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RISK, PROMOTIVE, AND PROTECTIVE INFLUENCES ON ADOLESCENT ALCOHOL USE MILESTONES

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RISK, PROMOTIVE, AND PROTECTIVE INFLUENCES ON ADOLESCENT ALCOHOL USE MILESTONES

BY

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ABSTRACT

Research focused on the initiation and development of alcohol use among adolescents can inform professionals, families, and preventative strategies. Much of the research on adolescent substance use among this population focuses on risk. This study investigated a model of the initiation of adolescent alcohol use milestones including first full drink, first time engaging in heavy drinking, and first time being drunk, extending the risk perspective by emphasizing a model of resilience. This was done by simultaneously including risk, promotive, and protective influences in a single model. It was hypothesized that parental monitoring and reasons for abstaining and limiting drinking would have a promotive effect on alcohol use such that these predictors would relate to a decreased probability of milestone initiation. Peer influences and impulsive personality traits were hypothesized to be risk factors and increase the probability of milestone initiation. Parental monitoring was also hypothesized to have a protective effect on adolescent drinking milestones by mitigating the influence of peers and impulsive personality. The sample is comprised of roughly equal numbers of 6th, 7th, and 8th graders (*N*=1,023) in six middle schools. Mean age at baseline was 12.22 years (SD=0.98, range 10-15) and the sample is 52% female and 27% non-White (4% Black, 11% other), and 12% Hispanic. Rates of initiation for all three milestones increased with time and females drank more than males at each time point. Survival analysis tested the overall model and results indicate adequate model fit (Δ AIC= -200). Reasons for abstaining and limiting drinking and parental monitoring decreased the probability of alcohol use initiation, first heavy drinking, and first drunk (hazard ratios = .37/.77; .50/.77; .49/.66,

respectively) Being female increased the probability of alcohol use initiation and first heavy drinking (H.R.= 1.62; 1.54). Peer influences increased the probability of alcohol use initiation (H.R.= 1.46) and sensation seeking was also a risk factor for heavy drinking (H.R.= 1.41). The influence of parental monitoring as a protective effect, mitigating the influence of peers and personality, was only partially supported as there was an interaction effect of parental monitoring and peer influences on first time being drunk. Results support a more resilient model with promotive effects remaining most significant when considered alongside risk. Further investigation of how these risk, promotive, and protective effects influence the development of future drinking patters such as regular use, or alcohol use disorders, should be considered. Results add to the burgeoning studies on reasons for abstaining and limiting drinking (RALD) and this cognitive factors' influence on alcohol use initiation. An emphasis on these cognitions either by encouraging the maintenance of previously held RALD or helping adolescents to acquire more RALD might be beneficial for preventative strategies and merits further investigation. *Research was supported by National Institute on Alcohol Abuse and Alcoholism (NIAAA) RO1 AA016838*.

Keywords: Adolescence, alcohol use, resilience, parental monitoring, peers, impulsivitiy, RALD

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CHAPTER 1

INTRODUCTION

Adolescence, comprising youth from ages 10-19, is a period of rapid development in many areas (Brown et al., 2008; Windle et al., 2008). This includes biological, social, neurological, attitudinal, and emotional growth along with changes in health related behaviors (Grotevant, 1998; Hollenstein, & Lougheed, 2013; Steinberg, & Morris, 2001; Masten, Faden, Zucker, & Spear, 2008; Windle et al., 2008). As substantial increases in alcohol use across adolescence have been observed for most demographic subgroups this is a particularly important health behavior for this group. According to the Monitoring the Future Study alcohol is the most widely used drug among adolescents (Johnston, O'Malley, Bachman, & Schulenberg, 2012a). Approximately 33 percent of all students in 8th grade and 70 percent of all high school students have consumed more than just a sip of alcohol (Johnston et al., 2012a). These data also show that 6 percent of all 8th graders, 15 percent of all 10th graders, and 22 percent of all 12th graders engaged in heavy drinking (five or more drinks in a row at least once in the past two weeks) (Johnston et al., 2012b), an outcome shown to lead to greater negative personal health consequences (Oesterle et al., 2004).

Early Onset and Developmental Progression

While it has been noted that alcohol use among this group is, to some degree, developmentally normative (Windle et al., 2008) it is also problematic. For instance, an early age of onset for drinking (< 14 years old) strongly predicts subsequent

problematic alcohol and other drug use. This includes, subsequent heavy drinking in adolescence and young adulthood (Blomeyer et al., 2011; Brook et al., 2010; Heron et al., 2012), and alcohol use disorders in adolescence and adulthood (Grant & Dawson, 1997; Hingson, Heeren, & Winter, 2006; Mason & Spoth, 2012). Early onset is also associated with abuse of other substances (Labouvie, Bates, & Padina, 1997) and other problem behaviors (e.g., risky sex, Eaton et al., 2005. In addition to negative consequences associated with the acute effects of alcohol, early initiation, particularly heavy drinking, has implications on cognitive development and subsequent neurological functioning.

As the brain is rapidly developing across early, middle, and late adolescence (Bava et al., 2010; Steinberg, 2008) the effects of alcohol on this development are pivotal. Early exposure to heavy drinking and early onset-alcohol use disorders have been associated with greater neurological impairment, both in human (Tapert, Caldwell, & Burke, 2004) and animal (Hiller-Sturmhöfel, & Swartzwelder, 2004) studies. The hippocampus, which plays a role in numerous cognitive functions related to learning and memory, is one area of the brain purportedly affected by alcohol use. Human and animal studies have found that heavy drinking and alcohol abuse during adolescence are associated with a reduction in the size of the hippocampus, which may be the physiological basis for impaired memory function (DeBellis et al., 2000; Hiller-Sturmhöfel and Swartzwelder, 2004; Squeglia, Jacobus, & Tapert, 2009). One of the most significant problems with damage to the brain and neurocognitive deficits caused by underage drinking (such as learning and intellectual development) is that these effects may affect developmental transitions and continue into adulthood (Hiller-

Sturmhöfel, & Swartzwelder, 2004; Squeglia, Spadoni, et al., 2009; Tapert et al., 2004; Zeigler et al., 2005).

While it has been recognized that the age of onset of landmark events (e.g. drinking milestones), is key (Randall et al., 1999), little attention has been given to milestone attainment and the factors associated with these milestones. Of particular importance are the factors delaying alcohol use onset. Jackson (2010) examined the progression of drinking milestones among a large treatment sample of adolescents. These milestones began with a first drink that is more than a sip and progressed to first full drink, first time being drunk, and ending with drinking at least five drinks every day for a period of two weeks. Jackson considered age of onset of first drink as a moderator and categorized initiation into three groups for analyses. These age categories of initiation were early (drinking before 10 yrs old), moderate (between 11-13 yrs), and late (greater than14). Comparing milestones attained between early and late groups, earlier onset individuals attained each milestone sooner than the moderate and late onset groups. In addition, "hazard models indicated that with each year that first drink was delayed, the estimated odds of attaining the milestones were lower than the odds for these one year younger" (Jackson, 2010. p 442). The early onset group also had the highest report of drug use, with roughly 25% of individuals in this group transitioning to the last milestone, daily heavy episodic drinking, by age 14.

The results of Jackson's (2010) study are useful for conceptualizing progression through adjacent drinking milestones (Darkes, 2010) and help underscore the impact delaying onset might have in reducing use and problem drinking among adolescents. However, Jackson's sample was comprised of treated adolescents.

Studying alcohol use initiation and progression through drinking milestones among a more general sample of adolescents is important for coming to a better understanding of the factors associated with these developments among non-treatment referred adolescents. There are several ways of classifying influential variables on adolescent alcohol use and their direction of association on outcomes. Research on resilience against substance use identifies important classifications including risk factors, promotive factors, and protective factors (Fergus, & Zimmerman, 2005). According to Fergus and Zimmerman risk factors display a direct positive effect on substance use (e.g. greater impulsivity related to higher levels of drinking), while promotive factors are the inverse of risk, having a direct negative association on substance use independent of risk (e.g. parental monitoring negatively associated with alcohol use) (2005). Finally, a protective factor mitigates the influence of another predictor on an outcome; thus, it is a variable that interacts with a risk factor to reduce the influence of that risk factor on problematic outcomes (e.g., parental monitoring reducing the influence of impulsive personality characteristics on alcohol use).

Etiologic Factors for Adolescent Alcohol Use

Understanding the risk, promotive, and protective factors associated with adolescent alcohol initiation cannot be done without consideration of the biopsychosocial influences congruent with developmental changes among this population (Zucker, Donovan, Masten, Mattson, & Moss, 2008). As multiple exhaustive reviews note, genetic, familial, social/environmental influences, personality/ emotionality, and cognition all influence alcohol use initiation and the progression through drinking milestones across adolescence (Brown et al., 2008;

Masten, et al., 2008; Windle et al., 2008). These reviews and other studies (Jackson, & Schulenberg, 2013) note important risk factors such as peer influences and personality as well as promotive and protective influences on adolescent drinking behaviors, such as the influence of parents and adolescents' cognitions about drinking. Prior to delineation of a model including risk, promotive, and protective factors to be used in predicting drinking milestones in the current study, we briefly review some of the most relevant biopsychosocial influences with particular emphasis on those in our model.

Personality

For more than 50 years, personality has been posited as etiologically relevant for understanding alcohol use and misuse (Sher, Grekin, & William, 2005). A longitudinal study by McGue, Iacono, and Legrand (2001) sought to replicate prior research on the risk associated with early onset and to elucidate the important personality correlates of early onset adolescent drinking. Consistent with findings of studies with adults (Sher et al., 2005), McGue et al. observed that a broad array of disinhibitory behavior traits, with facets such as oppositionality, hyperactivity/impulsivity, and inattentiveness assessed at age 11 predicted drinking onset by age 14.

Impulsivity is clearly a major personality factor associated with alcohol use and related outcomes (for reviews see Arnett, 2004 and Dick et al., 2010). Impulsivity is often discussed within a band of disinhibited, or undercontrolled, traits as a single construct identified with terms such as sensation seeking, novelty seeking, impulsiveness, risk taking, boredom susceptibility, and unorderliness (Cloninger,

Svrakic, & Przybeck, 1993; Depue & Collins, 1999; Eysenck & Eysenk, 1985; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). More recently, researchers have begun to view impulsivity as characterized by multiple facets (Cyders & Smith, 2007; Whiteside, & Lynam, 2001; 2009). Specifically, in a study among college students Whiteside and Lynam (2001) partitioned impulsivity into four factors: sensation seeking (seeking novel and thrilling experiences), lack of planning (acting without thinking), (lack of) perseverance (inability to remain focused on a task), and urgency (acting rashly when distressed or experiencing negative emotion). In an extension of Whiteside and Lynam's work, Cyders and Smith (2007) further divided urgency into both positive and negative urgency hypothesizing that people act rashly while experiencing both positive and negative affect. This study emphasizes sensation seeking and both urgency facets.

Meta-analyses of cross-sectional data among adolescent samples (age ranges 10.0 – 19.9) have found sensation seeking to be modestly associated with alcohol use initiation (r = .20), consumption (r = .28), and heavy episodic drinking (r = .26) (Stautz, & Cooper, 2013a). Cross-sectional studies have also found sensation seeking to be related with life-time prevalence of alcohol use (Malmberg, et al., 2010; Urbán, Kökönyei, & Demetriovics, 2008), current and heavy drinking (Urbán et al., 2008), but not age of onset (Malmberg et al., 2010). Prospective studies have found similar results for the positive associations of sensation seeking on adolescent drinking outcomes. In the same meta-analysis reported above, associations of sensation seeking with alcohol consumption were observed (r = .25) (Stautz, & Cooper, 2013a). Longitudinal research found sensation seeking in adolescents to be related to

subsequent drinking (Kong et al., 2013; Quinn & Harden, 2013) and greater sensation seeking has demonstrated concurrent associations with past year drinking and been associated with greater odds of alcohol use over time (MacPherson, Magidson, Reynolds, Kahler, & Lejuez, 2010). Prospective studies have also found sensation seeking to be associated with alcohol-related problems (Bates & Labouvie, 1995) and heavy episodic drinking (Sargent, Tanski, Stoolmiller, & Hanewinkel, 2010).

Urgency has not received as much attention as sensation seeking, but associations with alcohol use have been observed. In a cross-sectional study of 1,843 adolescents, Gunn and Smith (2010) observed significant associations between both negative and positive urgency and alcohol use initiation. Stautz and Cooper's (2013a) cross-sectional meta-analysis results found that positive urgency demonstrated the largest association with alcohol consumption (r = .27), while positive and negative urgency showed the largest associations with problematic alcohol use (r = .32 and r = .31, respectively). One limitation of research on urgency, including Stautz and Cooper's meta-analyses, is that data has been collected predominantly from samples over the age of 18 (Stautz & Cooper, 2013b). Thus, there is little information on the influence positive and negative urgency may have on alcohol use among early or middle adolescents.

In addition to Gunn and Smith (2010) very few studies have included either urgency facet as predictors of adolescent alcohol use. One cross-sectional study found negative urgency scores to be higher among female 5th graders who had initiated alcohol use compared to those who had not begun drinking (Fischer, Settles, Collins, Gunn, & Smith, 2012). Stautz and Cooper's cross-sectional study (2013b) found that

positive urgency had the largest correlation with measures of alcohol problems and that both positive and negative urgency explained a significant amount of the variance in alcohol problems, even after controlling for other non-urgency measures of impulsivity. In a sample of early adolescents (5th graders) Settles, et al. (2012) found negative urgency to be cross-sectionally associated with problem drinking and Phillips, Hine, and Marks (2009) found that affective associations were significantly related to binge drinking for adolescents high in negative urgency. One longitudinal study with an adolescent sample found that impulsivity, including a measure of the propensity to rash action, had direct associations on problematic behavior on an aggregate factor comprised of alcohol, tobacco, and drug use (Cooper, Wood, Orcutt, & Albino, 2003).

While sensation seeking has received a great deal of attention in the literature, its relation to the development of drinking milestones has not. In addition, very few studies have examined relations of both positive and negative urgency to current alcohol use, intensity of use, and alcohol use consequences among adolescents. To our knowledge, there is no prior published research analyzing urgency facets as risk factors concurrently with promotive and protective factors in an explanatory model for alcohol use initiation and drinking milestones.

Peer and Parent Influences

Transition into adolescence is characterized by an increased amount of time alone with friends and decreased time spent with parents (Steinberg & Morris, 2001). Research has shown a consistent association between peer influences and a range of teen behaviors, including marijuana and illicit drug use (Bahr, Hoffmann, & Yang,

2005; Barnes, Welte, Hoffman, & Dintcheff, 2005), cigarette use (Bahr et at., 2005; Tucker, Martinez, Ellickson, & Edelen, 2008), delinquency (Barnes et al., 2005), and alcohol consumption and heavy drinking (Danielsson, Wennberg, Tengström, & Romelsjö, 2010; Schulte et al., 2009). Among later adolescents, peer influence through social modeling has been associated with alcohol use (Wood, Read, Palfai, & Stevenson, 2001) and to be predictive of heavy episodic drinking and alcohol related consequences (Wood, Read, Mitchell, & Brand, 2004).

