** |
| | **Increasing HRSB, High TOB** | **.187** | **.038** | **1.21** | **4.94(.000)*** |
| | **Decreasing HRSB, High TOB** | **.159** | **.036** | **1.17** | **4.41(.000)*** |

Note: This table presents unstandardized model results when predictors were entered independently of one another. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 24

*Predictors (Entered Simultaneously) of Membership in Co-occurring Risky Sexual Behavior and Tobacco Use Trajectory Classes*

| | | **LOW HRSB/LOW TOB Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | **Increasing HRSB, Low TOB** | -.169 | .245 | .845 | -.689(.491) |
| | **Decreasing RSB, Low TOB** | .172 | .380 | 1.19 | .454(.650) |
| | **Low HRSB, Increasing TOB** | **.577** | **.289** | **1.78** | **1.99(.046)*** |
| | **~~Increasing RSB, Increasing TOB~~** | | | | |
| | **~~Decreasing RSB, Increasing TOB~~** | | | | |
| Deviant Peer Affiliation | **Low HRSB, Decreasing TOB** | **.779** | **.217** | **2.18** | **3.61(.000)*** |
| | **~~Increasing RSB, Decreasing TOB~~** | | | | |
| | **Decreasing HRSB, Decreasing TOB** | .627 | .372 | 1.87 | 1.69(.092) |
| | **Low HRSB, High TOB** | **1.12** | **.181** | **3.06** | **6.20(.000)*** |
| | **Increasing HRSB, High TOB** | **.940** | **.267** | **2.56** | **3.52(.000)*** |
| | **Decreasing HRSB, High TOB** | **.648** | **.248** | **1.91** | **2.62(.009)*** |

| | | **LOW HRSB/LOW TOB Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | **Increasing HRSB, Low TOB** | .361 | .229 | 1.43 | 1.58(.115) |
| | **Decreasing HRSB, Low TOB** | .038 | .294 | 1.04 | .129(.897) |
| | **Low HRSB, Increasing TOB** | -.021 | .262 | .979 | -.079(.937) |
| | **~~Increasing RSB, Increasing TOB~~** | | | | |
| | **~~Decreasing RSB, Increasing TOB~~** | | | | |
| Family Conflict | **Low HRSB, Decreasing TOB** | -.073 | .182 | .930 | -.398(.690) |
| | **~~Increasing RSB, Decreasing TOB~~** | | | | |
| | **Decreasing HRSB, Decreasing TOB** | .281 | .225 | 1.33 | 1.25(.210) |
| | **Low HRSB, High TOB** | .040 | .163 | 1.04 | .248(.804) |
| | **Increasing HRSB, High TOB** | .306 | .256 | 1.36 | 1.19(.232) |
| | **Decreasing HRSB, High TOB** | .151 | .227 | 1.16 | .662(.508) |

| | | **LOW HRSB/LOW TOB Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| Parental Monitoring | **Increasing HRSB, Low TOB** | **-.497** | **.245** | **.608** | **-2.03(.043)*** |
| | **Decreasing HRSB, Low TOB** | .080 | .309 | 1.08 | .260(.795) |
| | **Low HRSB, Increasing TOB** | -.147 | .301 | .863 | -.489(.625) |
| | ~~**Increasing RSB, Increasing TOB**~~ | | | | |
| | ~~**Decreasing RSB, Increasing TOB**~~ | | | | |
| | **Low HRSB, Decreasing TOB** | -.171 | .199 | .843 | -.861(.389) |
| | ~~**Increasing RSB, Decreasing TOB**~~ | | | | |
| | **Decreasing HRSB, Decreasing TOB** | -.278 | .363 | .758 | -.764(.445) |
| | **Low HRSB, High TOB** | .071 | .151 | 1.07 | .470(.638) |
| | **Increasing HRSB, High TOB** | -.498 | .371 | .608 | -1.34(.180) |
| | **Decreasing HRSB, High TOB** | **-.587** | **.293** | **.556** | **-2.00(.045)*** |

| | | **LOW HRSB/LOW TOB Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| Trauma History | **Increasing HRSB, Low TOB** | .068 | .047 | 1.07 | 1.44(.149) |
| | **Decreasing HRSB, Low TOB** | .078 | .049 | 1.08 | 1.61(.108) |
| | **Low HRSB, Increasing TOB** | .035 | .066 | 1.04 | .529(.597) |
| | ~~**Increasing RSB, Increasing TOB**~~ | | | | |
| | ~~**Decreasing RSB, Increasing TOB**~~ | | | | |
| | **Low HRSB, Decreasing TOB** | .039 | .040 | 1.04 | .963(.336) |
| | ~~**Increasing RSB, Decreasing TOB**~~ | | | | |
| | **Decreasing HRSB, Decreasing TOB** | .079 | .063 | 1.08 | 1.24(.213) |
| | **Low HRSB, High TOB** | **.065** | **.030** | **1.07** | **2.12(.034)*** |
| | **Increasing HRSB, High TOB** | **.151** | **.045** | **1.16** | **3.34(.001)*** |
| | **Decreasing HRSB, High TOB** | **.133** | **.037** | **1.14** | **3.54(.000)*** |

Note: This table presents unstandardized model results when predictors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 25

*Comparison of Co-occurring Risky Sexual Behavior and Alcohol Use Trajectory Classes on Demographic, Family, Peer, and Trauma Variables*

| ***RSB and ALC Class*** | **N** | **Male** | **Treatment Group** | **African American** | **Hispanic** | **Asian American** | **Other** | **SES** | **Family Conflict** | **Parental Monitoring** | **Deviant Peer Association** | **Trauma History** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low RSB, Low *ALC*** | 175 | 42% | 53% | 37% | 9% | 9% | 16% | -.28 (.72) | -.17 (.66) | .04 (.79) | -.10 (.75) | 2.33 (3.7) |
| **Increasing RSB, Low *ALC*** | 12 | 50% | 27% | 25% | 8% | 0% | 33% | .27 (.54) | -.26 (.61) | -.01 (.59) | .35 (.92) | 2.50 (3.8) |
| **Decreasing RSB, Low *ALC*** | 14 | 50% | 50% | 43% | 7% | 0% | 14% | -.68 (.91) | .03 (.68) | -.19 (.97) | .28 (.72) | 5.92 (7.8) |
| **Low RSB, Increasing *ALC*** | 162 | 44% | 51% | 34% | 7% | 7% | 19% | -.03 (.69) | -.05 (.77) | .04 (.75) | -.07 (.80) | 2.61 (3.9) |
| **Increasing RSB, Increasing *ALC*** | 28 | 43% | 43% | 29% | 4% | 0% | 21% | -.16 (.66) | .47 (1.0) | -.34 (.98) | -.12 (.46) | 4.31 (5.1) |
| **Decreasing RSB, Increasing *ALC*** | 15 | 47% | 33% | 53% | 13% | 7% | 7% | -.19 (.59) | .25 (.99) | -.21 (.88) | -.34 (.47) | 2.77 (2.7) |
| **Low RSB, Decreasing *ALC*** | 103 | 37% | 44% | 24% | 8% | 11% | 14% | -.08 (.67) | .09 (.78) | -.10 (.69) | .06 (.78) | 2.58 (3.8) |
| **Increasing RSB, Decreasing *ALC*** | 8 | 50% | 75% | 38% | 0% | 13% | 25% | -.38 (.81) | .07 (.77) | -.95 (.94) | .49 (.92) | 2.33 (3.4) |
| **Decreasing RSB, Decreasing *ALC*** | 28 | 46% | 57% | 50% | 4% | 0% | 18% | -.22 (.79) | .21 (.79) | -.35 (.89) | .16 (.94) | 4.12 (5.4) |
| **Low RSB, High *ALC*** | 260 | 64% | 49% | 17% | 5% | 6% | 12% | .29 (.63) | -.03 (.67) | .08 (.65) | .04 (.74) | 1.95 (3.2) |
| **Increasing RSB, High *ALC*** | 47 | 55% | 60% | 49% | 4% | 2% | 13% | .03 (.71) | .16 (.76) | -.07 (.81) | -.01 (.59) | 3.64 (4.1) |
| **Decreasing RSB, High *ALC*** | 56 | 70% | 54% | 27% | 2% | 2% | 11% | .22 (.64) | -.08 (.67) | -.07 (.93) | .20 (.79) | 2.68 (3.7) |
| **Significance Test** | | $\chi2$ (11) = 43.75, p < .00 | $\chi2$(11) = 11.77, ns | $\chi2$ (11) = 45.63, p < .00 | $\chi2$ (11) = 8.48, ns | $\chi2$ (11) = 14.69, ns | $\chi2$ (11) = 10.05, ns | F (11, 688) = 7.57, p <.00 | F (11, 752) = 2.60, p <.00 | F (11, 752) = 2.58, p < .00 | F (11, 757) = 1.77, p < .05 | F (11, 769) = 2.59, p < .00 |

Note: Significance tests are chi-square tests of independence for categorical variables and analysis of variance for continuous variables

Table 26

*Predictors (Entered Independently) of Membership in Co-occurring Risky Sexual Behavior and Alcohol Use Trajectory Classes*

| | | **LOW HRSB/LOW ALC Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | ~~**Increasing RSB, Low ALC**~~ | | | | |
| | ~~**Decreasing RSB, Low ALC**~~ | | | | |
| | **Low HRSB, Increasing ALC** | .138 | .195 | 1.15 | .709(.479) |
| | **Increasing HRSB, Increasing ALC** | -.081 | .259 | .922 | -.313(.754) |
| | ~~**Decreasing RSB, Increasing ALC**~~ | | | | |
| Deviant Peer Affiliation | **Low HRSB, Decreasing ALC** | .379 | .204 | 1.46 | 1.86(.063) |
| | ~~**Increasing RSB, Decreasing ALC**~~ | | | | |
| | **Decreasing HRSB, Decreasing ALC** | .463 | .312 | 1.59 | 1.48(.138) |
| | **Low HRSB, High ALC** | .285 | .170 | 1.33 | 1.67(.094) |
| | **Increasing HRSB, High ALC** | .242 | .219 | 1.27 | 1.10(.269) |
| | **Decreasing HRSB, High ALC** | **.482** | **.222** | **1.62** | **2.17(.030)*** |

| | | **LOW HRSB/LOW ALC Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | ~~**Increasing RSB, Low ALC**~~ | | | | |
| | ~~**Decreasing RSB, Low ALC**~~ | | | | |
| | **Low HRSB, Increasing ALC** | .278 | .193 | 1.32 | 1.44(.149) |
| | **Increasing RSB, Increasing ALC** | **1.01** | **.272** | **2.75** | **3.73(.000)*** |
| | ~~**Decreasing RSB, Increasing ALC**~~ | | | | |
| Family Conflict | **Low HRSB, Decreasing ALC** | **.493** | **.196** | **1.64** | **2.51(.012)*** |
| | ~~**Increasing RSB, Decreasing ALC**~~ | | | | |
| | **Decreasing HRSB, Decreasing ALC** | **.704** | **.286** | **2.02** | **2.46(.014)*** |
| | **Low HRSB, High ALC** | .325 | .170 | 1.38 | 1.91(.056) |
| | **Increasing HRSB, High ALC** | **.674** | **.235** | **1.96** | **2.88(.004)*** |
| | **Decreasing HRSB, High ALC** | .201 | .251 | 1.22 | .801(.423) |

| | | **LOW HRSB/LOW ALC Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| Parental Monitoring | ~~**Increasing RSB, Low ALC**~~ | | | | |
| | ~~**Decreasing RSB, Low ALC**~~ | | | | |
| | **Low HRSB, Increasing ALC** | -.092 | .171 | .912 | -.540(.589) |
| | **Increasing HRSB, Increasing ALC** | **-.726** | **.303** | **.484** | **-2.39(.017)*** |
| | ~~**Decreasing RSB, Increasing ALC**~~ | | | | |
| | **Low HRSB, Decreasing ALC** | -.338 | .174 | .713 | -1.93(.053) |
| | ~~**Increasing RSB, Decreasing ALC**~~ | | | | |
| | **Decreasing HRSB, Decreasing ALC** | **-.693** | **.278** | **.500** | **-2.49(.013)*** |
| | **Low HRSB, High ALC** | -.051 | .156 | .950 | -.325(.745) |
| | **Increasing HRSB, High ALC** | -.329 | .261 | .719 | -1.26(.207) |
| | **Decreasing HRSB, High ALC** | -.315 | .280 | .730 | -1.12(.261) |

| | | **LOW HRSB/LOW ALC Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| Trauma History | ~~**Increasing RSB, Low ALC**~~ | | | | |
| | ~~**Decreasing RSB, Low ALC**~~ | | | | |
| | **Low HRSB, Increasing ALC** | .028 | .036 | 1.03 | .799(.424) |
| | **Increasing HRSB, Increasing ALC** | **.119** | **.050** | **1.13** | **2.36(.018)*** |
| | ~~**Decreasing RSB, Increasing ALC**~~ | | | | |
| | **Low HRSB, Decreasing ALC** | .022 | .039 | 1.02 | .555(.579) |
| | ~~**Increasing RSB, Decreasing ALC**~~ | | | | |
| | **Decreasing HRSB, Decreasing ALC** | **.117** | **.051** | **1.12** | **2.28(.023)*** |
| | **Low HRSB, High ALC** | -.002 | .038 | .998 | -.055(.956) |
| | **Increasing HRSB, High ALC** | **.107** | **.042** | **1.11** | **2.54(.011)*** |
| | **Decreasing HRSB, High ALC** | .067 | .045 | 1.07 | 1.50(.133) |

Note: This table presents unstandardized model results when predictors were entered independently of one another. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 27

*Predictors (Entered Simultaneously) of Membership in Co-occurring Risky Sexual Behavior and Alcohol Use Trajectory Classes*

| | | **LOW HRSB/LOW ALC Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | ~~**Increasing RSB, Low ALC**~~ | | | | |
| | ~~**Decreasing RSB, Low ALC**~~ | | | | |
| | **Low HRSB, Increasing ALC** | .081 | .212 | 1.08 | .380(.511) |
| | **Increasing HRSB, Increasing ALC** | **-.797** | **.366** | **.451** | **-2.174(.030)*** |
| | ~~**Decreasing RSB, Increasing ALC**~~ | | | | |
| Deviant Peer Affiliation | **Low HRSB, Decreasing ALC** | .239 | .224 | 1.27 | 1.07(.286) |
| | ~~**Increasing RSB, Decreasing ALC**~~ | | | | |
| | **Decreasing HRSB, Decreasing ALC** | .072 | .306 | 1.07 | .234(.815) |
| | **Low HRSB, High ALC** | .285 | .189 | 1.33 | 1.51(.131) |
| | **Increasing HRSB, High ALC** | **-.006** | **.044** | **1.46** | **2.18(.029)*** |
| | **Decreasing HRSB, High ALC** | .378 | .258 | 1.46 | 1.47(.218) |

| | | **LOW HRSB/LOW ALC Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | ~~**Increasing RSB, Low ALC**~~ | | | | |
| | ~~**Decreasing RSB, Low ALC**~~ | | | | |
| | **Low HRSB, Increasing ALC** | .264 | .204 | 1.30 | 1.29(.195) |
| | **Increasing RSB, Increasing ALC** | **.988** | **.290** | **2.68** | **3.41(.001)*** |
| | ~~**Decreasing RSB, Increasing ALC**~~ | | | | |
| Family Conflict | **Low HRSB, Decreasing ALC** | **.421** | **.203** | **1.52** | **2.08(.038)*** |
| | ~~**Increasing RSB, Decreasing ALC**~~ | | | | |
| | **Decreasing HRSB, Decreasing ALC** | **.545** | **.268** | **1.72** | **2.03(.042)*** |
| | **Low HRSB, High ALC** | .310 | .183 | 1.36 | 1.69(.091) |
| | **Increasing HRSB, High ALC** | **.612** | **.245** | **1.84** | **2.50(.012)*** |
| | **Decreasing HRSB, High ALC** | .076 | .266 | 1.46 | .284(.776) |

| Predictor | Class | LOW HRSB/LOW ALC Referent Class | | | |
|---|---|---|---|---|---|
| | | Logit | SE | OR | t(p) |
| | **~~Increasing RSB, Low ALC~~** | | | | |
| | **~~Decreasing RSB, Low ALC~~** | | | | |
| | **Low HRSB, Increasing ALC** | -.013 | .183 | .987 | -.071(.944) |
| | **Increasing HRSB, Increasing ALC** | **-.705** | **.354** | **.494** | **-1.99(.046)*** |
| | **~~Decreasing RSB, Increasing ALC~~** | | | | |
| Parental Monitoring | **Low HRSB, Decreasing ALC** | -.198 | .183 | .820 | -1.08(.281) |
| | **~~Increasing RSB, Decreasing ALC~~** | | | | |
| | **Decreasing HRSB, Decreasing ALC** | -.507 | .294 | .602 | -.1.72(.085) |
| | **Low HRSB, High ALC** | .095 | .169 | 1.10 | .564(.573) |
| | **Increasing HRSB, High ALC** | -.174 | .275 | .840 | -.633(.527) |
| | **Decreasing HRSB, High ALC** | -.123 | .349 | .884 | -.353(.724) |

| Predictor | Class | LOW HRSB/LOW ALC Referent Class | | | |
|---|---|---|---|---|---|
| | | Logit | SE | OR | t(p) |
| | **~~Increasing RSB, Low ALC~~** | | | | |
| | **~~Decreasing RSB, Low ALC~~** | | | | |
| | **Low HRSB, Increasing ALC** | .024 | .037 | 1.03 | .657(.511) |
| | **Increasing HRSB, Increasing ALC** | **.110** | **.053** | **1.12** | **2.08(.038)*** |
| | **~~Decreasing RSB, Increasing ALC~~** | | | | |
| Trauma History | **Low HRSB, Decreasing ALC** | .006 | .041 | 1.01 | .133(.894) |
| | **~~Increasing RSB, Decreasing ALC~~** | | | | |
| | **Decreasing HRSB, Decreasing ALC** | .098 | .054 | 1.10 | 1.82(.068) |
| | **Low HRSB, High ALC** | -.010 | .040 | .990 | -.249(.803) |
| | **Increasing HRSB, High ALC** | **.095** | **.044** | **1.10** | **2.18(.029)*** |
| | **Decreasing HRSB, High ALC** | .055 | .045 | 1.06 | 1.23(.218) |

Note: This table presents unstandardized model results when predictors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 28