Parental monitoring, acquiring knowledge of adolescents' behavior, and parent-child communication have been shown to be important influences in the context of adolescent development. Parental monitoring has been described as "a set of correlated parenting behaviors involving attention to and tracking of the child's whereabouts, activities, and adaptations" (Dishion & McMahon, 1998, p. 61; Kerr & Stattin, 2000; Stattin & Kerr, 2000). As opposed to *attempts* at tracking whereabouts and activities, parental knowledge reflects the extent to which parents *actually do know* about their adolescent's behavior. Thus, parental knowledge is a product of the degree to which an adolescent communicates and discloses personal information to parents, the quality of the parent-child relationship, and parents' interest in knowing about the adolescent's life (Keijsers, Branje, VanderValk, & Meeus, 2010; Keijsers & Laird, 2010). These domains of parenting practices have been shown to significantly relate to adolescent alcohol use (Windle et al., 2008). Barnes, Reifman, Farrell, and Dintcheff (2000) observed a promotive effect for monitoring; it was negatively associated with initial alcohol use and was related to less growth in use over five years in a sample of adolescents. Similar results were found in a systematic quantitative

literature review of longitudinal studies (Ryan, Jorm, & Lubman, 2010). Some research reports that communication between adolescents and parents is related to less drinking and less future problems (Kafka, 1991; Mares et al., 2011), but other studies have not found this association for alcohol use initiation (Ennett, Bauman, Foshee, Pemberton, & Hicks, 2001). However Ennett et al. did find that communication between parents and adolescents was negatively associated with escalation of alcohol use across adolescence. Testing the association of parental involvement in the context of initiation and progression through drinking milestones with longitudinal adolescent data will extend and help clarify understanding of parental effects on adolescent alcohol use development, particularly whether the influence of parents mitigates risky peer and personality influences on adolescents' alcohol use decisions.

Cognition

Cognitive factors such as motives have long been recognized as pivotal. Cox and Klinger (1988) first proposed a motivational model of alcohol use describing motives both for drinking and for not drinking. The literature on adolescents' motives regarding decisions about drinking has primarily focused on alcohol use as opposed to decisions about not drinking. Kuntsche, Knibbe, Gmel, and Engels (2005) examined fifteen years of data on drinking motives among adolescents and concluded that drinking motives are associated with current and lifetime drinking, heavy drinking, and alcohol-related problems. However, the pathways leading to decisions not to drink have received less attention. Several studies have examined motives not to drink in emerging adult collegiate samples both cross-sectionally (Epler, Sher, & Piasecki, 2009; Huang, DeJong, Schneider, & Towvim, 2011; Huang, DeJong, Towvim, &

Shneider, 2008) and prospectively (Epler, Sher, & Piasecki, 2009), but much less research has examined motives for not drinking or reasons for abstaining or limiting drinking among adolescents (RALD).

Strizke and Butt (2001) and Chassin and Barrera (1993) both focused on adolescent RALD. Strizke and Butt developed a measure of adolescent RALD and, using both exploratory and confirmatory factor analysis, identified a five factor structure of these reasons (2001). These factors were labeled dispositional risk (e.g., not/limiting drinking due to previous medical condition, previous drinking problems, parents have drinking problem), family constraints (e.g., parents disapprove, brought up not to drink), religious constraints (e.g., my religion does not allow alcohol, drinking is against my spiritual beliefs), indifference (e.g., I have no desire to drink, I do not like the taste of alcohol) and fear of negative consequences RALD (e.g., drinking will interfere with school, alcohol impairs self control, being drunk may make me vulnerable). Strizke and Butt found that alcohol abstainers rated motives for not drinking as more important than drinkers for four of the five domains measured (dispositional risk was the only domain without main effects). Adolescents with higher scores on family constraints and indifference drank less frequently, whereas fear of negative consequences was negatively associated with quantity of drinking. Adolescents' decisions to drink or abstain were predicted by dispositional risk, religious constraints, and indifference.

Chassin and Barrera (1993) utilized Greenfield, Guydish, and Temple's (1989) reasons for limiting drinking scale to study the effects of these cognitions in a high-risk sample of adolescents. Greenfield, Guydish, and Temple's original three

factors, upbringing (e.g., "I was brought up not to drink" or "My religion discourages or is against drinking"), fear of loss of self-control (liking to feel in control, feeling that drinking heavily is a sign of personal weakness, and not liking to get drunk) and performance impairment (e.g., "Drinking reduces my performance in sports") were adapted and included in the study. Each of the three factors in the RALD scale significantly negatively correlated to frequency of past year alcohol use, quantity of past year alcohol use, and frequency of heavy drinking in the past year. Chassin and Barrera (1993) also reported that compared to controls, children of alcoholic parents had weaker endorsement of upbringing RALD.

A few recent cross-sectional studies have examined motives not drink among high school students. Beckman et al. (2011) found that motives not to drink related to abstention status and lower drinking rates. Their results indicate that non- and infrequent drinkers with higher RALD rarely engaged in heavy episodic drinking, and that greater endorsement of RALD motives was associated with lower levels of initiation into alcohol use and more quit attempts for those who did initiate drinking. Anderson, Grunwald, Beckman, Brown, and Grant (2011) found that RALD decreased from 9^{th} to 12^{th} grade, that individuals endorsing more RALD were less likely to initiate drinking, and had less 30-day past use compared to those with lower scores on these motives. However, they observed no effect of RALD on heavy episodic drinking (Anderson et al., 2011). In both studies (Anderson et al., 2011 & Beckman et al, 2011) RALD motives were endorsed less among older students and were least endorsed among students who were drinking regularly, such as those characterized by frequent drinking or engaging in binge drinking weekly. Thus, these findings suggest

that RALD motives decrease across adolescence as adolescents acquire drinking experience, consistent with patterns supported in prospective studies of emerging adult samples (Epler, Sher, & Piasecki, 2009).

Anderson, Briggs, and White (2013) recently examined RALD prospectively in a cohort sequential adolescent sample (ages 12, 15, & 18 year old at baseline). They used a measure of RALD with three factors; loss of control (associated with getting into trouble or losing control), adverse consequences (associated with interference with responsibilities) and convictions (related to religious influences and upbringing). In cross-sectional analyses, higher baseline alcohol consumption was inversely related to loss of control and personal convictions were also negatively associated with alcohol problems. While cross-sectional results found RALD associations on drinking, prospectively result indicated that RALD did not predict future drinking above and beyond other baseline predictors such as disinhibition, harm avoidance, and consumption.

While several recent results have found RALD influences on adolescent alcohol use the literature is nascent and there is a need to clarify these associations, particularly with longitudinal data. It is not clear whether RALD is influential only on drinking initiation and whether these potential promotive effects drop off after drinking experiences are acquired or whether RALD influences the development of later drinking such as progression through later milestones. Additionally, consistent with Anderson et al. (2013), there are remaining questions regarding the purported influences of RALD as part of larger models of risk and other promotive factors.

Protective Associations

Prior research has found that parental monitoring can have a protective effect, such that higher levels of monitoring were related to a dampening of the association between peer influences and adolescent alcohol use cross-sectionally in early (Bergh, Hagquist, & Starrin, 2011; Steinberg, Fletcher, & Darling, 1994), and late adolescents (Wood et al., 2004). Prospective protective effects were also found among emerging adults (Fairlie, Wood, & Laird, 2012). Few studies have investigated potential protective influences of parental monitoring on impulsivity - alcohol use relations. Kaynak et al. (2013) did not find protective effects of parental monitoring on the influence of sensation seeking on alcohol use cross-sectionally. A recent prospective study of emerging adults did observe prospective protective effects of parental monitoring on sensation seeking – alcohol outcome relations but protective effects were not observed for impulsivity (Wood, Martin, Bernstein, & Lavigne, 2013). Accordingly, the protective effects parental monitoring may have on the risk factors of personality and peer influences' merits further investigation. Testing the purported influence of parental monitoring in a model for drinking onset and drinking escalation may help clarify the protective influence parents may have on adolescent health behaviors.

CHAPTER 2

PRESENT STUDY

While the data on adolescent drinking highlight the prevalence and somewhat normative behavior of alcohol use among adolescents, evidence suggests that early onset of alcohol use strongly presages future problem drinking. As reviewed, a large body of work indicates peer influences and impulsive personality traits are risk factors for alcohol use and misuse. Prior research also indicates that parental monitoring is promotive on adolescent alcohol use, however; is the literature is less clear on RALD's promotive influence on alcohol use among adolescents, especially after youth gain some experience with alcohol. As reviewed, parental monitoring has demonstrated protective effects on peer influences, yet more research on this influence among adolescents and replications of protective effects for personality risk factors is also needed. Less work has examined progression through drinking milestones, particularly while combining important biopsychosocial risk, promotive, and protective factors among adolescents. Early-to-mid adolescence is an important developmental period for analyzing such a model as it constitutes a period of significant developmental changes and risk for substance misuse.

This study seeks to test a more comprehensive model of risk, promotive, and protective effects on the initiation of key alcohol use milestones among adolescents. Specifically, we will examine the combined influences of personality, peers, parents, and cognitions to better understand the attainment of alcohol use initiation, the first

time adolescents engage in heavy episodic drinking, and the first time adolescents report being drunk. Figure 1 proposes a general conceptual model of milestone attainment including purported directionality of risk, promotive, and protective factors on drinking outcomes. As depicted, we hypothesize that parental involvement, peer influences, impulsivity, and RALD will all significantly influence the probability of alcohol use initiation and report of more severe milestones (i.e. heavy episodic drinking and getting drunk). It is expected that progression past initial use to more severe milestones such as regular use will be observed among adolescents. However; given the low base rate prevalence of alcohol use in this sample and the majority of participants having not yet reached middle or late adolescence it is anticipated that insufficient time may have elapsed in this sample to capture movement into later milestones, such as regular drinking. Accordingly, we focus on the early use milestone of initiation and first time report of more substantial alcohol use milestones. There does not appear to be a compelling logical and empirical reason to suppose first drunk occurs prior to first heavy drinking episode and vice versa, therefore these outcomes will be modeled parallel to one another as opposed to one preceding or predicting the other.

It is hypothesized that peer influences and impulsivity will be risk factors related to an increased probability of initiation and report of subsequent milestone attainment (positive direct effect on the outcome), whereas parental involvement and RALD are hypothesized to demonstrate a promotive association to decrease the probability of attaining each milestone (negative direct effect). Finally, it is hypothesized that parental involvement will have a protective effect on adolescent

drinking milestones by mitigating the risk of peers and impulsive personality traits (negative effect).

It is recognized that many studies conducted among this population take gender effects into consideration. While there is evidence that males and females progress through milestones differently (Jackson, 2010), rates of use among early adolescents – the target of this study – are not strikingly different. Thus, the emphasis of this study is to highlight the influence of promotive and protective factors alongside risk and as such gender will be controlled for as a covariate in this model, but will not be utilized for invariance testing. Nationally representative data report that among younger adolescents alcohol use rates are slightly higher among girls than boys (Johnston et al., 2012a; SAMHSA, 2011abc), but by grade 12 boys are much higher in reports of regular alcohol use, being drunk, and engaging in heavy drinking (Johnston et al., 2012a). Therefore it is expected that alcohol use initiation and reports of first drunk and first heavy drinking will be similar, or somewhat higher for girls.

Figure 1. Proposed Model for Adolescent Alcohol Use Milestone Attainment

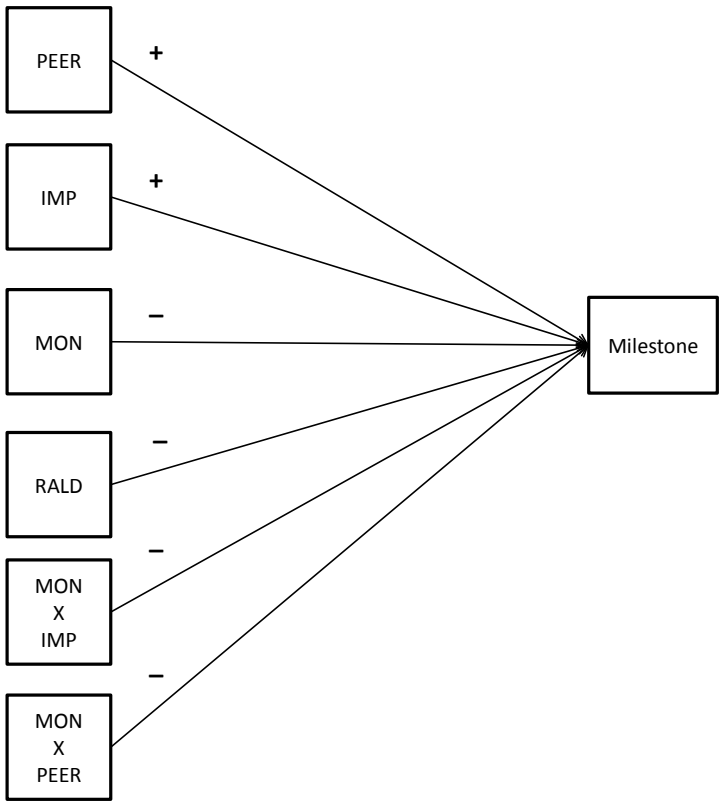


Figure 1. PEER = peer influences through social modeling; IMP = impulsivity modeled with positive urgency, negative urgency, and sensation seeking; MON = parental monitoring modeled with child disclosure, parental control, parental solicitation; RALD = reasons for abstaining or limiting drinking; MON x IMP = interaction effect between parental monitoring and impulsivity; MON x PEER = interaction effect between parental monitoring and peer influences. Milestone = alcohol initiation (having a first full drink of alcohol), first report of heavy episodic drinking, and/or first report of being drunk. PEER, IMP are purported risk factors, MON and RALD are purported promotive factors, and MONxIMP and MONxPEER are purported protective factors.

CHAPTER 3

METHODOLOGY

Sample

The sample was taken from an ongoing three-year prospective study examining alcohol initiation and progression among early adolescents which began in the fall of 2009 (Supported by NIAAA RO1 AA016838). The principal investigator of this study is Dr. Kristina Jackson of Brown University's Center for Alcohol and Addiction Studies. At baseline, most participants had not yet initiated alcohol use, but are expected to exhibit typical developmental progression of increasing alcohol involvement. Participants were 1,023 students in six Rhode Island middle schools, one urban (n=284), two rural (n=231), and three suburban (n=508). Data were collected in five cohorts enrolled six months apart and the sample is comprised of roughly equal numbers of 6th, 7th, and 8th graders (33%; 32%; 35%, respectively). The mean age at baseline was 12.22 years (SD=0.98, range 10-15) and the sample is 52% female and 24% non-White (5% Black, 3% Asian, 2% American Indian, 8% mixed race, 6% other), and 12% Hispanic. All procedures were approved by the university institutional review board; parents gave written informed consent and participants signed informed assent. A Certificate of Confidentiality was obtained from NIAAA to preserve participant confidentiality.