*Comparison of Co-occurring Risky Sexual Behavior and Marijuana Use Trajectory Classes on Demographic, Family, Peer, and Trauma Variables*

| ***RSB and MJ Class*** | **N** | **Male** | **Treatment Group** | **African American** | **Hispanic** | **Asian American** | **Other** | **SES** | **Family Conflict** | **Parental Monitoring** | **Deviant Peer Association** | **Trauma History** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low RSB, Low *MJ*** | 502 | 45% | 49% | 28% | 8% | 10% | 14% | -.02 (.71) | -.08 (.70) | .07 (.74) | -.12 (.74) | 2.13 (3.5) |
| **Increasing RSB, Low *MJ*** | 54 | 54% | 54% | 33% | 6% | 4% | 19% | .04 (.70) | .08 (.83) | -.14 (.79) | -.18 (.49) | 3.08 (4.2) |
| **Decreasing RSB, Low *MJ*** | 44 | 43% | 55% | 32% | 5% | 2% | 16% | -.17 (.85) | -.02 (.79) | -.06 (.98) | -.18 (.56) | 1.87 (2.5) |
| **Low RSB, Increasing *MJ*** | 70 | 61% | 53% | 36% | 6% | 1% | 17% | -.06 (.75) | -.12 (.74) | -.08 (.69) | .32 (.85) | 2.95 (4.2) |
| **Increasing RSB, Increasing *MJ*** | 13 | 39% | 50% | 31% | 0% | 0% | 31% | .12 (.54) | .58 (1.0) | -.78 (1.2) | .33 (.63) | 5.00 (5.0) |
| **Decreasing RSB, Increasing *MJ*** | 16 | 63% | 44% | 44% | 13% | 6% | 19% | -.23 (.86) | -.08 (.67) | .10 (.95) | -.06 (.58) | 3.73 (5.9) |
| **Low RSB, Decreasing *MJ*** | 55 | 53% | 58% | 22% | 4% | 2% | 16% | .22 (.68) | .05 (.69) | .08 (.57) | .01 (.49) | 3.33 (4.3) |
| **Increasing RSB, Decreasing *MJ*** | 5 | 80% | 80% | 40% | 0% | 0% | 20% | -.16 (.62) | -.15 (.97) | .51 (.16) | -.49 (.21) | 1.33 (1.5) |
| **Decreasing RSB, Decreasing *MJ*** | 21 | 62% | 52% | 52% | 0% | 0% | 5% | .19 (.60) | -.14 (.63) | -.24 (.89) | .21 (.94) | 4.80 (6.3) |
| **Low RSB, High *MJ*** | 73 | 73% | 43% | 18% | 4% | 1% | 15% | .28 (.62) | .13 (.74) | -.06 (.68) | .33 (.77) | 1.95 (2.8) |
| **Increasing RSB, High *MJ*** | 23 | 44% | 44% | 57% | 4% | 0% | 13% | -.27 (.72) | .32 (.79) | -.23 (.92) | .42 (.76) | 4.45 (4.5) |
| **Decreasing RSB, High *MJ*** | 32 | 75% | 50% | 34% | 3% | 6% | 9% | .03 (.65) | .32 (.78) | -.40 (.81) | .53 (.89) | 4.48 (4.8) |
| **Significance Test** | | $\chi2$ (11) = 37.40, p < .00 | $\chi2$(11) = 6.63, ns | $\chi2$ (11) = 24.44, p < .01 | $\chi2$ (11) = 7.79, ns | $\chi2$ (11) = 26.52, p < .01 | $\chi2$ (11) = 13.86, ns | F (11, 688) = 1.58, p <.02 | F (11, 752) = 2.05, p <.01 | F (11, 752) = 3.92, p < .00 | F (11, 757) = 10.35, p < .00 | F (11, 769) = 3.13, p < .00 |

Note: Significance tests are chi-square tests of independence for categorical variables and analysis of variance for continuous variables

Table 29

*Predictors (Entered Independently) of Membership in Co-occurring Risky Sexual Behavior and Marijuana Use Trajectory Classes*

| **Predictor** | Class | **LOW HRSB/LOW MJ Referent Class** Logit | SE | OR | t(p) |
|---|---|---|---|---|---|
| Deviant Peer Affiliation | **Increasing HRSB, Low MJ** | -.137 | .214 | .872 | -.642(.521) |
| | **Decreasing HRSB, Low MJ** | -.216 | .244 | .806 | -.885(.376) |
| | **Low HRSB, Increasing MJ** | **.715** | **.181** | **2.04** | **3.95(.000)*** |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| | **Low HRSB, Decreasing MJ** | .327 | .179 | 1.39 | 1.82(.068) |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | .675 | .360 | 1.97 | 1.87(.060) |
| | **Low HRSB, High MJ** | **.762** | **.164** | **2.14** | **4.64(.000)*** |
| | **Increasing HRSB, High MJ** | **.943** | **.218** | **2.57** | **4.33(.000)*** |
| | **Decreasing HRSB, High MJ** | **.957** | **.235** | **2.60** | **4.07(.000)*** |

| **Predictor** | Class | **LOW HRSB/LOW MJ Referent Class** Logit | SE | OR | t(p) |
|---|---|---|---|---|---|
| Family Conflict | **Increasing HRSB, Low MJ** | .318 | .209 | 1.37 | 1.52(.129) |
| | **Decreasing HRSB, Low MJ** | .077 | .264 | 1.08 | .291(.771) |
| | **Low HRSB, Increasing MJ** | -.078 | .234 | .925 | -.335(.738) |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| | **Low HRSB, Decreasing MJ** | .243 | .205 | 1.27 | 1.18(.235) |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | -.113 | .367 | .893 | -.309(.757) |
| | **Low HRSB, High MJ** | **.409** | **.170** | **1.51** | **2.41(.016)*** |
| | **Increasing HRSB, High MJ** | **.668** | **.251** | **1.95** | **2.66(.008)*** |
| | **Decreasing HRSB, High MJ** | **.707** | **.221** | **2.03** | **3.20(.001)*** |

| Predictor | Class | LOW HRSB/LOW MJ Referent Class | | | |
|---|---|---|---|---|---|
| | | Logit | SE | OR | t(p) |
| Parental Monitoring | **Increasing HRSB, Low MJ** | **-.443** | **.210** | **.649** | **-2.06(.039)*** |
| | **Decreasing HRSB, Low MJ** | -.233 | .266 | .792 | -.875(.382) |
| | **Low HRSB, Increasing MJ** | -.260 | .190 | .771 | -1.37(.171) |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| | **Low HRSB, Decreasing MJ** | -.114 | .201 | .892 | -.569(.569) |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | **-.728** | **.322** | **.483** | **-2.25(.024)*** |
| | **Low HRSB, High MJ** | **-.362** | **.184** | **.696** | **-1.96(.049)*** |
| | **Increasing HRSB, High MJ** | -.499 | .307 | .607 | -1.63(.104) |
| | **Decreasing HRSB, High MJ** | **-.875** | **.261** | **.417** | **-3.35(.001)*** |

| Predictor | Class | LOW HRSB/LOW MJ Referent Class | | | |
|---|---|---|---|---|---|
| | | Logit | SE | OR | t(p) |
| Trauma History | **Increasing HRSB, Low MJ** | .077 | .040 | 1.08 | 1.95(.051) |
| | **Decreasing HRSB, Low MJ** | -.016 | .045 | .984 | -.362(.718) |
| | **Low HRSB, Increasing MJ** | **.080** | **.037** | **1.08** | **2.15(.032)*** |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| | **Low HRSB, Decreasing MJ** | **.103** | **.036** | **1.11** | **2.82(.005)*** |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | **.201** | **.053** | **1.22** | **3.80(.000)*** |
| | **Low HRSB, High MJ** | .027 | .038 | 1.03 | .718(.473) |
| | **Increasing HRSB, High MJ** | **.152** | **.049** | **1.16** | **3.12(.002)*** |
| | **Decreasing HRSB, High MJ** | **.182** | **.041** | **1.20** | **4.46(.000)*** |

Note: This table presents unstandardized model results when predictors were entered independently of one another. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

Table 30

*Predictors (Entered Simultaneously) of Membership in Co-occurring Risky Sexual Behavior and Marijuana Use Trajectory Classes*

| | | **LOW HRSB/LOW MJ Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | **Increasing HRSB, Low MJ** | -.442 | .247 | .643 | -1.79(.074) |
| | **Decreasing HRSB, Low MJ** | -.383 | .262 | .682 | -1.46(.144) |
| | **Low HRSB, Increasing MJ** | **.707** | **.199** | **2.03** | **3.55(.000)*** |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| Deviant Peer Affiliation | **Low HRSB, Decreasing MJ** | .287 | .228 | 1.33 | 1.26(.209) |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | .358 | .370 | 1.43 | .967(.333) |
| | **Low HRSB, High MJ** | **.733** | **.170** | **2.08** | **4.31(.000)*** |
| | **Increasing HRSB, High MJ** | **.716** | **.246** | **2.05** | **2.91(.015)*** |
| | **Decreasing HRSB, High MJ** | **.564** | **.273** | **1.76** | **2.06(.039)*** |

| | | **LOW HRSB/LOW MJ Referent Class** | | | |
|---|---|---|---|---|---|
| **Predictor** | Class | Logit | SE | OR | t(p) |
| | **Increasing HRSB, Low MJ** | .262 | .215 | 1.29 | 1.22(.223) |
| | **Decreasing HRSB, Low MJ** | .064 | .268 | 1.06 | .240(.811) |
| | **Low HRSB, Increasing MJ** | -.219 | .243 | .803 | -.903(.366) |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| Family Conflict | **Low HRSB, Decreasing MJ** | .186 | .212 | 1.21 | .877(.381) |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | -.377 | .337 | .686 | -1.12(.263) |
| | **Low HRSB, High MJ** | .280 | .175 | 1.32 | 1.60(.109) |
| | **Increasing HRSB, High MJ** | .475 | .250 | 1.61 | 1.90(.057) |
| | **Decreasing HRSB, High MJ** | .420 | .255 | 1.52 | 1.64(.100) |

| **Predictor** | Class | **LOW HRSB/LOW MJ Referent Class** Logit | SE | OR | t(p) |
|---|---|---|---|---|---|
| Parental Monitoring | **Increasing HRSB, Low MJ** | **-.496** | **.236** | **.609** | **-2.11(.035)*** |
| | **Decreasing HRSB, Low MJ** | -.347 | .272 | .707 | -1.28(.202) |
| | **Low HRSB, Increasing MJ** | .002 | .205 | 1.00 | .009(.993) |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| | **Low HRSB, Decreasing MJ** | .066 | .252 | 1.07 | .262(.793) |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | -.589 | .392 | .555 | -1.50(.133) |
| | **Low HRSB, High MJ** | .042 | .195 | 1.04 | .214(.830) |
| | **Increasing HRSB, High MJ** | -.078 | .357 | .925 | -.218(.828) |
| | **Decreasing HRSB, High MJ** | -.455 | .351 | .634 | -1.29(.195) |

| **Predictor** | Class | **LOW HRSB/LOW MJ Referent Class** Logit | SE | OR | t(p) |
|---|---|---|---|---|---|
| Trauma History | **Increasing HRSB, Low MJ** | .075 | .041 | 1.08 | 1.83(.067) |
| | **Decreasing HRSB, Low MJ** | -.015 | .046 | .985 | -.327(.743) |
| | **Low HRSB, Increasing MJ** | .065 | .037 | 1.07 | 1.77(.076) |
| | ~~**Increasing RSB, Increasing MJ**~~ | | | | |
| | ~~**Decreasing RSB, Increasing MJ**~~ | | | | |
| | **Low HRSB, Decreasing MJ** | **.095** | **.038** | **1.09** | **2.48(.013)*** |
| | ~~**Increasing RSB, Decreasing MJ**~~ | | | | |
| | **Decreasing HRSB, Decreasing MJ** | **.189** | **.054** | **1.21** | **3.51(.000)*** |
| | **Low HRSB, High MJ** | -.002 | .039 | .998 | -.040(.968) |
| | **Increasing HRSB, High MJ** | **.127** | **.052** | **1.14** | **2.43(.015)*** |
| | **Decreasing HRSB, High MJ** | **.154** | **.040** | **1.17** | **3.81(.000)*** |

Note: This table presents unstandardized model results when predictors were entered simultaneously. All analyses controlled for youth-reported ethnic/racial background, socio-economic status, intervention status and gender. Raw p values are reported. Bolded and asterisked numbers indicate p values that were significant before applying the FDR correction. Bolded, asterisked and highlighted numbers indicate p values that were significant after applying the FDR correction.

# APPENDIX B

# FIGURES

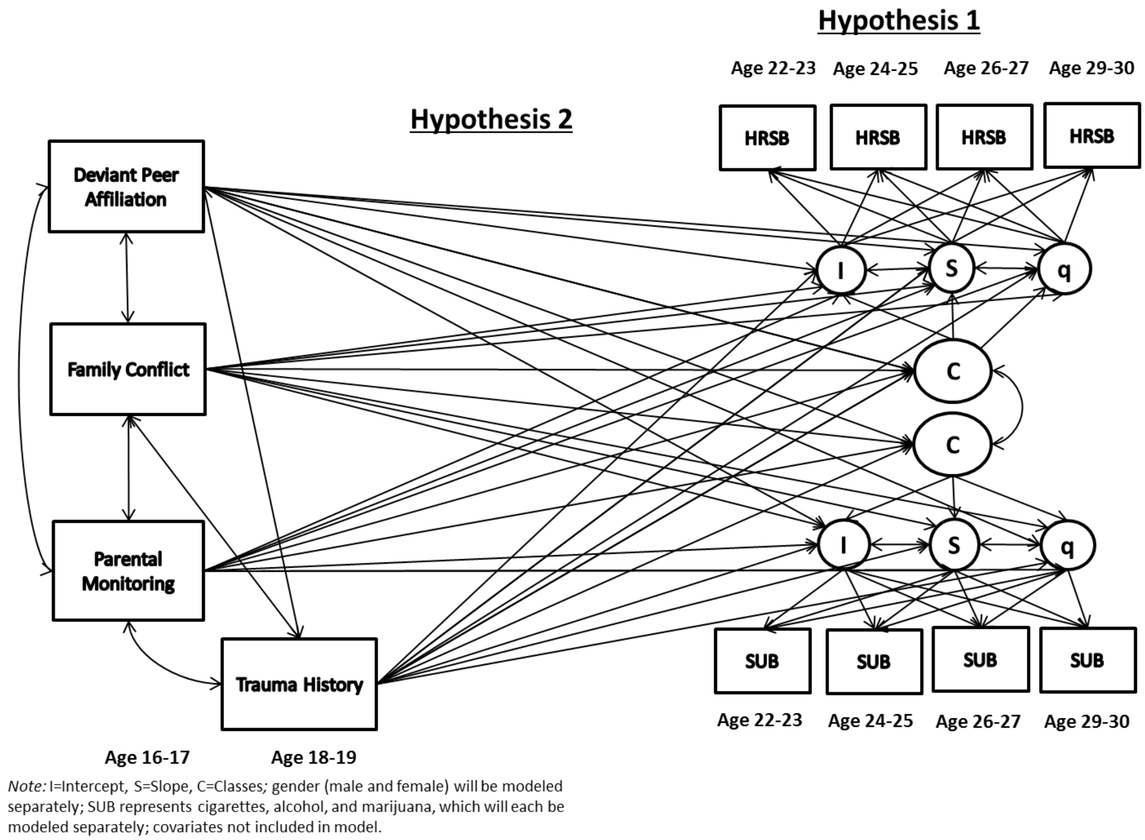



*Figure 1.* The proposed model.

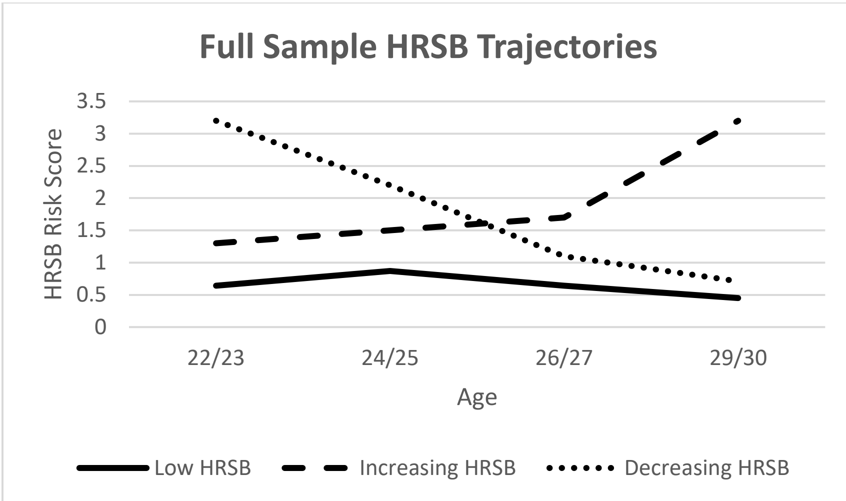



*Figure 2.* Full sample high-risk sexual behavior trajectory classes during young adulthood.

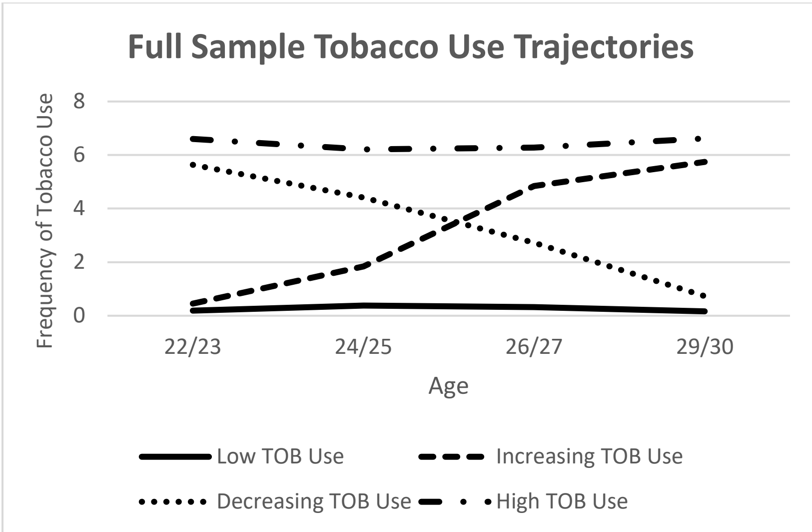



*Figure 3.* Full sample tobacco use trajectory classes during young adulthood.