Procedure

These analyses utilize secondary data to test the proposed models. For complete procedural detail see Jackson et al. (2014), but a summary is given here. Using the school roster, information about the study and consent forms were mailed to each student's home and a second set of packets were distributed in schools by faculty. Completed consent forms were returned to schools with classroom incentives for returned forms. Incentives were provided to students to return a signed consent form regardless of whether consent to participate in the study was granted. Across the schools, an average of 38% of students returned a consent form (range 21%-55%). A range of 16%-30% of all students in the school returned a consent form allowing for participation in the study (51%-75% of all of those who returned consent forms consented to participate).

The sample is largely representative of the schools from which they were drawn. The distribution in the sample across grades is representative of each school's distribution with the exception of an overrepresentation of eighth graders in one school and an underrepresentation of seventh graders in another. The proportion of girls in the sample aptly represents the school population in five of the six schools. In all but two schools, there are fewer Whites in the sample than the school population from which it was drawn, with greater proportion of Hispanic students in the sample in three of the schools. Finally, students receiving subsidized lunch are well represented in three of the six schools but underrepresented in the remaining three, suggesting that the sample utilized here is more racially diverse than the school populations but also less disadvantaged.

Over the course of the study, participants were assessed over a three-year period, with five semi-annual follow-up surveys and a three-year follow-up survey. After baseline, assessments were conducted using web-based surveys that took approximately 45 minutes to complete. Participants were provided with multiple reminders (mailed card, email, text, phone calls) that alerted them that the survey was open, and access was granted with their login information. Surveys could be completed from any location with Internet access. During orientation sessions, emphasis was placed on finding a private location to take the survey. For the orientation/baseline session, the students were compensated with a $25 mall gift card; for each follow-up survey completed they received a $20 mall gift card.

The present study uses data from assessments at Waves 1, 3, 5 and 6, which were spaced one year apart except between Waves 5 and 6 which were spaced six months apart. The response rate overall for Wave 3 was 88% (N = 901, and ranging from 83% to 96% across school cohort), Wave 5 was 83% (N = 846; ranging from 75% to 90% across school cohort), and at Wave 6 was 55 % (N = 567; with Cohort responses = 85%, 81%, 75%, for the first three schools and no response for the last two schools). At the time of this study Wave 6 survey assessments had not been completed by all cohorts and two of the five schools had not submitted their Wave 6 assessment responses. One of the two schools missing at Wave 6 had the highest reported SES compared to the other schools and this school also reported the lowest drinking rates. However, all available responses from Wave 6 assessments were included in this study.

Measures

Details of each measure with original survey questions, program code for scoring, and variable names are given in Appendix A. Below is a general summary of the predictor and outcome variables used in this study.

Impulsivity.

A set of 18 items assessing three facets of impulsive behavior were used: negative urgency, positive urgency and sensation seeking. The 18 items were taken from the UPPS+P Impulsive Behavior Scale (Lynam, Smith, Whiteside & Cyders, 2006), a 59-item measure that assesses five personality pathways to impulsive behavior. Only the negative urgency (α = .84), positive urgency (α = .85), and sensation seeking (α = .82) items were assessed in this study because of a particular interest in urgency facets of impulsivity and because sensation seeking has been closely related to alcohol use outcomes. Mean scores of each factor were calculated and used as predictors in analyses. All impulsivity scores were measured at baseline and the survey items were preceded by the prompt, "For each statement, please indicate how much you agree or disagree with the statement." Although response options in the survey itself ranged from agree strongly (1) to disagree strongly (4), items were reverse-scored so that higher scores indicate greater impulsivity.

Peer Influences.

Peer influences were measured with two questions assessing "passive social influences" (Graham, Marks, & Hansen, 1991). These questions assess close friends' opinions about drinking and getting drunk. Response options for the two questions, "how do most of your close friends feel about kids your age (drinking / getting drunk,

respectively)?" ranged from Strongly Disapprove (0) to Strongly Approve (4). The measure was taken from Wood, Read, Mitchell & Brand (2004), who adapted the items from measures created by Jessor, Jessor & Donavan (1981). Because Wood's measure was developed for college students, the items were adapted to make them more easily understood by younger participants. The phrase "kids your age" was added to clarify questions and the word "alcohol" was also added to the first question to make it explicit that they were being asked about drinking alcohol.

Parental monitoring.

Kerr and Stattin's (2000) set of 15 items, administered to adolescents, assessing parental monitoring was used. The questions from this measure are divided into three subscales, child disclosure, parental solicitation, and parental control. The mean of each subscale was used as a predictor and each subscale was included as a covariate in the hypothesized models. All items had the same response options from "No, never" (1) to "Yes, always" (5). Child disclosure items include questions such as "Do you talk at home about how you are doing in the different subjects in school?", and "Do you hide a lot from your parents about what you do during nights and weekends?" (α = .77). Parental control items include questions such as "Do you need to have your parents' permission to stay out late on a weekday evening?", "Do you need to ask your parents before you can decide with your friends what you will do on a Saturday evening?", and "Do your parents always make you tell them where you are at night, who you are with, and what you do together?" (α = .85). Parent solicitation items include "In the last month, have your parents talked with the parents of your friends?", "During the past month, how often have your parents started a conversation

with you about your free time?", and "Do your parents usually ask you to talk about things that happened during your free time (whom you met while you were at the mall, free time activities, etc.)?", for example (α = .81). All subscale items were measured at baseline.

Reasons for abstaining and limiting drinking (RALD).

A set of 12 items that assess cognitions associated with abstaining or limiting alcohol consumption, with subscales assessing self-control/performance, and upbringing reasons for regulating alcohol use were used. The items were preceded by the following prompt: "How important would you say each of the following is to you as a reason for NOT drinking or LIMITING your drinking?" Response options included "Not true" (4), "True, but not at all important" (3), "True and fairly important" (2) and "True and very important" (1).

These items were adapted from Chassin and Barrera's Reasons for Limiting Drinking measure, which was administered to adolescents of ages 10 to 15 (1993). The 11 items in Chassin and Barrera's measure were taken from Greenfield, Guydish & Temple's Reasons for Limiting Drinking scale (RLD; 1989) which was developed with a college student population. Whereas the original measure asked about reasons for limiting drinking, this study asked about reasons for not drinking or limiting drinking. Chassin & Barrera chose to include the entire Performance subscale (α = .69), the entire Upbringing subscale, and 4 of the 6 items on the Self-Control subscale that emerged from factor analysis of Greenfield et al.'s measure (α = .78 for upbringing; α = .69 for performance/self control; α = .83 overall).

A change in Greenfield et al.'s wording for one question was made. The original item stated "a sign of personal weakness" and was changed to "a sign that you are a weak person" because of concern that this item would be difficult for middle school students to understand. In addition, a twelfth item: "Drinking is something that bad kids do" was added. Changes to the instructions and response scale were also made. This was an important change for a younger population in which many participants choose not to drink entirely. The original measure included a three-point response scale ranging from "Very Important" (1) to "Not at All Important" (3). A fourth response option, "Not true" was added. "True but/and" was added to three other response options. Items were reverse scored so higher values indicate more endorsement of RALD. The mean of each subscale was calculated and used in these analyses of RALD's influence on initiation and milestone attainment in the proposed models.

Drinking milestones.

Self reported alcohol use was assessed at each Wave of data collection included in this study with a binary response to one of three questions. Alcohol use initiation was assessed with the question "Have you ever had a full drink of alcohol?" (0= no, 1= yes) along with the question, "How old were you when you had your first full drink of alcohol?" The first time being drunk was assessed with the question "Have you ever felt drunk from alcohol" (0= no, 1= yes) along with the question "How old were you the first time you felt drunk from alcohol?" The first time for engaging in a heavy drinking episode, or a heavy episodic drinking (HED), was assessed with the question, "Have you ever had three or more drinks of alcohol in one

sitting in your lifetime?" (0= no, 1= yes) along with "How old were you when you did this?" Donovan's estimation of the number of drinks consumed in one sitting for drinking to be considered HED among adolescents was used for this study (2009). The criterion of three or more drinks of alcohol in one sitting for HED is based on laboratory alcohol challenge Donovan conducted. Donovan modeled the NIAAA criterion for binge drinking which defines a binge episode, or HED, to be consuming enough alcohol in one setting for an individual to reach a BAC (blood alcohol concentration) = 80 mg/dl. Donovan utilized the Widmark estimation to calculate the number of drinks it would take for an adolescent to reach a BAC = 80 mg/dl and found that for boys aged 9-13 and girls aged 9-17 three or more drinks consumed within two hours was sufficient to reach this level of intoxication.

Analytic Plan

A major goal of this study was to examine risk, promotive, and proactive factors together on milestone attainment. Continuous-time survival analysis (Singer & Willett, 2003) was used to evaluate timing of milestone attainment modeled from birth to first report of milestone (Cox, 1972; Singer & Willett, 2003). Survival analyses are particularly suited for analyzing longitudinal data and addressing the aims of this study. Survival analyses calculate the probability of event occurrence, here milestone attainment, and assess the influence either continuous or categorical variables have on that probability. Covariate effects are expressed in hazard ratios (e.g., difference in log hazard initiation for boys vs. girls). Survival analyses handle right censoring (failure to reach a milestone due to attrition or study end) and missing data are modeled for individuals who already initiated a given event at study outset. Further

detail on survival analyses, its assumptions, and examples of result interpretation can be found in Appendix B.

CHAPTER 4

RESULTS

Missing Data

Table 1 reports variations in demographic characteristics and predictor scores between the baseline assessments and the Wave 3 and Wave 5 attriters along with non responders at Wave 6. As seen below there were a few differences in the predictor scores, but very little variation in demographics. In comparison to the baseline sample, peer influences were higher and parental monitoring and RALD were lower among non completers at Waves 3 and 5, while the non completers at Wave 6 were slightly older and had higher reports of sensation seeking. Fisher's exact test was used to compare survey non completers on baseline rates of each drinking outcome. T3 and T5 non completers were lower in baseline proportion of each outcome, respectively (ever having had a full drink, $p < .001$; ever HED, $p < .01$ & $p < .05$; and ever drunk, $p < .001$ & $p < .01$), while T6 non completers were not significantly different in their baseline proportion of ever drink, ever HED, or ever drunk.

Table 1

Differences in Demographics and Predictor Scores Compared to Baseline Sample

Covariates	**Wave 3** $N = 122$	**Wave5** $N = 177$	**Wave 6** $N = 456$
Sex			
Ethnicity			
Age			t=2.08, $p < .05$
Negative Urgency			
Positive Urgency			
Sensation Seeking			t=2.49, $p < .05$
Peer Drink	t=4.70, $p < .001$		
Peer Drunk	t=4.66, $p < .001$	t=2.42, $p < .05$	t=-2.23, $p < .05$
Child Disclosure	t=-3.29, $p < .01$	t=-3.40, $p < .001$	
Parent Control	t=-3.28, $p < .001$	t=-2.08, $p < .05$	
Parent Solicitation			
RALD UP	t=-3.61, $p < .001$		
RALD P/SC	t=-2.79, $p < .01$		

Note. *N*'s reported above are number missing at each time point. Only significant differences are reported in the table above. Demographics and predictors with no difference from baseline characteristics are left blank.

Descriptive Statistics

Prior to constructing and testing the more comprehensive model of milestone attainment presented in Figure 1 several preliminary tests were conducted. Univariate statistics were computed on all continuous predictors to assess normality and detect irregularities in the data (outliers, skewness and kurtosis). Adjustments were made to outliers and predictors did not markedly depart from normality (e.g., skew > 2.0 and kurtosis > 4.0) (Tabachnick & Fidell, 2007). Table 2 reports the mean and standard deviation statistics of the covariates included in this model. Overall, endorsement of impulsive personality characteristics was quite low. The reported acceptance of drinking and getting drunk among this sample's peers was surprisingly low with an average report of peers "strongly disapproving" to "disapproving" of drinking and

getting drunk. Reported parental involvement on all three subscales was fairly high in this sample as were the adolescents' reports of how much they disclose information to their parents about their activities and whereabouts. The adolescents in this sample on average also reported a high rate of reasons for abstaining and limiting drinking.

Table 2

Mean and Standard Deviation of Model Predictors.

Variable	Mean	Std. Dev.
Negative Urgency	2.00	.76
Positive Urgency	1.68	.69
Sensation Seeking	2.18	.80
How do most close friends feel about drinking alcohol?	.63	.88
How do most close friends feel about getting drunk?	.51	.81
Child Disclosure	3.85	.92
Parental Control	4.29	.94
Parental Solicitation	3.21	1.06
Upbringing RALD	3.19	.67
Performance/Self Control RALD	3.09	.76

Note. **Negative Urgency**, **Positive Urgency**, and **Sensation Seeking** are all mean scored and higher values represent greater endorsement of personality characteristic. **Peer Passive Social Influence**: 0 = strongly disapprove, 4 = strongly approve. **Parental Involvement**: Higher scores indicate more disclosure and parental involvement with 0 = never, 5 = always. **RALD**: Higher scores indicate more reasons for abstaining or limiting drinking in response to questions in these subscales with 1 = not true and 4 = true and very important.

Overall drinking rates for this sample were fairly low, but a noteworthy trend in milestone attainment is seen by drinking rates steadily increased over time. This is seen in Figure 2 with each Wave's outcome distribution. It's important to recall that Wave 6 includes incomplete data as not all cohorts have completed their survey responses. Therefore, the overall Wave 6 sample size is much smaller and skews the proportions of drinking outcomes compared at each time. So, Wave 6 outcome distributions were higher than the overall distribution rate reported for the entire study as seen below in Table 2. As mentioned previously the sample size is different because several schools had yet to submit their Wave 6 data at the time this study was conducted.

In Wave 1 (average age = 12), only 7.7 percent of the participants reported ever having had a full drink, but by Wave 6 (average age = 15.18) 32 percent of the sample reported ever drinking a full drink of alcohol. A similar trend was seen with both first HED and first drunk, though the proportion of the sample experiencing these events was much lower. At Wave 1 only 2.7 percent of the sample had both experienced a heavy drinking episode and been drunk, whereas by Wave 6 these rates increased to 18.3 percent reported HED and 17.3 percent reported ever being drunk.