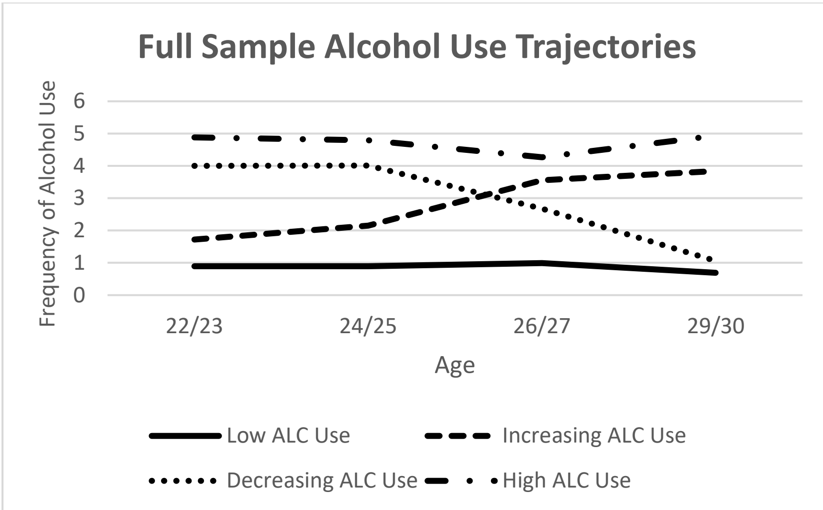



*Figure 4.* Full sample alcohol use trajectory classes during young adulthood.

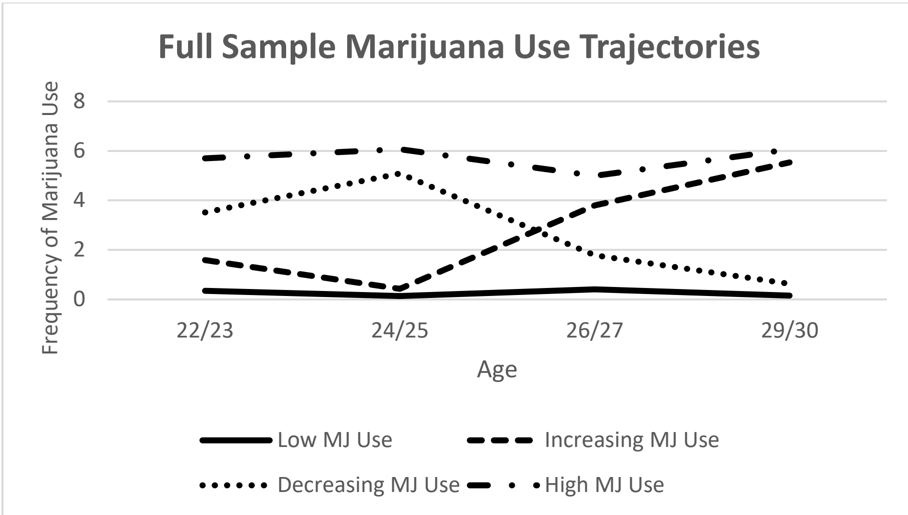



*Figure 5.* Full sample marijuana use trajectory classes during young adulthood.

# APPENDIX C

# SUPPLEMENTARY MATERIAL

## Gender Specific Growth Mixture Model Results

**Results for GMMs of male and female HRSB.** Table S1 presents the result of the systematic GMM fitting process for male and female HRSB. For HRSB among males, the three-class quadratic solution emerged as the best fitting model (BIC = 4524.27; SSABIC = 4467.14; LMR-LR = 105.49, $p < .00$; BLRT = 108.92, $p = 1.0$). Model fit indices (BIC and SSABIC) continued to decrease up until the three-class model quadratic model and then started to increase again in the linear and quadratic four-class solutions, suggesting that the three-class solution was a better fit. In addition, the LMR-LR test indicated that the three-class quadratic solution provided a better fit for the data than did the two-class solution. Although the non-significant BLRT suggests the fit of the three-class model is not necessarily better than the two-class model, all of the other fit indices suggest that three-class quadratic solution seem to be the best fit and had the best interpretability, and therefore we decided that overall the quadratic three-class model was the best fit for HRSB among males. Separation among the three classes was found to be high with entropy = .83 (Clark & Muthén, 2009). The linear and quadratic five-class solutions did not converge and thus cannot be considered stable trustworthy solutions.

Class trajectories for male HRSB are shown in Figure S1. The three classes that emerged are as follows: (1) a **stable, low HRSB** class, comprising 73.5% (n = 356) of the sample, which was characterized by low levels of HRSB from age 22 through age 30; (2) an **increasing HRSB** class, comprised of 11.9% (n = 46) of the sample, which was characterized by moderate levels of HRSB at age 22 and then steadily increased to high levels of HRSB during the mid and late 20s; (3) a **decreasing HRSB** class, comprised of

14.5% (n = 63) of the sample, which was characterized by high levels of HRSB during the early to mid-20s and then decreased from the mid to late 20s to low levels of HRSB.

For HRSB among females, the three-class quadratic solution was also chosen as the most parsimonious model (see Table S1; BIC = 4487.08; SSABIC = 4429.96; LMR-LR = 166.64, $p < .03$; BLRT = 172.11, $p = 1.0$). Although the four-class model overall showed acceptable model fit without any improper solutions, parsimony is preferable when using the mixture modeling approach (Bauer & Curran, 2003). In addition, the female HRSB three-class solution showed consistent patterns with that of the male HRSB three-class solution. Thus, based on various fit indices, interpretability, consistency and parsimony, we chose the three-class model as the best fitting model. Separation among the three classes was found to be high with entropy = .88 (Clark & Muthén, 2009).

Class trajectories for female HRSB are shown in Figure S1. Similar to the male model, the three classes that emerged are as follows: (1) a **stable, low HRSB** class, comprised of 75.9% (n = 343) of the sample, which was characterized by low levels of HRSB from age 22 through age 30; (2) an **increasing HRSB** class, comprised of 11.7% (n = 49) of the sample, which was characterized by moderate levels of HRSB at age 22 and then steadily increased to high levels of HRSB during the mid and late 20s' (3) a **decreasing HRSB** class, comprising 12.4% (n = 51) of the sample, which was characterized by high levels of HRSB during the early to mid-20s and then decreased from the mid to late 20s to low levels of HRSB.

**Results for GMMs of male and female tobacco use.** Table S2 presents the result of the systematic GMM fitting process for male and female tobacco use. For tobacco use among males the four-class quadratic solution emerged as the best fitting model (BIC =

6111.10; SSABIC = 6050.80; LMR-LR = 287.52, $p < .04$; BLRT = 299.19, $p = 1.0$). The BIC and SSABIC steadily decreased through the five-class solution. Although the BIC and SSABIC were lowest in the five-class solutions, other fit indices suggested that the four-class model was a better fit than the five-class model. First, the LMR-LR was significant for the four-class quadratic solution, confirming that the four-class solution provided a better fit for the data relative to the three-class solution. Second, both the LMR-LR and the BLRT were not significant for the linear and quadratic five-class solutions, suggesting that the five-factor model did not improve fit relative to the four-factor model. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the fit of the four-class model was not necessarily better than the three-class model, all other fit indices suggested better fit for the four-class model. Therefore, the quadratic four-class model was selected as having the best overall fit for tobacco use among males. Separation among the four classes was very high with entropy = .95 (Clark & Muthén, 2009).

Class trajectories for male tobacco use are shown in Figure S2. The four classes are as follows: (1) a **stable, low tobacco use** class comprising 52.7% (n = 253) of the sample, which was characterized by low levels of tobacco use from age 22 through age 30, (2) an **increasing tobacco use** class comprising 8.9% (n = 38) of the sample which was characterized by low levels of tobacco use during the early to mid-20s and then steadily increased to moderate and then high levels of tobacco use during the mid and late 20s; (3) a **decreasing tobacco use** class comprising 10.8% (n = 48) of the sample, which was characterized by moderate levels of tobacco use during the early to mid-20s and then decreased use from the mid to late 20s from moderate to low levels of tobacco use; (4) a

**stable, high tobacco use** class comprising 27.6% (n = 133) of the sample, which was characterized by high levels of tobacco use from age 22 through age 30.

For tobacco use among females the four-class quadratic solution was also chosen as the most parsimonious model (see Table S2; BIC = 5855.26; SSABIC = 5794.96; LMR-LR = 522.43, $p < .01$; BLRT = 543.82, $p = 1.0$). The five-class model also showed acceptable model fit without any improper solutions, but the four-class model was more parsimonious and interpretable (Bauer & Curran, 2003). The female tobacco use four-class quadratic solution, not only showed consistent patterns with that of the male tobacco use four-class solution, but also showed consistent patterns with all of the other substances. Thus, based on various fit indices, interpretability, consistency and parsimony, we chose the four-class model as the best fitting model. Separation among the four classes was found to be very high with entropy = .97 (Clark & Muthén, 2009).

Class trajectories for female tobacco use are shown in Figure S2. Similar to the male model, the four classes that emerged were as follows: (1) a **stable, low tobacco use** class comprising 62.0% (n = 280) of the sample, which was characterized by low levels of tobacco use from age 22 through age 30; (2) an **increasing tobacco use** class comprising 7.4% (n = 32) of the sample, which was characterized by low levels of tobacco use during the early to mid-20s and then steadily increased to moderate and then high levels of tobacco use during the mid and late 20s, (3) a **decreasing tobacco use** class, comprising 10.0% (n = 44) of the sample, which was characterized by high levels of tobacco use during the early to mid-20s and then decreased use from the mid to late 20s from moderate to low levels of tobacco use; (4) a stable, **high tobacco use** class, comprising 20.7% (n = 93) of the sample, which was characterized by high levels of tobacco use from age 22 through age 30.