Figure 2. Change in Raw Mean Scores Reported for Milestone Attainment over Time

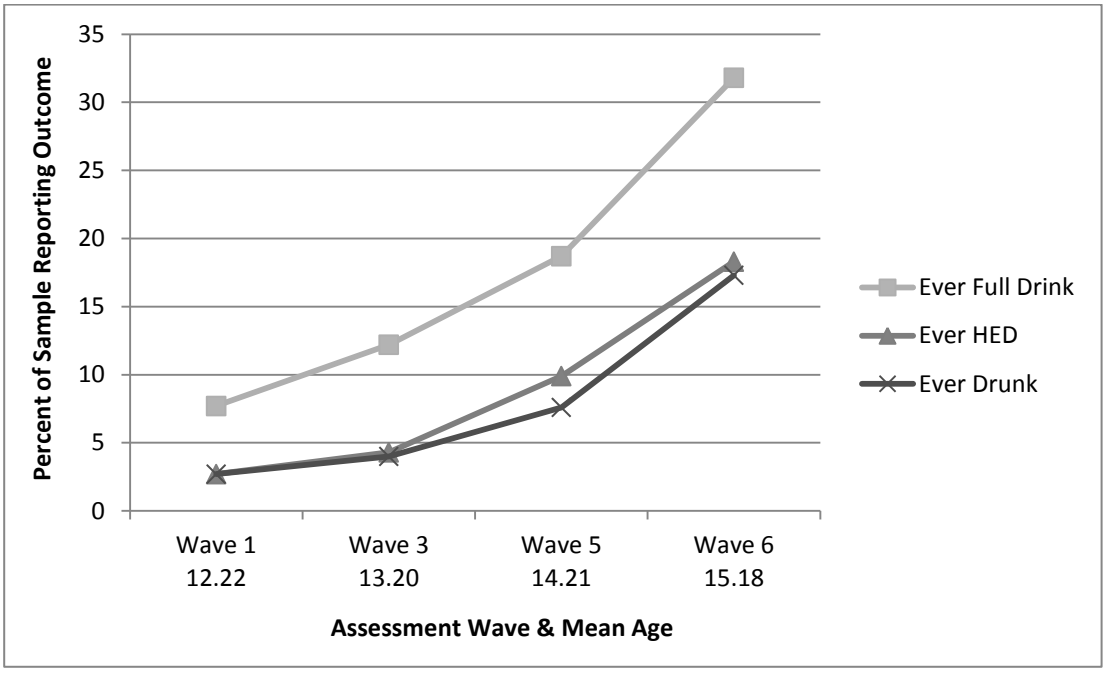


Table 3 reports cumulative outcome distributions for the entire study across the course of the study. A quarter of the entire sample reported ever having had a full drink of alcohol, 13.5 percent reported ever HED, and nearly 13 percent reported ever being drunk. Table 2 also shows the difference in these outcomes by gender and ethnicity. Girls had higher endorsement of all three drinking milestones compared to boys and white adolescents had the lowest proportion of endorsement for each outcome.

Table 3

Total Proportion of Sample Ever Reporting Milestone: By Gender and Ethnicity

	Ever Full Drink	Ever HED	Ever Drunk
	Yes	Yes	Yes
Total Sample (%)	25.32	13.59	12.81
Gender (%)			
Female	29.21	15.73	13.86
Male	21.06	11.25	11.66
Race (%)			
White	24.59	12.84	12.70
Hispanic	25.00	13.71	9.68
Black	34.15	17.07	14.63
Other	27.12	16.95	16.10

Table 4 below compares the frequency of those who have experienced HED and ever being drunk among all adolescents who have initiated alcohol use. This table shows that the two largest groups are those who have not experienced either of the later milestones and those who have experienced both. From the frequencies reported in the table below neither first drunk or first HED emerges as a predominant outcome, suggesting perhaps that these are more contemporaneous rather than temporally ordered outcomes.

Table 4

Contingency Table Comparing Lifetime Reports of HED and Drunkenness among Drinkers

	Never HED	Have HED	Total
Never Been Drunk	92	36	128
Have Been Drunk	28	103	131
Total	120	139	259

Note. Frequencies calculated above are among those who have ever had a full drink of alcohol, $N = 259$.

Table 5 presents results of univariate analyses testing the difference of each predictor's mean score between those reporting each milestone and those not experiencing each milestone. T-tests for equality of means of each predictor within each outcome (i.e. each drinking milestone) were all significant at the $p < .001$ level. For example negative urgency mean scores for those who initiated alcohol use compared to non drinkers were significant as were the mean scores of this predictor for those who reported HED or ever being drunk, respectively. Individuals never reporting a respective milestone compared to those who have experienced the milestone on average had significantly lower impulsive personality facet scores and reported significantly lower peer acceptance of drinking and getting drunk. Also, non drinkers had higher rates of parental involvement and RALD.

Table 5

Comparison of Covariate Means between Drinkers and Nondrinkers

	Ever Full Drink Mean (*Std*)		Ever HED Mean (*Std*)		Ever Drunk Mean (*Std*)	
Covariates	Yes	No	Yes	No	Yes	No
Negative Urgency***	2.21 (*.79*)	1.93 (*.74*)	2.31 (*.79*)	1.95 (*.75*)	2.26 (*.81*)	1.96 (*.75*)
Positive Urgency***	1.91 (*.77*)	1.60 (*.64*)	2.00 (*.80*)	1.63 (*.65*)	1.99 (*.79*)	1.64 (*.66*)
Sensation Seeking***	2.35 (*.83*)	2.13 (*.78*)	2.53 (*.84*)	2.13 (*.78*)	2.42 (*.85*)	2.15 (*.79*)
Peer Feelings: Drink***	1.17 (*1.03*)	.45 (*.74*)	1.34 (*1.05*)	.52 (*.80*)	1.42 (*1.02*)	.52 (*.80*)
Peer Feelings: Drunk***	.97 (*.99*)	.35 (*.68*)	1.14 (*.98*)	.41 (*.74*)	1.22 (*1.02*)	.41 (*.72*)
Child Disclosure***	3.75 (*1.00*)	4.01 (*.83*)	3.20 (*1.03*)	3.95 (*.85*)	3.17 (*.98*)	3.95 (*.86*)
Parental Control***	4.02 (*1.04*)	4.38 (*.88*)	3.88 (*1.10*)	4.35 (*.90*)	3.88 (*1.12*)	4.35 (*.90*)
Parental Solicitation***	2.99 (*1.01*)	3.29 (*1.07*)	2.83 (*1.04*)	3.27 (*1.06*)	2.90 (*1.03*)	3.26 (*1.06*)
Upbringing RALD***	2.83 (*.69*)	3.31 (*.61*)	2.72 (*.73*)	3.26 (*.63*)	2.71 (*.69*)	3.26 (*.63*)
Performance / Self Control RALD***	2.93 (*.69*)	3.14 (*.77*)	2.86 (*.67*)	3.12 (*.77*)	2.89 (*.67*)	3.12 (*.77*)

Note. T-tests for equality of means within each outcome resulted in the same significance levels across all outcomes: $p < .001$***.

Bivariate correlations between the independent and dependent variables indicate with the exception of gender each model predictor was significantly correlated with each outcome in this sample (See Table 6). Being male was negatively correlated with first ever full drink ($p < .01$) and HED ($p < .05$), but not correlated to first time being drunk. Personality and peer influences were positively associated with

drinking outcomes while parental involvement and RALD items were negatively associated with each outcome.

Table 6

Pearson Moment Correlations among All Study Predictors[a]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Sex	1													
2. Negative Urg.	-.02[ns]	1												
3. Positive Urg.	.01[ns]	.71	1											
4. Sen. Seeking	.17	.44	.45	1										
5. Peer Drink	.06[ns]	.23	.25	.14	1									
6. Peer Drunk	.09	.17	.23	.12	.83	1								
7. Child Disc.	-.04[ns]	-.26	-.29	-.15	-.38	-.36	1							
8. Parent Control	-.10	-.07*	-.13	-.04[ns]	-.22	-.23	.49	1						
9. Parent Solic.	-.08	-.11	-.13	-.01[ns]	-.22	-.20	.56	.45	1					
10. RALD UP	-.07*	-.04[ns]	-.11	-.04[ns]	-.35	-.32	.35	.28	.22	1				
11. RALD P/SC	-.03[ns]	.04[ns]	-.004[ns]	.15	-.16	-.17	.19	.15	.22	.55	1			
12. Ever Drink	-.09	.15	.19	.11	.35	.33	-.30	-.16	-.12	-.31	-.11	1		
13. Ever HED	-.07*	.15	.17	.15	.31	.31	-.28	-.15	-.14	-.27	-.10	.68	1	
14. Ever Drunk	-.03[ns]	.12	.16	.10	.33	.33	-.28	-.15	-.11	-.27	-.09	.65	.72	1

Note. [a] All values are significant at the $p < .01$ level unless otherwise indicated. *$p < .05$. [ns] = not significant.
Bivariate correlations calculated between each variable with $N = 998$.
Negative Urg. = Negative Urgency; Positive Urg. = Positive Urgency; Sen. Seeking = Sensation Seeking; Peer Drink= how most friends feel about drinking; Peer Drunk= how most friends feel about getting drunk; Child Disc. = Child Disclosure; Parent Solic. = Parent Solicitation. RALD UP = reasons for abstaining and limiting drinking, upbringing; RALD P/SC = reasons for abstaining and limiting drinking, performance / self control.

Table 7 presents the number of early initiators in this sample, or those reporting drinking milestone prior to the baseline assessment. The demographic characteristics of early initiators were compared to those not reporting early initiation. The early initiators for having a full drink or ever being drunk were not significantly different in gender, ethnicity or age and early HED initiators were not different in gender or age, but were different in ethnicity (Fisher's Test, $p < .001$). Among early initiators of alcohol use 7 percent were Hispanic, however Hispanics only made up 5 percent of those not initiating early. Hispanic and Whites were highest among the early initiator group (7 percent and 6 percent respectively). Across all three outcomes early initiators were not significantly different in any of the mean predictor variable scores compared to those who did not initiate early. With little variation in the demographics and non-significant differences in all predictor scores among the early initiators these individuals were included with the remainder of the sample for subsequent analyses.

Table 7

Frequency of Milestone Initiation for Pre and Post Baseline Initiators

Milestone	Early Initiator – Yes	Early Initiator – No	Total
Ever had a full drink	67	192	259
Ever engaged in HED	26	113	139
Ever been drunk	21	110	131

Survival Analyses

Several models were tested in a step wise manner using survival analyses. First models were tested to assess the cumulative hazard and survival for each outcome without any predictors (See Figures 3-5). These are the baseline models of

survival and hazard. Gender effects were considered next and models were stratified by gender for survival analyses. The survival and hazard curves for gender are presented in Figures 6-8. Hazard and survival for milestone attainment was then assessed with the influence of each predictor separately, to determine univariate risk and promotive influences. Following the univariate analyses, covariates were grouped by like category and risk and promotive predictor groups tested separately while controlling for like predictors. Next, survival analyses on the probability of milestone attainment with risk and promotive effects together were run and finally survival models including risk, promotive, and protective effects were analyzed.

In Figures 3-5 the baseline models include the 95 percent confidence bands for survival and kernel-smoothed functions are reported for the cumulative hazard (Singer & Willett, 2003). Hazard for first alcohol use was more substantial at earlier ages compared to the hazard for HED and being drunk, but hazard increased with age for all three outcomes. At age 14 one in four adolescents had initiated alcohol use and this proportion increased over the next two years to 32 percent at age 15 and 44 percent by age 16. By age 17 half of all adolescents in this sample had consumed their first full drink of alcohol. The risk of adolescents engaging in more severe alcohol use began to increase at a later age than first alcohol use. Mid adolescence was the period of more substantial hazard for ever engaging in heavy episodic drinking and being drunk, with one in four of all 16 year olds reporting HED. This increased to 31 percent of all adolescents drinking heavily by age 17. The risk for getting drunk was slightly lower than HED with 23 percent at age 16, and increased to 26 percent by age 17.

Figure 3. Survival and Hazard Curve for Ever Full Drink

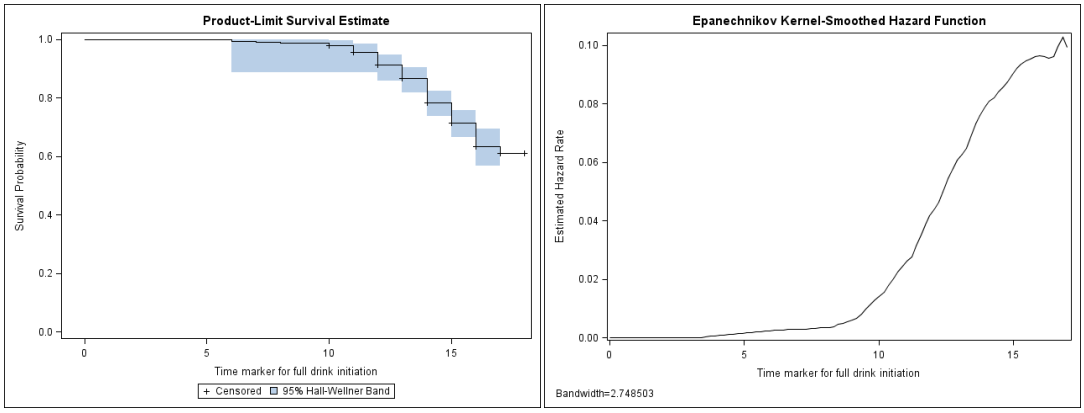


Figure 4. Survival and Hazard Curve for Ever HED

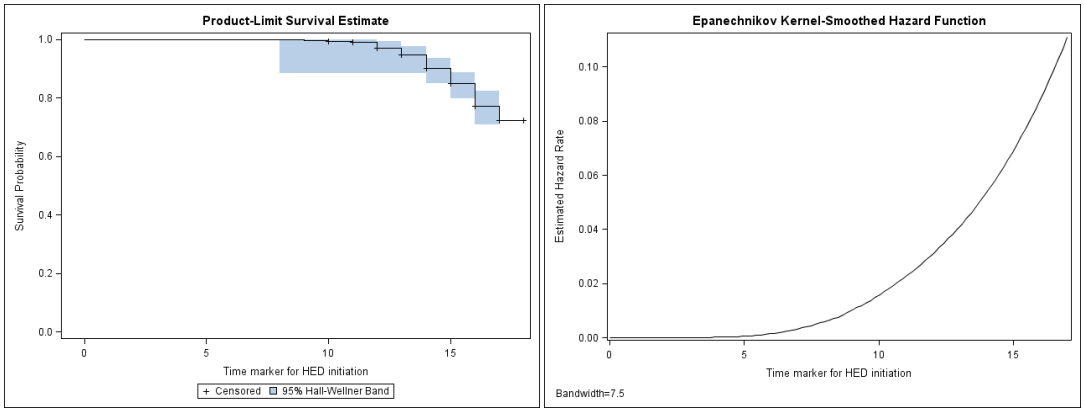
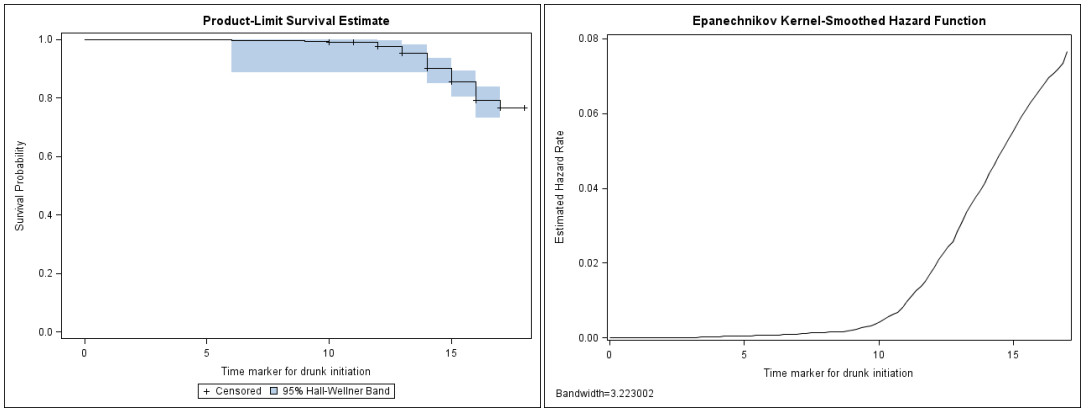


Figure 5. Survival and Hazard Curve for Ever Drunk



Figures 6 through 8 display estimated survival and kernel-smoothed cumulative hazard for each drinking milestone stratified by gender. As seen below there was a significant difference between boys and girls for their survival and hazard

functions for alcohol use initiation (first full drink) with females showing earlier initiation compared to boys (χ^2 = 8.9, p < .01). Among younger ages, females displayed an approximately 10% greater hazard of alcohol use initiation (age 14 hazard for full drink among females = .28). This difference increased as adolescents got older and even one year later females were15 percent more likely to initiate alcohol use than boys (hazard = .40 at age 15 among females).