**Results for GMMs of male and female alcohol use.** Table S3 presents the result of the systematic GMM fitting process for male and female alcohol use. For alcohol use among males the four-class quadratic solution emerged as the best fitting model (BIC = 6402.82; SSABIC = 6342.52; LMR-LR = 81.87, $p < .02$; BLRT = 85.20, $p = 1.0$). The BIC and SSABIC steadily decreased through the five-class solutions. Although the BIC and SSABIC were lowest in the five-class solution, other fit indices suggested that the four-class model was a better fit. First, the LMR-LR was significant for the four-class quadratic solution, confirming that the four-class solution provided a better fit to the data relative to the three-class solution. Second, both the LMR-LR and the BLRT were not significant for the linear and quadratic five-class solutions, suggesting that the five-factor model did not improve fit relative to the more parsimonious four-factor model. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the fit of the four-class model was not necessarily better than the three-class model, all of the other fit indices suggested better fit for the four-factor model. Therefore, the quadratic four-class model was selected as providing the best overall fit for alcohol use among males. Separation among the four classes was found to be fair with entropy = .77 (Clark & Muthén, 2009).

Class trajectories for male alcohol use are shown in Figure S3. The four classes that emerged include: (1) a **stable, low alcohol use** class comprising 15.6% (n = 76) of the sample, which was characterized by low levels of alcohol use from age 22 through age 30; (2) an **increasing alcohol use** class comprising 22.7% (n = 102) of the sample, which was characterized by low levels of alcohol use during the early to mid-20s and then steadily increased to moderate levels of alcohol use during the mid and late 20s; (3) a **decreasing alcohol use** class comprising 9.1% (n = 32) of the sample, which was characterized by high levels of alcohol use during the early to mid-20s and then decreases from the mid to late 20s to low levels of alcohol use; (4) a **stable, high alcohol use** class comprising 52.5% (n = 262) of the sample, which was characterized by consistently high levels of alcohol use from age 22 through age 30.

For alcohol use among females the four-class quadratic solution emerged as the best fitting model (see Table S3; BIC = 6471.31; SSABIC = 6411.01; LMR-LR = 98.87, $p < .03$; BLRT = 102.91, $p = 1.0$). Model fit indices (BIC and SSABIC) continued to decrease up until the four-class quadratic model and then started to increase again in the linear and quadratic five-class solutions, thus suggesting that the four-class solution was a better fit. In addition, the LMR-LR confirmed that the four-class solution provided a better fit to the data relative to the three-class solution. Both the LMR-LR and the BLRT were not significant for the linear and quadratic five-class solutions, suggesting again that the five-factor model did not improve fit relative to the more parsimonious four-factor model. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the fit of the four-class model was not necessarily better than the three-class model, all other fit indices suggested that the four-factor model provided better fit. Therefore, the quadratic four-class model was selected as providing the best overall fit for alcohol use among females. Separation among the four classes was found to be fair with entropy = .73 (Clark & Muthén, 2009).

Class trajectories for female alcohol use are shown in Figure S3. The four female alcohol use classes, similar to the male alcohol use classes, included: (1) a **stable, low alcohol use** class comprising 25.4% (n = 118) of the sample, which was characterized by low levels of alcohol use from age 22 through age 30; (2) an **increasing alcohol use** class comprising 23.5% (n = 107) of the sample, which was characterized by low levels of alcohol use during the early to mid-20s and then steadily increased to moderate levels of alcohol use during the mid and late 20s; (3) a **decreasing alcohol use** class comprising 22.9% (n = 100) of the sample, which was characterized by moderate levels of alcohol use during the early to mid-20s followed by decreases from the mid to late 20s from moderate to low levels of alcohol use; (4) a **stable, high alcohol use** class comprising 28.3% (n = 124) of the sample, which was characterized by consistently high levels of alcohol use from age 22 through age 30.

**Results for GMMs of male and female marijuana use.** Table S4 presents the result of the systematic GMM fitting process for male and female marijuana use. For marijuana use among males the four-class quadratic solution emerged as the best fitting model (BIC = 6088.14; SSABIC = 6027.84; LMR-LR = 365.17, p <.00; BLRT = 380.00, p = 1.0). Model fit indices (BIC and SSABIC) continued to decrease up until the four-class quadratic model and then started to increase again in the linear and quadratic five-class solutions. In addition, the LMR-LR confirmed that the four-class solution provided a better fit for the data relative to the three-class solution. Both the LMR-LR and the BLRT were not significant for the linear and quadratic five-class solutions, suggesting that the four-class solution was more parsimonious. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the four-class model was not necessarily better than the three-class model, all of the other fit indices suggest better fit for the four-factor model. Therefore, the quadratic four-class model was selected as providing the best overall fit for marijuana use among males. Separation among the four classes was found to be very high with entropy = .92 (Clark & Muthén, 2009).

Class trajectories for male marijuana use are shown in Figure S4. The four classes included: (1) a **stable, low marijuana use** class comprising 56.1% (n = 277) of the sample, which was characterized by low levels of marijuana use from age 22 through age 30; (2) an **increasing marijuana use** class comprising 15.1% (n = 60) of the sample, which was characterized by low levels of marijuana use during the early to mid-20s and followed by steady increases to moderate and then high levels of marijuana use during the mid and late 20s; (3) a **decreasing marijuana use** class comprising 10.3% (n = 47) of the sample, which was characterized by moderate levels of marijuana use during the early to mid-20s and then decreases from the mid to late 20s from moderate to low levels of marijuana use; (4) a **stable, high marijuana use** class comprising 18.5% (n = 88) of the sample, which was characterized by high levels of marijuana use from age 22 through age 30.

For marijuana use among females the four-class quadratic solution also emerged as the best fitting model (see Table S4; BIC = 5627.81; SSABIC = 5567.51; LMR-LR = 441.46, $p < .00$; BLRT = 459.53, $p = 1.0$). The BIC and SSABIC steadily decreased through the five-class solutions. Although the BIC and SSABIC were lowest in the five-class solutions, other fit indices suggested that the four-class model provided a better fit. First, the LMR-LR was significant for the four-class quadratic solution, confirming that the four-class solution provided a better fit to the data relative to the three-class solution.

Second, both the LMR-LR and the BLRT were not significant for the linear and quadratic five-class solutions, suggesting that the four-class solution was more parsimonious than the five-class solutions. While the BLRT was also non-significant for the quadratic four-class solution, suggesting that the fit of the four-class model was not necessarily better than the three-class model, all of the other fit indices suggested better fit for the four-factor model. Therefore, the quadratic four-class model was selected as providing the best overall fit for marijuana use among females. Separation among the four classes was found to be very high with entropy = .97 (Clark & Muthén, 2009).

Class trajectories for female marijuana use are shown in Figure S4. The four female marijuana use classes, similar to the male marijuana use classes, included: (1) a **stable, low marijuana use** class comprising 73.4% (n = 332) of the sample, which was characterized by low levels of marijuana use from age 22 through age 30; (2) an **increasing marijuana use** class comprising 9.2% (n = 39) of the sample, which was characterized by low levels of marijuana use during the early to mid-20s and then steady increases to moderate and then high levels of marijuana use during the mid and late 20s; (3) a **decreasing marijuana use** class comprising 8.2% (n = 36) of the sample, which was characterized by moderate levels of marijuana use during the early to mid-20s and then decreases from the mid to late 20s from moderate to low levels of marijuana use; (4) a **stable, high marijuana use** class comprising 9.2% (n = 42) of the sample, which was characterized by high levels of marijuana use from age 22 through age 30.

Table S1

*Model Fit Indices of Growth Mixture Models for Male and Female Risky Sexual Behavior During Young Adulthood*

| | Male Risky Sexual Behavior | | | | | Female Risky Sexual Behavior | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 4712.05 | 4683.49 | - | - | - | 4734.19 | 4705.62 | - | - | - |
| **1Q** | 4735.85 | 4694.59 | - | - | - | 4738.03 | 4706.29 | - | - | - |
| **2L** | 4630.89 | 4595.97 | 118.38, p < .00 | 123.20, p < .00 | .87 | 4456.79 | 4415.54 | 289.86, p < .00 | 301.76, p < .00 | .71 |
| **2Q** | 4554.13 | 4503.35 | 195.56, p < .00 | 200.87, p < .00 | .80 | 4538.41 | 4487.63 | 229.89, p < .00 | 236.18, p < .00 | .74 |
| **3L** | 4553.02 | 4505.42 | 98.42, p < .03 | 102.43, p = 1.0 | .80 | 4510.00 | 4465.57 | 148.13, p < .00 | 156.23, p = 1.0 | .85 |
| **3Q** | 4524.27 | 4467.14 | 105.49, p < .00 | 108.92, p = 1.0 | .83 | 4487.08 | 4429.96 | 166.64, p < .03 | 172.11, p = 1.0 | .88 |
| **4L** | 4540.66 | 4480.36 | 35.48, p < .02 | 36.93, p = 1.0 | .81 | 4468.63 | 4408.33 | 58.11, p < .01 | 60.49, p = 1.0 | .90 |
| **4Q** | 4541.41 | 4481.11 | 71.12, p = .13 | 74.01, p = 1.0 | .81 | 4416.62 | 4327.76 | 87.66, p < .01 | 90.06, p = .67 | .89 |
| **5L** | Did | Not | Converge | | | 4315.41 | 4258.29 | 74.44, p = .17 | 78.51, p = 1.0 | .95 |
| **5Q** | Did | Not | Converge | | | 4292.85 | 4219.86 | 257.17, p = .14 | 267.72, p = 1.0 | .94 |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

Table S2

*Model Fit Indices of Growth Mixture Models for Male and Female Tobacco Use During Young Adulthood*

| | Male Tobacco Use | | | | | Female Tobacco Use | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 6983.98 | 6955.41 | - | - | - | 7059.50 | 7030.94 | - | - | - |
| **1Q** | 7006.10 | 6964.84 | - | - | - | 7075.69 | 7034.43 | - | - | - |
| **2L** | 6445.15 | 6410.24 | 632.09, p < .00 | 657.75, p < .00 | .97 | 6431.57 | 6396.67 | 698.58, p < .00 | 727.18, p < .00 | .97 |
| **2Q** | 6378.77 | 6337.51 | 711.76, p < .00 | 734.88, p < .00 | .96 | 6429.66 | 6388.40 | 717.59, p < .00 | 741.09, p < .00 | .97 |
| **3L** | 6421.52 | 6383.43 | 365.21, p < .00 | 384.98, p = 1.0 | .97 | 6204.42 | 6156.81 | 241.69, p = .12 | 251.58, p = 1.0 | .94 |
| **3Q** | 6385.67 | 6338.07 | 387.38, p < .00 | 403.11, p = 1.0 | .97 | 6374.66 | 6327.06 | 343.30, p < .03 | 357.35, p = 1.0 | .97 |
| **4L** | 6112.35 | 6064.74 | 310.81, p < .00 | 327.63, p = 1.0 | .94 | 5880.03 | 5832.42 | 499.20, p < .00 | 526.45, p = 1.0 | .97 |
| **4Q** | 6111.10 | 6050.80 | 287.52, p < .04 | 299.19, p = 1.0 | .95 | 5855.26 | 5794.96 | 522.43, p < .01 | 543.82, p = 1.0 | .97 |
| **5L** | 5980.58 | 5923.45 | 142.52, p = .16 | 150.24, p = 1.0 | .94 | 5658.4 | 5601.27 | 227.53, p < .03 | 239.95, p = 1.0 | .97 |
| **5Q** | 5978.67 | 5905.67 | 150.93, p = .26 | 157.06, p = 1.0 | .95 | 5651.84 | 5578.84 | 360.25, p < .02 | 375.00, p = 1.0 | .97 |
| **6L** | - | - | - | - | - | 5502.68 | 5436.03 | 165.03, p =.08 | 174.04, p = 1.0 | .97 |
| **6Q** | - | - | - | - | - | Did | Not | Converge | | |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

Table S3

*Model Fit Indices of Growth Mixture Models for Male and Female Alcohol Use During Young Adulthood*

| | Male Alcohol Use | | | | | Female Alcohol Use | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 6490.70 | 6462.13 | - | - | - | 6523.62 | 6495.06 | - | - | - |
| **1Q** | 6496.49 | 6464.75 | - | - | - | 6527.14 | 6495.40 | - | - | - |
| **2L** | 6450.85 | 6415.93 | 93.04, p < .00 | 96.82, p < .00 | .70 | 6534.95 | 6500.04 | 42.99, p < .00 | 44.75, p < .00 | .72 |
| **2Q** | 6454.17 | 6412.91 | 102.16, p < .00 | 105.48, p < .00 | .74 | 6544.60 | 6503.34 | 43.54, p < .00 | 44.96, p < .00 | .71 |
| **3L** | 6451.13 | 6413.04 | 62.25, p < .03 | 65.62, p = 1.0 | .74 | 6544.80 | 6506.72 | 44.26, p < .00 | 46.68, p = 1.0 | .68 |
| **3Q** | 6463.40 | 6415.79 | 66.80, p = .07 | 69.51, p = 1.0 | .75 | 6549.80 | 6502.20 | 55.24, p = .29 | 57.51, p = 1.0 | .72 |
| **4L** | 6390.54 | 6342.93 | 75.00, p < .00 | 79.06, p = 1.0 | .77 | 6483.52 | 6435.91 | 75.48, p < .00 | 79.60, p = 1.0 | .73 |
| **4Q** | 6402.82 | 6342.52 | 81.87, p < .02 | 85.20, p = 1.0 | .77 | 6471.31 | 6411.01 | 98.87, p < .03 | 102.91, p = 1.0 | .73 |
| **5L** | 6391.48 | 6334.35 | 16.63, p = .49 | 17.53, p = 1.0 | .66 | 6486.45 | 6429.33 | 14.58, p = .56 | 15.38, p = 1.0 | .74 |
| **5Q** | 6394.29 | 6321.29 | 31.86, p = .56 | 33.15, p = 1.0 | .69 | 6476.36 | 6403.37 | 18.61, p = .37 | 19.37, p = 1.0 | .74 |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

Table S4

*Model Fit Indices of Growth Mixture Models for Male and Female Marijuana Use During Young Adulthood*

| | Male Marijuana Use | | | | | Female Marijuana Use | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Class** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** | **BIC** | **SSABIC** | **LMR-LR** | **BLRT** | **Entropy** |
| **1L** | 6946.32 | 6917.75 | - | - | - | 6647.67 | 6619.10 | - | - | - |
| **1Q** | 6948.23 | 6906.97 | - | - | - | 6652.65 | 6620.91 | - | - | - |
| **2L** | 6653.67 | 6625.11 | 973.71, p < .00 | 1026.43, p < .00 | .96 | 6284.85 | 6256.28 | 977.48, p < .00 | 1030.83, p < .00 | .98 |
| **2Q** | 6652.56 | 6617.64 | 998.04, p < .00 | 1038.57, p < .00 | .96 | 6268.33 | 6233.42 | 1017.36, p < .00 | 1059.01, p < .00 | .98 |
| **3L** | 6453.58 | 6415.50 | 207.33, p < .00 | 218.56, p = 1.0 | .95 | 6080.65 | 6042.57 | 210.99, p < .04 | 222.51, p = 1.0 | .96 |
| **3Q** | 6443.52 | 6395.91 | 224.54, p < .00 | 233.66, p = 1.0 | .94 | 6062.91 | 6015.31 | 220.80, p < .04 | 229.84, p = 1.0 | .97 |
| **4L** | 6203.15 | 6155.54 | 255.09, p < .02 | 268.90, p = 1.0 | .91 | 5653.11 | 5605.51 | 422.78, p < .00 | 445.86, p = 1.0 | .97 |
| **4Q** | 6088.14 | 6027.84 | 365.17, p <.00 | 380.00, p = 1.0 | .92 | 5627.81 | 5567.51 | 441.46, p < .00 | 459.53, p = 1.0 | .97 |
| **5L** | 6093.36 | 6036.23 | 121.67, p = .16 | 128.26, p = 1.0 | .92 | 5560.02 | 5502.89 | 105.64, p = .23 | 111.41, p = 1.0 | .96 |
| **5Q** | 6073.39 | 6000.39 | 37.84, p = .47 | 39.37, p = 1.0 | .92 | 5540.32 | 5467.33 | 111.66, p = .10 | 116.23, p = 1.0 | .96 |

Note: BIC = Bayesian Information Criteria, SSABIC = Sample-Size Adjusted Bayesian Information Criterion, LMR-LR= Lo-Mendell-Rubin Adjusted LRT Test, BLRT = Bootstrapped Likelihood Ratio Test.