This pattern was the same for HED, however; the difference between boys and girls was less dramatic. Hazard rates for HED were not as high in early adolescence as those for having a full drink. A quarter of the girls in this sample had engaged in heavy drinking by age 16 and were only at 3 percent greater risk for initiation than boys at that age.

Alternatively, there was no significant difference between boys and girls for their survival and hazard for first time being drunk (χ^2 = 1.20, p =.27). Boys and girls had slightly lower hazard rates for being drunk with hazard being below 25 percent even by the time boys and girls are 16.

Figure 6. Survival and Hazard Curve for Ever Drink by Gender

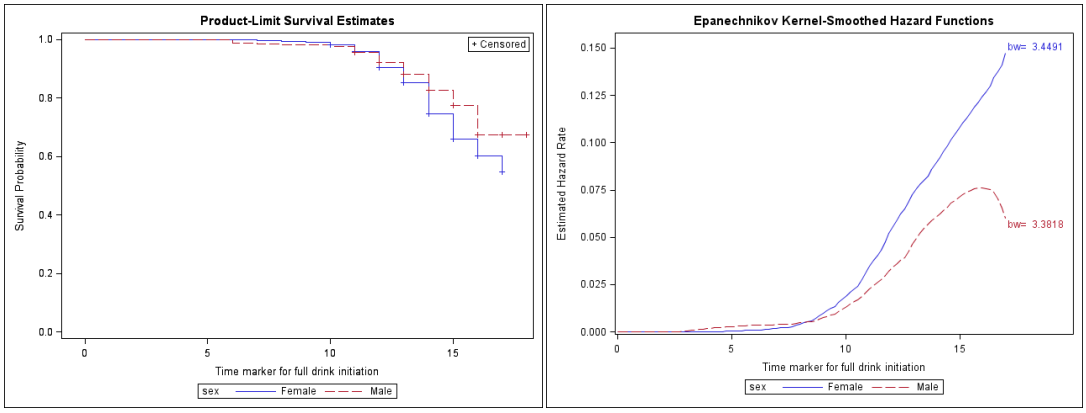


Figure 7. Survival and Hazard Curve for Ever HED by Gender

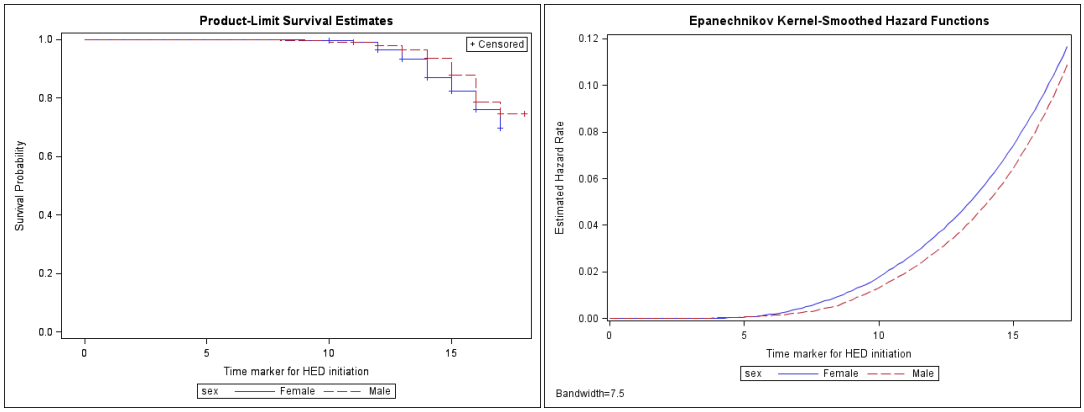
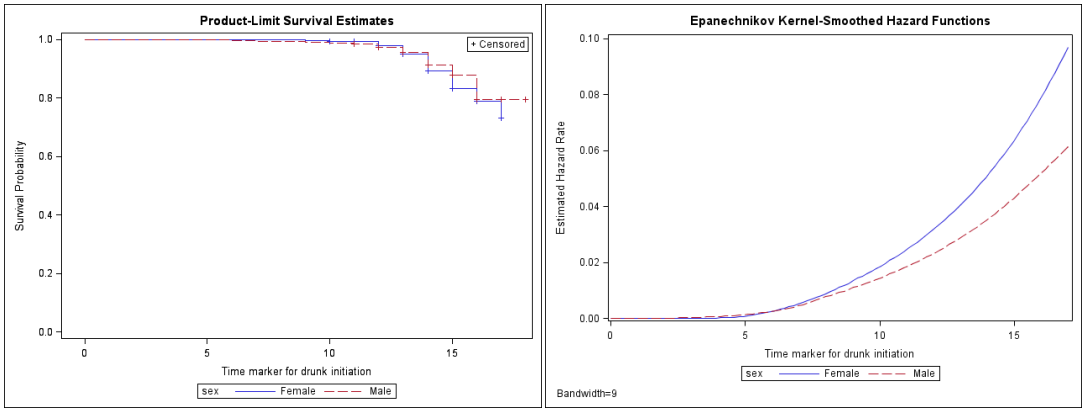


Figure 8. Survival and Hazard Curve for Ever Drunk by Gender



Cox proportional hazard models were calculated to assess covariate effects on the attainment of drinking milestones. Table 8 reports hazard ratios of each predictor on each milestone while not controlling for any other criterion. Significant hazard

ratios result when the 95 percent confidence limit does not include 1 as a hazard rate of 1 signifies event rates between comparison groups are equal. Very small changes in overall model fit statistics were found when including one covariate compared to the baseline hazard function with no predictors. The -2 Log Likelihood and AIC fit statistics only changed by 10, respectively. When every predictor was modeled independently each was significantly influential on the probability of initiating each milestone. Gender (male), parental monitoring, and RALD decreased the probability of alcohol use initiation and engaging in later milestones, consistent with a promotive effect. For example, males were 31 percent less likely to drink than females (1 - .69), and adolescents who more freely offer information about their activities and whereabouts to their parents were 43 percent less likely to drink alcohol and 50 percent less likely to get drunk or drink heavily. Impulsive personality traits and peers with more favorable attitudes toward drinking and getting drunk all increased the probability of milestone attainment, consistent with being a risk factor. Adolescents with peers who have favorable attitudes toward drinking were 1.83 times more likely to begin drinking and were two times more likely to get drunk, while higher impulsive personality traits increased the likelihood of initiation more than 1.3 times with each unit increase in reported impulsivity and approximately more than one and a half times for first HED and first drunk.

Table 8

Individual Coefficient Effects on Each Outcome

	First Full Drink		First HED		First Drunk	
Covariate	Hazard Ratio	95% C.L.	Hazard Ratio	95% C.L.	Hazard Ratio	95% C.L.
Sex (male)	**.69**	**.54, .89**	**.68**	**.48, .96**	.83	.59, 1.17
Negative Urgency	**1.43**	**1.23, 1.67**	**1.67**	**1.35, 2.06**	**1.54**	**1.24, 1.92**
Positive Urgency	**1.61**	**1.37, 1.89**	**1.81**	**1.47, 2.23**	**1.76**	**1.42, 2.19**
Sensation Seeking	**1.29**	**1.11, 1.50**	**1.63**	**1.32, 2.01**	**1.40**	**1.13, 1.74**
Peer Drink	**1.83**	**1.65, 2.04**	**1.91**	**1.66, 2.20**	**2.05**	**1.77, 2.63**
Peer Drunk	**1.72**	**1.55, 1.92**	**1.84**	**1.60, 2.11**	**1.97**	**1.72, 2.27**
Child Disclosure	**.57**	**.50, .64**	**.50**	**.43, .59**	**.49**	**.42, .58**
Parent Control	**.73**	**.66, .82**	**.67**	**.58, .77**	**.67**	**.58, .78**
Parent Solicitation	**.80**	**.72, .90**	**.72**	**.61, .84**	**.77**	**.66, .90**
RALD UP	**.47**	**.41, .54**	**.43**	**.36, .52**	**.43**	**.35, .52**
RALD P/SC	**.72**	**.62, .83**	**.66**	**.54, .80**	**.67**	**.55, .82**

Note. Significant hazard ratios are indicated by **bold type** in the table above.

While it is interesting to note the individual effect of each variable on event occurrence, the influence of these factors taken together is the major aim of the current research. Accordingly, covariates were next grouped together and the influence of these predictors was tested by group, thus the influence of each predictor was controlled for with like predictors. Personality, peer influences, parental involvement, and RALD scales and/or items were each grouped, respectively. Table 9 displays the results of each variable in the groups tested. There were very modest changes in the overall fit statistics for the models with grouped covariates with a range of difference in -2 LL and AIC of 15-100. As mentioned previously, the influence of gender was controlled for in these groupings, and was a significant predictor among all groups tested. As seen below when other factors are considered together the significant associations for several criteria are eliminated. When impulsive personality factors

are considered together negative urgency does not affect milestone attainment above positive urgency and sensation seeking. The efforts of parents trying to control their adolescents' behavior and solicit information from their children were also no longer significant promotive behaviors. On the other hand, child's self disclosure of information to their parents was still an important promotive influence on their substance use as was upbringing RALD. Interestingly, the influence of performance and self control RALD reversed and was associated with increased risk for milestone attainment when modeled alongside upbringing RALD. This is likely an indication of a suppresser effect from upbringing RALD as performance and self control was negatively correlated to each milestone in bivariate analyses (see Table 6).

Table 9

Comparison of Significant Coefficient Affects on Each Outcome by Predictor Grouping

	First Full Drink		First HED		First Drunk	
Covariate	Hazard Ratio	95% C.L.	Hazard Ratio	95% C.L.	Hazard Ratio	95% C.L.
Group A						
Negative Urgency	1.04	.83, 1.31	1.12	.81, 1.54	1.03	.74, 1.44
Positive Urgency	**1.49**	**1.16, 1.89**	**1.41**	**1.01, 1.94**	**1.60**	**1.14, 2.26**
Sensation Seeking	1.11	.93, 1.33	**1.40**	**1.10, 1.80**	1.14	.89, 1.48
Group B						
Peer Drink	**1.66**	**1.33, 2.07**	**1.53**	**1.14, 2.04**	**1.58**	**1.18, 2.12**
Peer Drunk	1.14	.91, 1.42	1.31	.98, 1.74	**1.35**	**1.01, 1.81**
Group C						
Child Disclosure	**.56**	**.48, .65**	**.52**	**.42, .63**	**.48**	**.39, .58**
Par. Control	.90	.78, 1.03	.87	.72, 1.04	.86	.72, 1.04
Par. Solicitation	1.12	.97, 1.28	1.06	.87, 1.29	1.20	.99, 1.47
Group D						
RALD UP	**.37**	**.30, .47**	**.33**	**.25, .45**	**.32**	**.22, .44**
RALD P/SC	**1.29**	**1.05, 1.59**	1.31	.98, 1.74	**1.40**	**1.04, 1.89**

Note. Significant hazard ratios are indicated by **bold type**. Gender effects have been controlled for with each covariate grouping.

Survival analyses were then conducted to account for the influence of all the covariates taken together in one model. Changes in the fit statistics for the models with all covariates were much higher compared to the baseline models with no covariates and higher than the models with grouped predictors with differences ranging from 150-200, indicative of greater overall fit for the full model. As seen in Table 10 gender, peer influences, child disclosure, and upbringing RALD all significantly influenced the probability of ever having a full drink. Male adolescents had a smaller probability of initiation, being 38 percent less likely to have a first drink compared to girls. Over time adolescents who talked more to their parents about their behavior were 23 percent less likely to initiate alcohol use compared to those who didn't talk to their parents about their activities. Adolescents with more reasons for abstaining or limiting drinking based on their upbringing, i.e., because they were brought up not to drink were 63 percent less likely to begin drinking and had half the risk of first HED or getting drunk. Having friends with a more favorable attitude toward drinking increased risk and was associated with 1.5 times more likelihood of initiating drinking.

Impulsive personality characteristics were not significant on alcohol use initiation nor were close friends attitudes about getting drunk. Parental influences related to parent's own behavior were not shown have a promotive influence on any of outcomes. And while upbringing reasons for abstaining or limiting drinking impacted milestone attainment, performance and self control reasons did not.

Table 10

Comparison of Survival Analysis Results for All Drinking Milestones When Modeling all Covariates

	First Full Drink		First HED		First Drunk	
Covariate	Hazard Ratio	95% C.L.	Hazard Ratio	95% C.L.	Hazard Ratio	95% C.L.
Sex (male)	**.62**	**.48, .80**	**.54**	**.38, .78**	.71	.50, 1.03
Negative Urgency	.96	.74, 1.22	1.05	.75, 1.46	.92	.65, 1.30
Positive Urgency	1.13	.87, 1.47	1.00	.71, 1.42	1.13	.79, 1.61
Sensation Seeking	1.10	.91, 1.32	**1.41**	**1.09, 1.83**	1.09	.83, 1.43
Peer Drink	**1.46**	**1.15, 1.85**	1.24	.90, 1.69	1.34	.97, 1.86
Peer Drunk	1.03	.81, 1.30	1.24	.91, 1.70	1.25	.90, 1.74
Child Disclosure	**.77**	**.64, .92**	**.77**	**.60, .98**	**.66**	**.51, .84**
Par. Control	1.00	.87, 1.15	.97	.79, 1.17	1.00	.82, 1.22
Par. Solicitation	1.09	.93, 1.26	1.00	.81, 1.12	1.19	.96, 1.42
RALD UP	**.37**	**.30, .47**	**.50**	**.36, .70**	**.49**	**.35, .70**
RALD P/SC	1.12	.90, 1.40	1.04	.77, 1.42	1.20	.87, 1.65

Note. Significant hazard ratios are indicated by **bold type**.

As proposed, the interaction of parental influences on personality and peer influences were modeled to assess whether parental influences had a protective effect on adolescent alcohol use milestones. This included creating an interaction term between parental monitoring and personality and peer influences then including the interaction terms in the survival analyses along with the predictors as previously tested. This new model with the interaction term and all other covariates resulted in decrease of the -2LL and AIC by about 150 for all three models ($\pm$ 20 for HED and drunk). These overall goodness-of-fit tests with model interactions were similar to the models with all covariates, though they did not change as much, suggesting that the model without interactions fit the data slightly better. A protective influence from parental monitoring on peer influences and impulsive personality characteristics was not observed for first alcohol use or ever heavy drinking, so that parental effects did

not mitigate the influence of these risk factors on the probability of alcohol initiation and HED. However, there was a significant interaction between child disclosure and peer attitudes about getting drunk on the first drunk milestone ($p < .05$). Table 11 presents the hazard ratio for the influence of child disclosure at each level of peer influences. As seen in Table 11 the influence of child disclosure on peer influence was associated with a lower probability of the first drunk milestone, but only at lower levels of peer influences. As peer influences become more favorable the influence of child disclosure was diminished to non-significant levels.

Table 11

Effect of 1-Unit Change in Child Disclosure by Peer Drinking

Description	Hazard Ratio	95% Confidence Limits	
Child Disclosure Unit=1 at Peer Drunk =0	**.53**	**.40**	**.71**
Child Disclosure Unit=1 at Peer Drunk =1	**.65**	**.51**	**.82**
Child Disclosure Unit=1 at Peer Drunk =2	.79	.60	1.05
Child Disclosure Unit=1 at Peer Drunk =3	.97	.65	1.44
Child Disclosure Unit=1 at Peer Drunk =4	1.18	.69	2.02

Note. Hazard ratios for the effect of child disclosure on ever drunk are reported for different levels of peer attitudes about getting drunk. Peer drunk units: 0 = "Strongly Disapprove"; 1= "Disapprove"; 2 = "Neither Approve nor Disapprove"; 3 = "Approve"; 4 = "Strongly Approve".

There are assumptions about the covariate effects in survival analyses and several diagnostic tests were conducted to verify two of these; the proportional hazards assumption of the Cox regression models, and verification of the functional form of the covariates (Singer & Willett, 2003). In survival analyses covariates are assumed to have a constant multiplicative effect on the hazard rate and have a loglinear relationship to the outcome. This means that each unit change in the

covariate is associated with the same proportional change in the hazard rate, or a constant hazard ratio, no matter at what level of the covariate. For example, moving from a 1 to 2 would have the same percent change as going from 50 to 100 (Therneau & Grambsh, 2000; UCLA, 2014).

A central assumption of Cox regression is that covariate effects on the hazard rate, namely hazard ratios, are constant, or proportional, over time (Singer & Willett, 2003). For example, if males have twice the hazard rate of females 1 day after follow up, the Cox model assumes that males have twice the hazard rate at 1000 days after follow up as well. Violations of the proportional hazard assumption may cause bias in the estimated coefficients as well as incorrect inference regarding significance of effects.

Using Proc ASSESS in SAS the functional form of the covariates was tested with graphical methods (Lin, Wei, & Zing, 1993). This test is based on martingale residuals grouped around time or a covariate value (which is the difference between the observed events and the predicted events [Singer & Willett, 2003]). These residuals should fluctuate randomly around 0 and departures from random error in the data suggest model misspecification. These departures are approximated using a zero-mean Gaussian process (Lin, Wei, & Zing, 1993; UCLA, 2014).

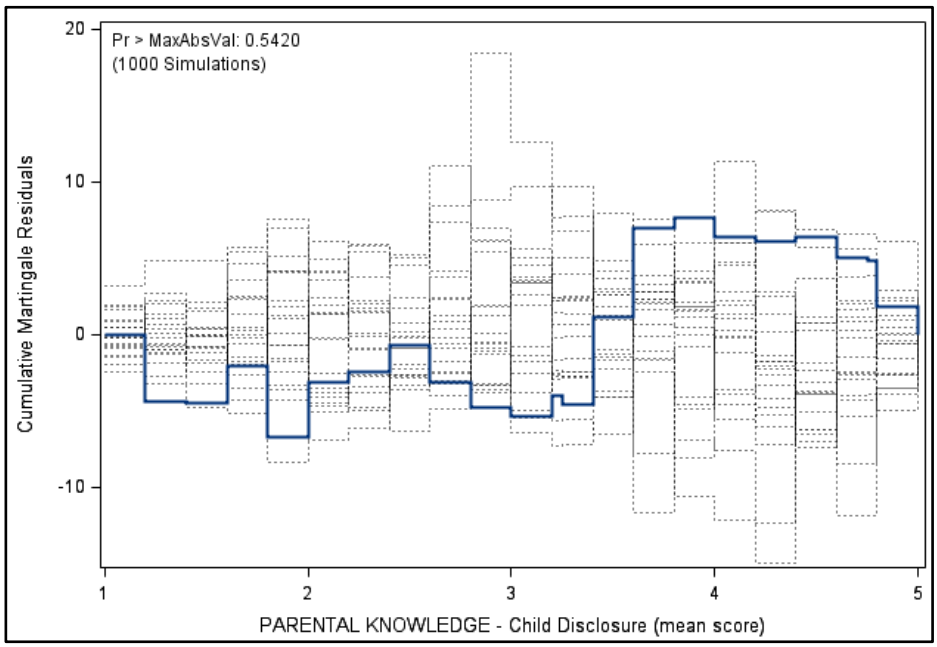
This test was done on all covariates in this model. Figure 9 below presents the graphical test on one of the model covariates, for example. The solid line represents the observed cumulative residuals and the dotted lines are simulated expected residuals. Solid lines (observed values) outside the dotted lines (expected values) indicate a violation in the functional form of the data. Supremum tests are another

way to assess the function form of the covariate consistent with the graphical method. According to UCLA's Statistics Consulting Group,

> Supremum tests calculate the proportion of 1000 simulations that contain a maximum cumulative martingale residual larger than the observed maximum cumulative residual. This proportion is reported as the p-value. If only a small proportion, say 0.05, of the simulations have a maximum cumulative residual larger than the observed maximum, then that suggests that the observed residuals are larger than expected under the proposed model and that the model should be modified. (2014).

Linear effects of the covariates were tested in each model and fit statistics were adequate for each covariate in the models for all three drinking milestones. None of the solid lines on the graph fell outside the expected values and none of the supremum tests were significant when analyzing the functional form of the covariates suggesting that the covariates included in this model met the linear effects assumption of survival analyses.

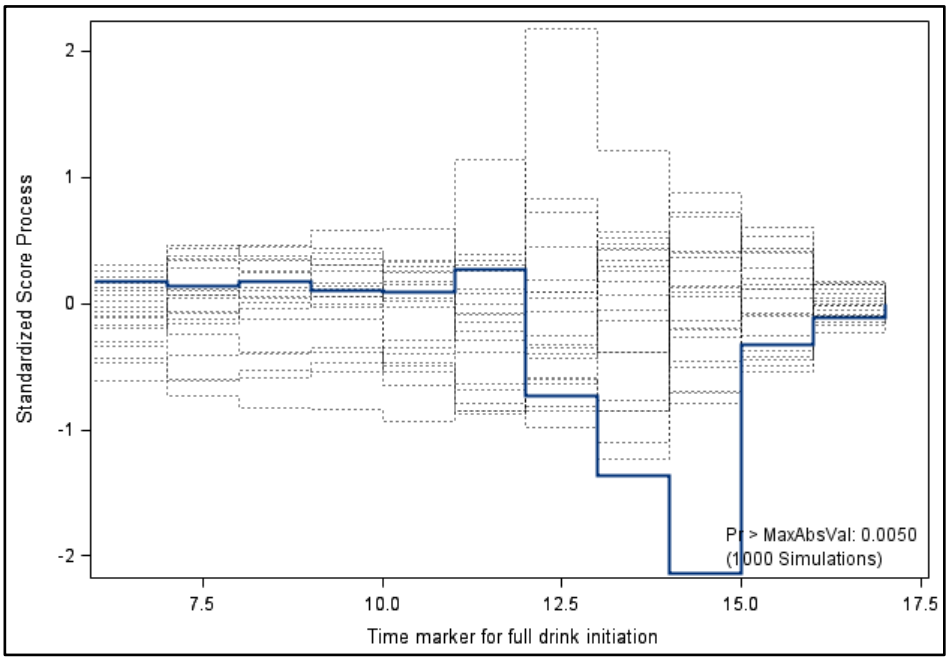
Figure 9. Checking the Functional Form of Covariates



The proportional hazards assumption of the influence of each covariate on the hazard ratio was tested similarly to the functional form of the covariates using a transform of the martingale residuals calculated with PROC ASSESS in SAS (Lin, Wei, & Zing, 1990). The only covariate that appeared to fall out of proportional hazards was child disclosure, which did so only for the first drink and first drunk models (See Figure 10). One way of to deal with non proportionality is to include covariate interactions by time in the Cox model, as a significant interaction indicates a violation of the proportional hazards (which is simply another test of the proportional hazards assumption) (UCLA, 2014). This was done to further test the proportional hazards assumption. An interaction term for child disclosure by time was created and this variable was included in a new model. The influence of this new time by child disclosure interaction term was not significant in both the first drink and first drunk

models, suggesting perhaps that this predictor does not violate the proportional hazards assumption.

Figure 10. Checking the Proportional Hazards Assumption



CHAPTER 5

DISCUSSION

This study sought to prospectively test an integrated model of risk, promotive, and protective influences on the acquisition of key drinking milestones among adolescents, an etiologically important population. Using a step-wise survival analysis approach, we assessed the effect of covariates on the probability of acquiring alcohol use milestones across time.

While each of the risk and promotive factors we examined were significantly associated with the three drinking milestones in univariate survival analyses, study hypotheses were only partially supported when all risk and promotive factors were examined simultaneously. In the integrated model, gender was significantly associated with each outcome, such that girls were more likely to report milestones of first drink, first HED, and first drunk. As hypothesized, peer influences and impulsive personality traits acted as risk factors, but not consistently across each of the milestones or all predictors. Peer approval for drinking was only influential on the risk of alcohol use initiation, while peer approval for drunkenness was not predictive of any milestones in the integrated model. Sensation seeking was a significant predictor of the HED milestone while positive and negative urgency were not associated with any milestones in the integrated model. Also consistent with our hypotheses, aspects of parental monitoring and RALD acted as consistent promotive factors associated with reduced hazard rates for milestone attainment. The subscale of child disclosure significantly reduced the probability of alcohol use initiation, first HED and first

drunk. The RALD facet of upbringing also decreased the risk for acquiring any of the drinking milestones. However, parental solicitation, parental control, and performance/self control RALD did not have a significant influence in these models when all other predictors were included. In an attempt to extend prior research indicating protective effects of parental involvement on peer (Wood et al., 2004; Fairlie et al., 2012) and personality (Wood et al., 2013) associations with alcohol outcomes, we also examined whether aspects of parental monitoring would moderate peer and personality influences in an early adolescent sample. Overall, we observed little evidence in support of these protective effects. There was a significant interaction effect of child disclosure on the peer influences - first drunk milestone, such that child disclosure was associated with a lower probability of attaining the first drunk milestone but only when peer attitudes toward drunkenness were less favorable. This interaction effect was not observed on other milestones, nor did other interaction effects emerge.

The influence of child disclosure and upbringing RALD were most salient in this study. Child disclosure was a consistent significant facet of monitoring and consistent with prior research (Kafka, 1991; Mares et al., 2011) parent-child communication through the child's own disclosure to parents reduced the probability of alcohol use initiation and the initiation of HED and getting drunk for the first time. Taken together it's important to note that the monitoring behavior directly controlled by parents, that is attempts to solicit information, set rules about where an adolescent goes and what they do, was not significant, but that a child's willingness to disclose information about their lives was. Adolescent's disclosure of information has been

found to be the primary source of parent's knowledge of their children's behavior (Crouter, Bumpus, Davis, & McHale, 2005; Waizenhofer, Buchanan, & Jackson-Newsom, 2004) and has been shown to relate to later risky behavior (Crouter et al., 2005) and to attenuate peer influences on adolescent delinquent behavior (Laird, Criss, Pettit, Dodge, & Bates, 2008). This would suggest that parents need to focus on strategies for improving open communication with their children, not simply trying to control what they do or attempt to compel their children to disclose information.

Prior research has not been clear about the impact of adolescent's reported RALD and whether it is a predictor associated with decreased use, or something that loses potency very quickly as youth age. Cross sectional results have suggested an influence of RALD on future drinking (Anderson et al., 2011; 2013; Beckman et al., 2011), yet prospective results have not (Anderson et al., 2013). This prospective study found that upbringing RALD decreases the probability of alcohol use initiation, engaging in HED for the first time, and getting drunk the first time. These are important results for identifying RALD's influence on adolescent substance use, especially as they are found after controlling for multiple predictors, something Anderson et al did not find when RALD was modeled together with other predictors (2013). It is interesting to note that upbringing RALD was only moderately correlated with parental monitoring factors, suggesting perhaps that this is a unique promotive influence, not something dependent upon parent-child relationships.

Alcohol use rates of the adolescents in this sample were lower than national averages (Johnston et al, 2012a). This sample reported a low mean score on risk factors and a substantially high report of promotive influences. Taken together the

low report of risk factors, the high report of promotive factors, and the low rates of alcohol use suggest this sample might be accurately characterized as a low risk sample for alcohol use. Accordingly, our findings should be considered in this context.

Nonetheless, there was an increasing trend of outcome proportions among this sample over time, similar to national data with adolescents increasing in alcohol use as they get older (Johnston et al., 2012a). The milestone with the highest reported endorsement was alcohol use initiation and compared to first HED and first drunk this milestone was also reported at the youngest age overall. In this sample 25 percent of all 14 year olds have had a full drink, a rate which steadily increased each subsequent year. An early age of onset for drinking (14 years old) strongly predicts subsequent problematic alcohol and other drug use (Blomeyer et al., 2011; Brook et al., 2010; Heron et al., 2011; Labouvie et al., 1997), and alcohol use disorders in adolescence and adulthood (Grant & Dawson, 1997; Hingson, Heeren, & Winter, 2006; Mason & Spoth, 2012). While this sample is still relatively young, follow up assessments are being conducted to assess whether regular drinking habits and more severe drinking patterns are being formed as well as whether adolescents experience more negative consequences associated with alcohol use as they get older.

Similar to national data, girls reported higher milestone frequency at younger ages (Johnston et al., 2012: SAMHSA, 2011abc), but contrary to national data were also higher than boys at later ages. It was surprising to find that White and Hispanic adolescents drank the least compared to all other ethnic groups in this sample. This is also contrary to typical adolescent health data reporting alcohol use among minority youth (SAMHSA, 2011), which could be an artifact of the potentially low risk sample

of this study. Additionally, Jackson found that boys and whites engaged in earlier drinking whereas girls initiated later, but telescoped, or increased more rapidly to catch up (2010). Telescoping was not assessed in this study, but it is interesting that girls were higher in milestones reported compared to boys at all ages in this sample.