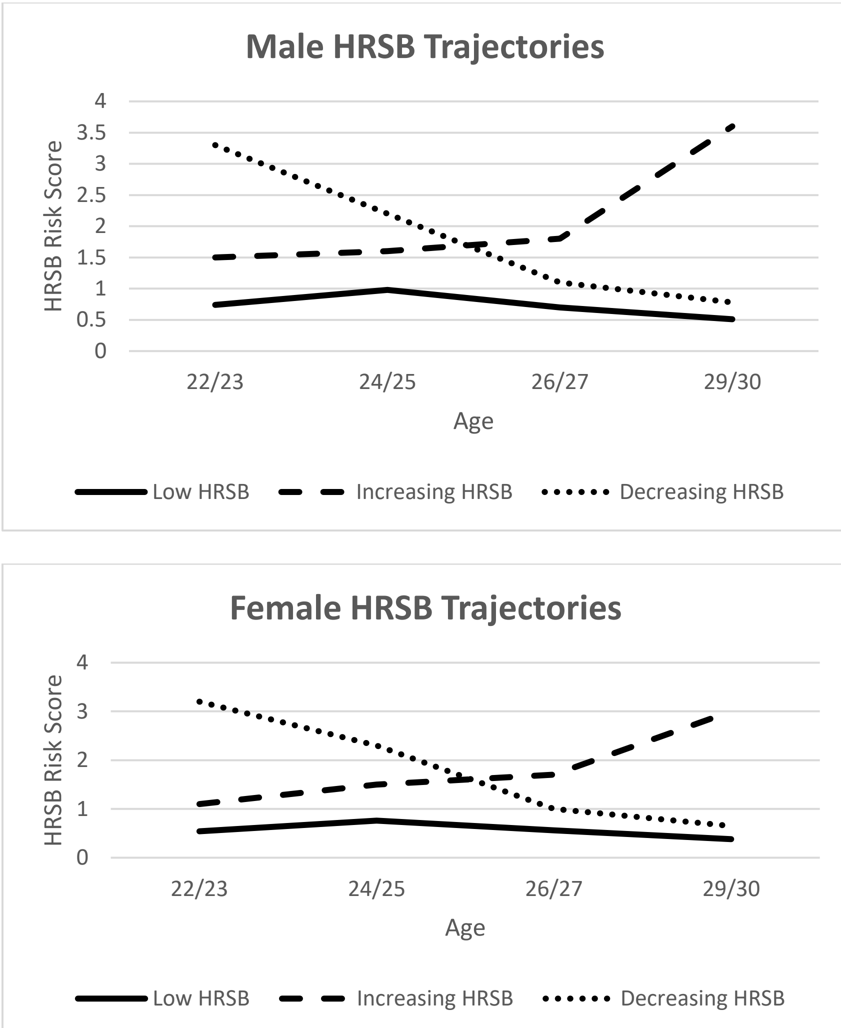
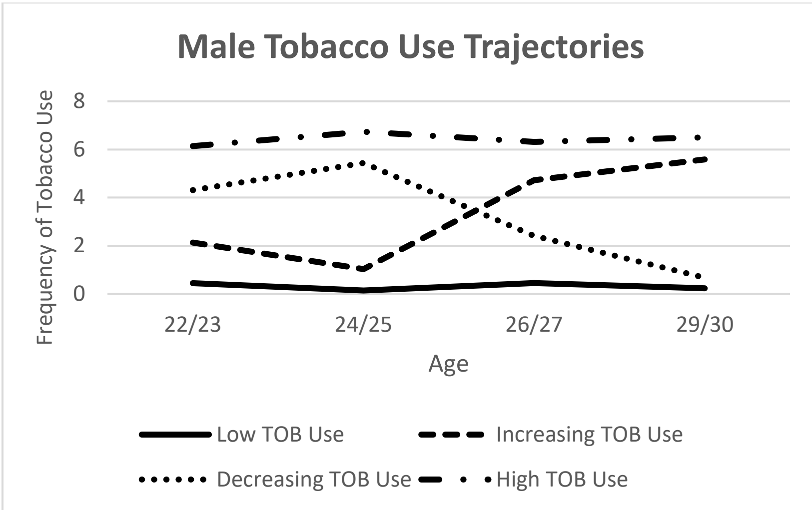



*Figure S1.* Male and female high-risk sexual behavior trajectory classes during young adulthood.



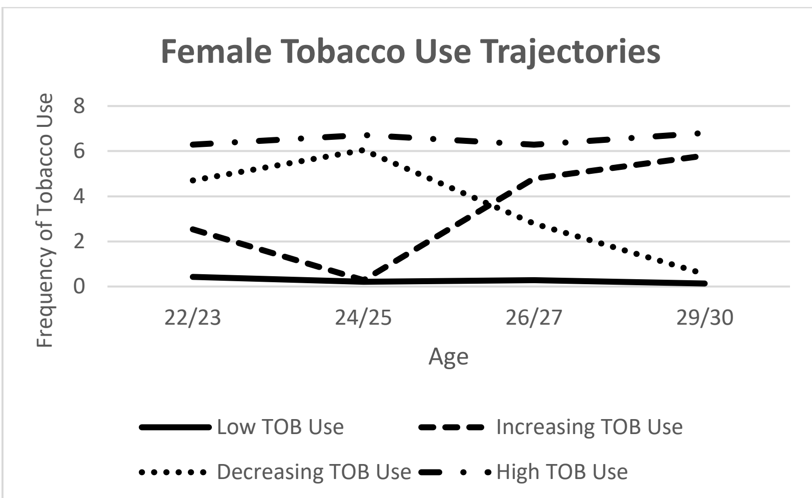
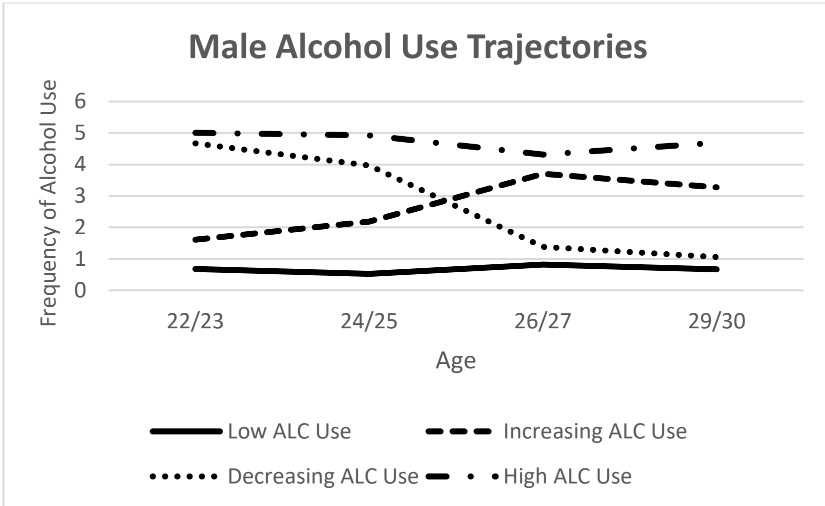




*Figure S2.* Male and female tobacco use trajectory classes during young adulthood.



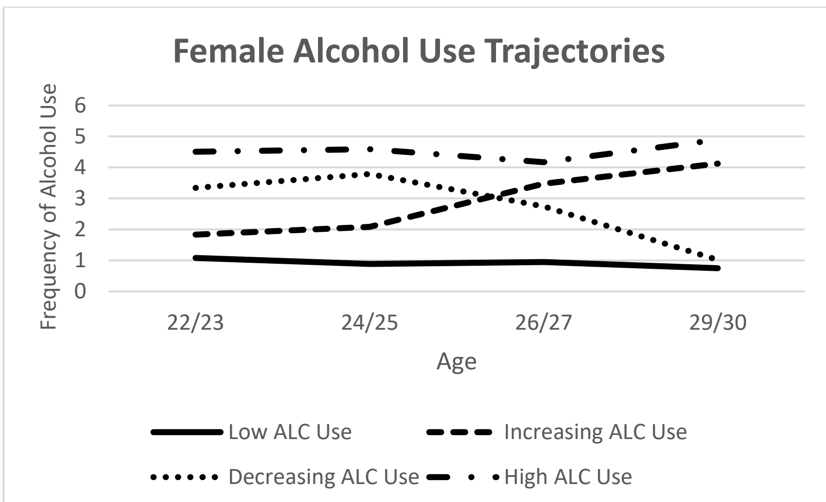
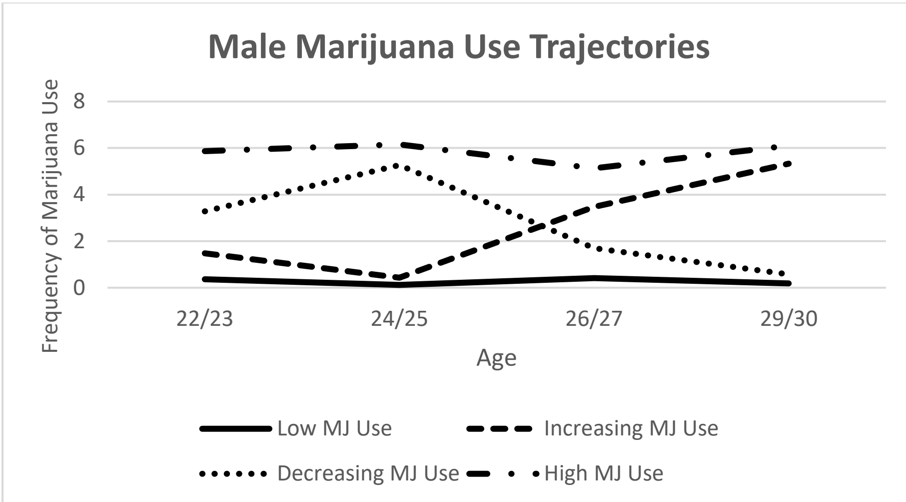




*Figure S3.* Male and female alcohol use trajectory classes during young adulthood.



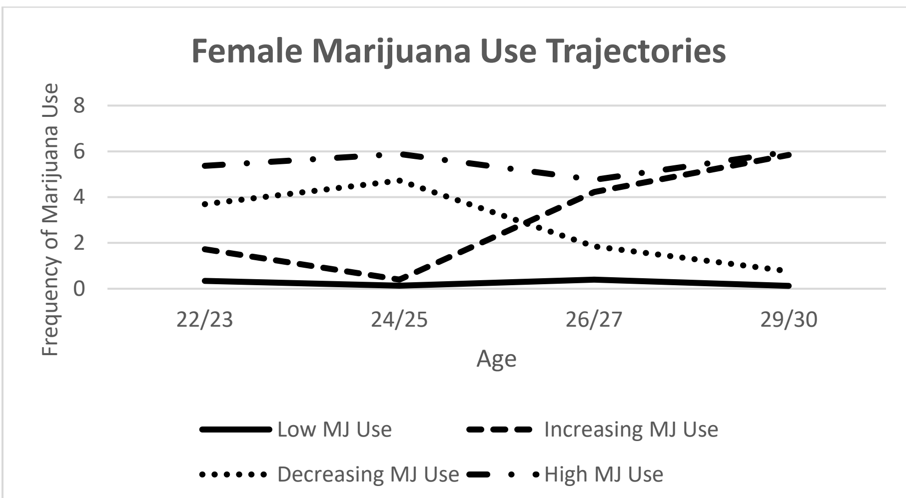




*Figure S4.* Male and female marijuana use trajectory classes during young adulthood.