Positive and negative trait urgency have been shown to relate to substance use (Gunn and Smith, 2010; Stautz and Cooper, 2013a). These findings were replicated in the univariate survival analysis models, but did not extend to models examining grouped effects, or the integrated model. Friends' alcohol use during adolescence is associated with young people's alcohol use and abuse (Visser, et al., 2013; Windle et al., 2008), but results from this study are mixed. Again, peer influences were consistent predictors of milestones in the univariate survival analyses models and peer attitudes toward drinking were consistent predictors in the grouped effects models. However, when considered with all other factors peer influences on drinking impacted the probability of initiation, but were not significant on the subsequent milestones, HED and getting drunk. Consistent with prior research this study showed parental monitoring to be negatively associated with alcohol use initiation and the development of later, more problematic alcohol use milestones (Barnes, Reifman, Farrell, and Dintcheff, 2000; Ryan, Jorm, & Lubman, 2010). Our findings suggest that child disclosure may be the most significant facet of monitoring, which is consistent with research reporting that communication between adolescents and parents is related to less drinking and less future problems (Kafka, 1991; Mares et al., 2011). The influence of child disclosure in this study also reduced the probability of alcohol use initiation and the initiation of HED and getting drunk for the first time.

Environmental and contextual influences are important, but were not investigated in this study. Transition into an environment with more prevalent alcohol use, such as entering high school, has been associated with increased prevalence of current drinking (Jackson & Schulenberg, 2013). Also, Cyders and Smith (2008) proposed that, for most people, drinking is more likely to occur on days of celebration and to be related to positive affect situations such as drinking at a party or with friends, contexts prevalent for adolescents. As adolescents are underage and cannot legally purchase liquor their availability to alcohol is limited, with typical access through parents' stocks, older siblings or friends, and most prominently through parties (Friese, Grube, Seninger, Paschall, & Moore, 2011; Wagenaar et al., 1993). These contexts and their influence cannot be ignored. While not included in this study future investigations may consider the impact of the situational influences.

Strengths and Weaknesses

This study sought to test a model focusing more on resilience as opposed to exclusively focusing on risk by considering purported promotive and protective effects in conjunction with risk factors. By combining resilience and risk factors and controlling for the influence of several predictors together this approach offers a more comprehensive view of adolescent substance use. Survival analyses utilized for this model are particular capable of handling longitudinal data. Survival analysis offers robust modeling by analyzing the probability of event occurrence over time in a multivariate framework, considering how multiple predictors impact the probability of event occurrences. This method is ideally suited for addressing the questions of this study. The study design and sample size provided substantial prospective data via a

large cohort sequential study comprised exclusively of adolescents, a population of great interest. This study over sampled for minority students compared to school demographics from which participants were drawn. While not entirely representative of racial/ethnic groups nationally, minority students were included in sufficient numbers to enable their examination, yielding unanticipated patterns of effects, which warrant replication in future research with heterogeneous samples. More work among adolescents and adolescent minorities is needed to understand what behaviors are typical among these young people. For example, which factors result in problematic outcomes and which factors helps promote health outcomes in the future. This study adds insight in answering these questions and directing future research among these groups.

Survival analyses assume temporal ordering of the predictors, that they are measured prior to an event. With the cohort design of the current study there were 69 adolescents who reported milestone attainment prior to their baseline assessment, when they were measured on all predictors. An ideal design would enroll these students at younger ages, prior to any substance use, and measure predictor scores from baseline through subsequent assessment period. However, in results reported earlier the early initiators in our sample did not significantly differ in baseline covariate values from the rest those who did initiate post baseline, therefore the earlier initiators were retained for analyses (B. Stout, personal communication, April 24, 2014).

Future Directions

With twenty-five percent of the sample having their first full drink by the time they are 14 following this sample over time will be important to determine when and for whom regular use occurs and to examine the progression to more severe use, , or associated negative consequence, and alcohol use disorder. Additionally a more integrative model with risk, promotive, and protective effects on the development of more problematic use is consistent with the known complex etiology of alcohol use and misuse. Follow up with conducting survival analyses on the development of future drinking patterns and whether age of initiation or age of the HED and drunk milestones is related to future outcomes would help inform this understanding.

From a public health perspective, if early age of initiation is a causal risk factor for later development of substance use disorders (SUDs), one straightforward implication would be that delaying the onset of substance use could result in a reduction in the number of persons who eventually develop SUDs. If the alternative hypothesis is correct, that is, that age of initiation is a non-causal risk factor, this would imply that prevention programs may need to broadly target a range of problematic adolescent behaviors, including antisocial behaviors, to reduce the development of SUD. Future work to elucidate these considerations is needed among adolescents.

Hollenstein and Lougheed (2013) suggest that age may not be a suitable proxy for equating adolescents in terms of functional maturity. If the onset of alcohol use and the development of drinking milestones are significantly related to stages of adolescent development then the way developmentally different periods are defined

among this population may be more substantial than simply looking at their initiation by age. This may include assessing substance use in relation to affect regulation for example. There is a great deal of between-person variability in adolescent development (Steinberg, 2008) and this variability may be important when considering the ability of an adolescent to regulate impulsive behaviors. Regulatory compensation is more mature in adolescence than in preadolescence (Hollenstein, & Lougheed, 2013), and during adolescence the cognitive control network matures so that by adulthood risk-taking can be modulated (Steinberg, 2008). Perhaps what is most important then are not levels of impulsivity, but modulation ability, or temperament regulation. These regulatory behaviors are not fixed, but develop, and may be more salient in understanding risk-taking behaviors than "fixed traits" are. Future studies might include affect regulation to determine the impact it has on adolescent alcohol use initiation.

This study utilized baseline covariate values when considering event time in the survival analyses. Survival analyses need not be limited to time-invariant effects, but can also model the effect of time-varying covariates (Singer & Willett, 2003). Further investigation looking at time varying effects of these covariates may reveal different effects on the event probability. For example, MacPherson, et al. found that not only were initial levels in sensation seeking related to alcohol use, but that increases were related to a greater odds of future use (2010). Thus, future studies could extend current knowledge by examining time-varying effects of these covariates.

Results suggest that gender, child disclosure, and RALD are most influential on the attainment of alcohol use milestones when considered in a larger model of risk, promotive, and protective influences. These results help clarify salient criteria after controlling for the influence of multiple variables in one model. The impact of child disclosure in reducing the probability of alcohol use initiation over time is important and merits intervention strategies focusing on parent-child communication. Additionally, RALD, particularly reasons associated with upbringing, might also be important to emphasize in children and young adults to delay or prevent alcohol use. Even if strategies do not prevent initiation simply delaying alcohol use onset may impact future positive health outcomes. Focusing on parent-child communication and the strengthening of RALD in early adolescence or pre-adolescence may support such delay.

Clearly not every adolescent who drinks develops heavy use and experiences problems. A large group of adolescents abstain, are light drinkers, or are very rarely heavy drinkers (Brown, et al., 2008). It has been noted that it is normative for adolescents to drink (Masten et al., 2008), and epidemiologic data clearly indicate that a substantial proportion of adolescents report drunkenness and a heavy drinking episode at some point before they turn twenty one (Johnston et al., 2012b). However, as reviewed earlier, alcohol use is associated with future use and problems. While a large group of adolescents do not drink, there are enough that do to cause concern. Focusing on the group of adolescents including abstainers and very light drinkers is beneficial for identifying promotive and protective factors to minimize initiation and future alcohol use. A greater focus on prevention rather than treatment could reduce

future drinking rates and associated problems. It is therefore important to identify risk factors influencing initiation and attaining drinking milestones and together with promotive and protective factors identify salient factors to develop strategies to bolster promotive and protective influences that could eliminate alcohol use outcomes. This might be done with preventive interventions among adolescents and even among adolescent-parent dyads.

APPENDIX A

MEASURES

Impulsivity

UPPS+P Impulsive Behavior Scale

A set of 18 items assessing three personality pathways to impulsive behavior: negative urgency, positive urgency and sensation seeking. The items were preceded by the prompt, "For each statement, please indicate how much you agree or disagree with the statement." Although response options in the survey itself ranged from agree strongly (1) to disagree strongly (4), items were reverse-scored so that a high score indicated high sensation seeking.

The items were taken from the UPPS+P Impulsive Behavior Scale (Lynam, Smith, Whiteside & Cyders, 2006), a 59-item measure that assesses 5 personality pathways to impulsive behavior. Though the UPPS+P also includes (lack of) perseverance and (lack of) premeditation scales, we selected 6 items from each of the following scales: **negative urgency** (#1, 4, 6, 9, 12, 15), **positive urgency** (#7, 10, 14, 16, 17, 18) and **sensation seeking** (#2, 3, 5, 8, 11, 13). Negative urgency is the tendency to act impulsively under conditions of negative affect, while positive urgency is the tendency to act rashly in response to high positive affect (Cyders, Smith, Spillane, Fischer, Annus, & Peterson, 2007). Sensation seeking is interest in and tendency to pursue activities that are exciting and novel (Cyders et al., 2007).

The UPPS+P is the most recent iteration of the UPPS, which was originally developed by Whiteside & Lynam (2001), and included only four factors; the UPPS+P adds the positive urgency factor to the measure. The UPPS was developed with a college student sample as an attempt to unify disparate scholarly findings about impulsivity by identifying and separating distinct personality facets related to the trait – conceptualized not as variations of impulsivity, but rather discrete psychological processes that lead to impulsive-like behaviors.

In a study comparing UPPS scores of alcohol abusers with a control sample, negative urgency was greater in people with alcohol abuse (Whiteside & Lynam, 2003). Scores on the sensation seeking, perseveration and premeditation scales were higher than controls in a subgroup of alcohol abusers with antisocial personality traits, but not alcohol abusers without these traits (Whiteside & Lynam, 2003). Cyders et al. (2007) found that positive urgency was related to frequency of drinking and problem drinking in college students (*r*'s ranging from .24 to .43), through expectancies of positive mood enhancement, positive arousal, and negative arousal.

We changed the wording of three items: #6 (the original version read "I **will** often say"), #10 (the original read "things that **can** have bad consequences") and #17 (the original read "I feel like it is ok to give **in to** cravings or **overindulge**"). After making these adjustments, we made no additional changes to the questionnaire during the course of the study.

The questionnaire was administered yearly – at wave 1, wave 3, etc.

Item	Wave 1 (BL)	Wave 3	Wave 5
1. I often get involved in things I later wish I could get out of.	t1upps1	t3upps1	t5upps1
2. I quite enjoy taking risks.	t1upps2	t3upps2	t5upps2
3. I would enjoy parachute jumping.	t1upps3	t3upps3	t5upps3
4. When I am upset I often act without thinking.	t1upps4	t3upps4	t5upps4
5. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	t1upps5	t3upps5	t5upps5
6. When I feel rejected, I often say things that I later regret.	t1upps6	t3upps6	t5upps6
7. Others are shocked or worried about the things I do when I am feeling very excited.	t1upps7	t3upps7	t5upps7
8. I would like to learn to fly an airplane.	t1upps8	t3upps8	t5upps8
9. It is hard for me to resist acting on my feelings.	t1upps9	t3upps9	t5upps9
10. When I get really happy about something, I tend to do things that could have bad consequences.	t1upps10	t3upps10	t5upps10
11. I sometimes like doing things that are a bit frightening.	t1upps11	t3upps11	t5upps11
12. I often make matters worse because I act without thinking when I am upset.	t1upps12	t3upps12	t5upps12
13. I would enjoy the sensation of skiing very fast down a high mountain slope.	t1upps13	t3upps13	t5upps13
14. When I am really excited, I tend not to think of the consequences of my actions.	t1upps14	t3upps14	t5upps14
15. In the heat of an argument, I will often say things that I later regret.	t1upps15	t3upps15	t5upps15
16. When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.	t1upps16	t3upps16	t5upps16
17. When I am very happy, I feel like it is ok to give into cravings or overdo it.	t1upps17	t3upps17	t5upps17
18. I am surprised at the things I do while in a great mood.	t1upps18	t3upps18	t5upps18
Negative Urgency (mean)	t1upps_nu	t3upps_nu	t5upps_nu
Positive Urgency (mean)	t1upps_pu	t3upps_pu	t5upps_pu
Sensation Seeking (mean)	t1upps_ss	t3upps_ss	t5upps_ss

References

Cyders, M. A., Smith, G. T., Spillane, N. S., Fischer, S., Annus, A. M. & Peterson, C. (2007). Integration of impulsivity and positive mood to predict risky behavior: Development and validation of a measure of positive urgency. *Psychological Assessment, 19*, 107-118.

Lynam, D.R., Smith, G.T., Whiteside, S.P., & Cyders, M.A. (2006). *The UPPS-P: Assessing five personality pathways to impulsive behavior* (Technical Report). West Lafayette: Purdue University. Downloaded from http://www1.psych.purdue.edu/~dlynam/uppspage.htm, June 2009.

Whiteside, S.P. & Lynam, D.R. (2001). The Five Factor Model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*, 669-689.

Whiteside, S.P. & Lynam, D.R. (2003). Understanding the role of impulsivity and externalizing psychopathology in alcohol abuse: Application of the UPPS Impulsive Behavior Scale. *Experimental and Clinical Psychopharmacology*, *11*, 210-217.

Scoring

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************************************************************
UPPS - MR emailed code 7/20/11
************************************************************;
*3 sub-scales:
negative urgency: mean of 1,4,6,9,12,15
positive urgency: mean of 7,10,14,16,17,18
sensation seeking: mean of 2,3,5,8,11,13
;

*reverse-code all items;
array upps1{18} &T.UPPS1-&T.UPPS18;
array upps2{18} &T.UPPSr1-&T.UPPSr18;

do i=1 to 18;
 upps2{i}=5-upps1{i};
end;

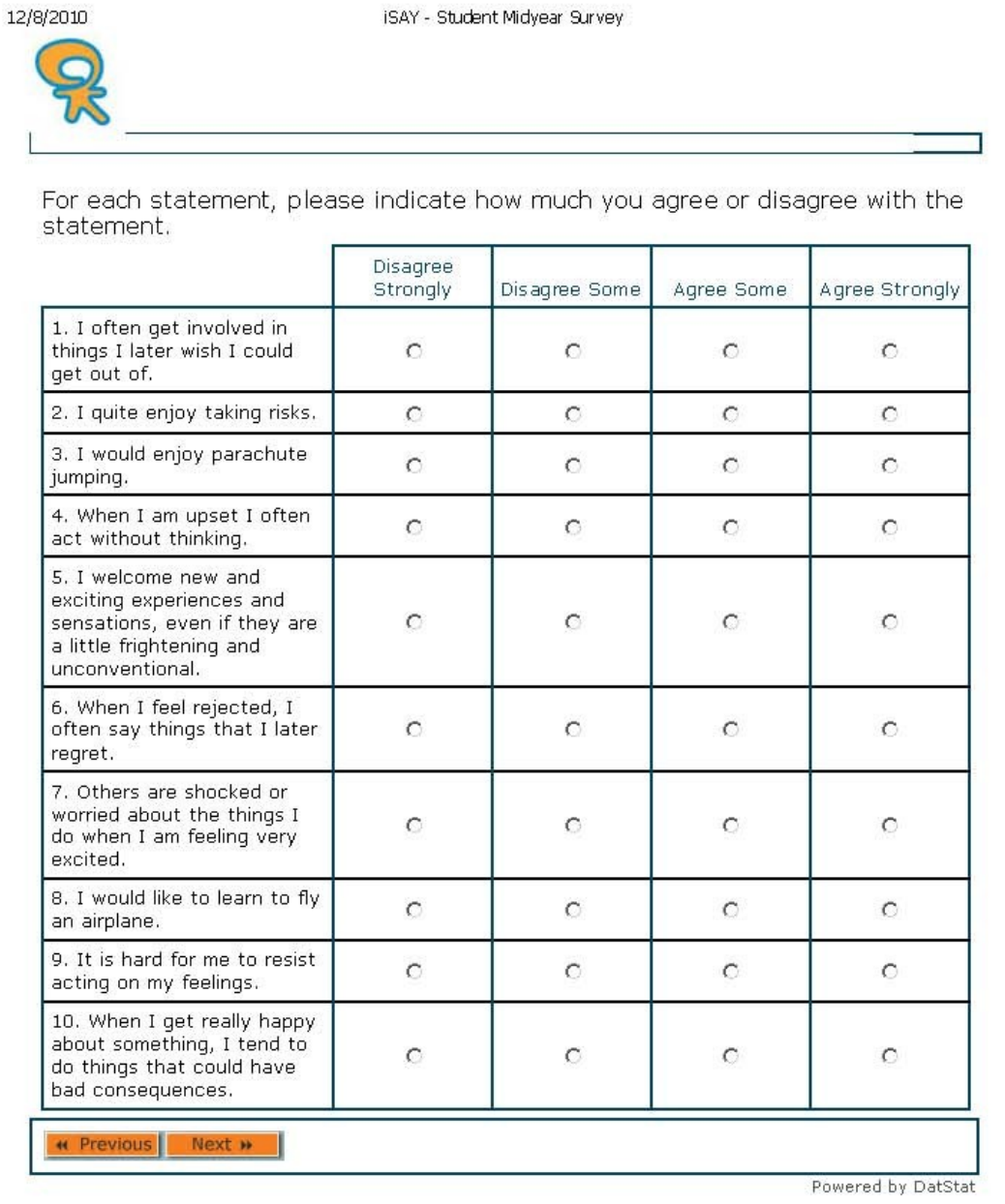
format &T.UPPSr1-&T.UPPSr18 upps.;

&T.UPPS_NU=mean(of
&T.UPPSr1,&T.UPPSr4,&T.UPPSr6,&T.UPPSr9,&T.UPPSr12,&T.UPPSr15);
&T.UPPS_PU=mean(of
&T.UPPSr7,&T.UPPSr10,&T.UPPSr14,&T.UPPSr16,&T.UPPSr17,&T.UPPSr18);
&T.UPPS_SS=mean(of
&T.UPPSr2,&T.UPPSr3,&T.UPPSr5,&T.UPPSr8,&T.UPPSr11,&T.UPPSr13);

label
&T.UPPS_NU='UPPS: Negative Urgency (mean)'
&T.UPPS_PU='UPPS: Positive Urgency (mean)'
```

```
&T.UPPS_SS='UPPS: Sensation Seeking (mean)'
;
```

Current version. *These print screens are taken from the Cohort 1 Wave 3 survey, but are valid for all cohorts and waves.*



12/8/2010 iSAY - Student Midyear Survey

For each statement, please indicate how much you agree or disagree with the statement.

	Disagree Strongly	Disagree Some	Agree Some	Agree Strongly
1. I often get involved in things I later wish I could get out of.	○	○	○	○
2. I quite enjoy taking risks.	○	○	○	○
3. I would enjoy parachute jumping.	○	○	○	○
4. When I am upset I often act without thinking.	○	○	○	○
5. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	○	○	○	○
6. When I feel rejected, I often say things that I later regret.	○	○	○	○
7. Others are shocked or worried about the things I do when I am feeling very excited.	○	○	○	○
8. I would like to learn to fly an airplane.	○	○	○	○
9. It is hard for me to resist acting on my feelings.	○	○	○	○
10. When I get really happy about something, I tend to do things that could have bad consequences.	○	○	○	○

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...brown.edu/Collector/Survey.ashx 1/1

For each statement, please indicate how much you agree or disagree with the statement.

	Disagree Strongly	Disagree Some	Agree Some	Agree Strongly
11. I sometimes like doing things that are a bit frightening.	○	○	○	○
12. I often make matters worse because I act without thinking when I am upset.	○	○	○	○
13. I would enjoy the sensation of skiing very fast down a high mountain slope.	○	○	○	○
14. When I am really excited, I tend not to think of the consequences of my actions.	○	○	○	○
15. In the heat of an argument, I will often say things that I later regret.	○	○	○	○
16. When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.	○	○	○	○
17. When I am very happy, I feel like it is ok to give into cravings or overdo it.	○	○	○	○
18. I am surprised at the things I do while in a great mood.	○	○	○	○

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Peer Influences

Peer passive social influence

A set of 3 items assessing passive peer social influence through social modeling. The first two questions assess close friends' opinions about drinking and getting drunk, while the third question asks about friends' drinking behavior. Response options for the first two questions ranged from Strongly Disapprove (0) to Strongly Approve (4). Response options for the third question ranged from "They don't drink" (0) to "More than 3 drinks" (4).

The measure was taken from Wood, Read, Mitchell & Brand (2004), who adapted the items from measures created by Jessor, Jessor & Donavan (1981). In a college student sample, social modeling (assessed with an extended, 6-item questionnaire) was found to have a larger effect on alcohol use than perceived norms or alcohol offers (Wood, Read, Palfai, & Stevenson, 2001). The current questionnaire was found to be internally reliable (alpha = .89) and to be strongly predictive of heavy episodic drinking and negative alcohol-related consequences in a college student sample (Wood et al., 2004).

Because Wood's measure was developed for college students, we adapted the items to make them more easily understood by our younger participants. We added the phrase "kids your age" to clarify #1 and #2 ("How do most of your close friends feel about drinking?", "How do most of your close friends feel about getting drunk?"). We also added the word "alcohol" to #1 to make it explicit that we were asking about drinking alcohol. In addition, we added the phrase "at a sitting" to #3 to clarify the time period implied in the question.

The questionnaire was administered every 6 months except between Waves 5+6 where there was a 12 month lapse.

Item	Wave 1 (BL)	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
How do most of your close friends feel about kids your age drinking alcohol?	t1psi1	t2psi1	t3psi1	t4psi1	t5psi1	t6psi1
How do most of your close friends feel about kids your age getting drunk?	t1psi2	t2psi2	t3psi2	t4psi2	t5psi2	t6psi2
When your close friends drink, how much (on average) does each person drink at a sitting?	t1psi3	t2psi3	t3psi3	t4psi3	t5psi3	t6psi3
Peer Passive Social Influence (sum of #1 & #2)	t1psi	t2psi	t3psi	t4psi	t5psi	t6psi

References

Jessor, R., Jessor, S. L., & Donovan, J. E. (1981). *Young adult follow-up study.* Boulder: University of Colorado, Institute of Behavioral Science.

Wood, M.D., Read, J. P., Mitchell, R.E. & Brand, N.H. (2004). Do parents still matter? Parent and peer influences on alcohol involvement among recent high school graduates. *Psychology of Addictive Behaviors*, *18*, 19- 30.

Wood, M.D., Read, J.P., Palfai, T.P., & Stevenson, J. F. (2001). Social influence processes and college student drinking: The mediational role of alcohol outcome expectancies. *Journal of Studies on Alcohol, 62*, 32-43.

Scoring

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************************************************************
Peer Passive Social Influence – MR emailed code 3/23/11
************************************************************;
/*
T1PSI1, T1PSI2
sum score of items 1 and 2 (range of 0-8)
T1PSI
per KJ, do not incl item 3 since it has diff. response options
*/

&T.PSI=sum(of &T.PSI1, &T.PSI2);
label &T.PSI="PSI: Sum of Items 1 and 2";
```

Current version. This print screen is from the C3 baseline (T1 assessment). No changes have been made at any time during the study.

	Strongly Disapprove	Disapprove	Neither Approve Nor Disapprove	Approve	Strongly Approve
How do most of your close friends feel about kids your age drinking alcohol?	○	○	○	○	○
How do most of your close friends feel about kids your age getting drunk?	○	○	○	○	○

	They don't drink	1 drink	2 drinks	3 drinks	More than 3 drinks
When your close friends drink, how much (on average) does each person drink at a sitting?	○	○	○	○	○

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Parental Monitoring

Sources of parental knowledge

A set of 15 items, administered to children, assessing parental knowledge with 3 subscales: child disclosure, parental solicitation, and parental control. Response options ranged from "No, never (0%)" [1] to "Yes, always (100%)" [5].

The scale was taken from Kerr & Stattin (2000). Kerr & Stattin developed it with 14-year-olds living in a mid-sized Swedish city. They found that child disclosure was better related to child adjustment than parental monitoring through "tracking and surveillance" (parental control, parental solicitation) (Kerr & Stattin, 2000; Stattin & Kerr, 2000).

We simplified the wording of several items; "require that" and "require you to" in #3, 4 & 5 of the Parental Control Scale was changed to "make" and "make you". "Initiate" in #4 of the Parental Solicitation Scale was changed to "start". In addition, we changed "out in the city" in #5 of the Parental Solicitation Scale to "at the mall" to make it more broadly applicable to adolescents in rural, suburban and urban environments.

The questionnaire was administered yearly – at waves 1, 3, 5, and 6

Item	Wave 1 (BL)	Wave 3	Wave 5	Wave 6
Child Disclosure				
1. Do you talk at home about how you are doing in the different subjects in school?	t1parcd1	t3parcd1	t5parcd1	t6parcd1
2. Do you usually tell how school was when you get home (how you did on different exams, your relationships with teachers, etc.)?	t1parcd2	t3parcd2	t5parcd2	t6parcd2
3. Do you keep a lot of secrets from your parents about what you do during your free time?	t1parcd3	t3parcd3	t5parcd3	t6parcd3
4. Do you hide a lot from your parents about what you do during nights and weekends?	t1parcd4	t3parcd4	t5parcd4	t6parcd4
5. If you are out at night, when you get home, do you tell what you have done that evening?	t1parcd5	t3parcd5	t5parcd5	t6parcd5
Parental Control				

1. Do you need to have your parents' permission to stay out late on a weekday evening?	t1parpc1	t3parpc1	t5parpc1	t6parpc1
2. Do you need to ask your parents before you can decide with your friends what you will do on a Saturday evening?	t1parpc2	t3parpc2	t5parpc2	t6parpc2
3. If you have been out very late one night, do your parents make you explain what you did and whom you were with?	t1parpc3	t3parpc3	t5parpc3	t6parpc3
4. Do your parents always make you tell them where you are at night, who you are with, and what you do together?	t1parpc4	t3parpc4	t5parpc4	t6parpc4
5a. Before you go out on a Saturday night, do your parents make tell them where you are going and with whom? ***C1, W1 ONLY***	t1parpc5	--	--	--
5b. Before you go out on a	t1parpc5	t3parpc5	t5parpc5	t6parpc5

Saturday night, do your parents make you tell them where you are going and with whom?				
Parental Solicitation				
1. In the last month, have your parents talked with the parents of your friends?	t1parps1	t3parps1	t5parps1	t6parps1
2. How often do your parents talk with your friends when they come to your home (ask what they do or what they think and feel about different things)?	t1parps2	t3parps2	t5parps2	t6parps2
3. During the past month, how often have your parents started a conversation with you about your free time?	t1parps3*	t3parps3	t5parps3	t6parps3
4. How often do your parents start a conversation about things that happened during a normal day at school?	t1parps4	t3parps4	t5parps4	t6parps4
5. Do your parents usually ask you to talk about things	t1parps5	t3parps5	t5parps5	t6parps5

that happened during your free time (whom you met while you were at the mall, free time activities, etc.)?				
Child Disclosure (Mean)	t1mparknow_cd	t3mparknow_cd	t5mparknow_cd	t6mparknow_cd
Parental Control (Mean)	t1mparknow_pc	t3mparknow_pc	t5mparknow_pc	t6mparknow_pc
Parental Solicitation (Mean)	t1mparknow_ps	t3mparknow_ps	t5mparknow_ps	t6mparknow_ps
** t1parps3 was not administered to Cohort 1 due to an illume (software) error.*				

References

Kerr, M. & Stattin, H. (2000). What Parents Know, How They Know It, and Several Forms of Adolescent Adjustment: Further Support for a Reinterpretation of Monitoring. *Developmental Psychology*, 36, 366-380.

Stattin, H. & Kerr, M. (2000). Parental Monitoring: A Reinterpretation. *Child Development*, 71, 1072-1085.

Note: Items 3 and 5 for Parental Control and Item 5 for Child Disclosure had a "Not Applicable" option for the parent survey. These were set to null (system missing) and then the average all items was calculated for each subscale. In both the parent and teen files, an alternate subscale was created that took the mean of only items 1, 2, and 4 for Parental Control, and items 1-4 for Child Disclosure.

Scoring

****
Parental Knowledge (MR emailed code 1/21/2011)

updated by MLR on 10.03.12
**********;
****
Parental Knowledge
**********;
*three scales;
*raw items:
Child Disclosure: &T.PARCD1-&T.PARCD5
Parental Control: &T.PARPC1-&T.PARPC5
Parental Solicitation: &T.PARPS1-&T.PARPS5;

*10.03.12: create new scales for CD and PC to match the parent versions
(CD5, PC3, and PC5 had a N/A option, so KJ has requested a second version of the scales excluding these items);

*reverse-code PARCD3 & 4;
array parcd{*} &T.PARCD3 &T.PARCD4;
array parcdr{*} &T.PARCDR3-&T.PARCDR4;
do i=1 to dim(parcd);
 parcdr{i}=6-parcd{i}; *recode from 1-5 into 5-1;
end;
drop i;

*if have 4 of 5 items;
misscd=nmiss(of &T.PARCD1-&T.PARCD5);
misspc=nmiss(of &T.PARPC1-&T.PARPC5);
missps=nmiss(of &T.PARPS1-&T.PARPS5);

if misscd le 1 then do;
 &T.MPARKNOW_CD=mean(of &T.PARCD1, &T.PARCD2, &T.PARCDR3, &T.PARCDR4, &T.PARCD5);
end;

```
drop misscd;
if misspc le 1 then do;
 &T.MPARKNOW_PC=mean(of &T.PARPC1-&T.PARPC5);
end;
drop misspc;
if missps le 1 then do;
 &T.MPARKNOW_PS=mean(of &T.PARPS1-&T.PARPS5);
end;
drop missps;

&T.MPARKNOW_CD_alt=mean(of &T.PARCD1, &T.PARCD2, &T.PARCDR3,
&T.PARCDR4);
&T.MPARKNOW_PC_alt=mean(of &T.PARPC1, &T.PARPC2, &T.PARPC4);

label
&T.MPARKNOW_CD='PARENTAL KNOWLEDGE - Child Disclosure (mean score)'
&T.MPARKNOW_PC='PARENTAL KNOWLEDGE - Parental Control (mean score)'
&T.MPARKNOW_PS='PARENTAL KNOWLEDGE - Parental Solicitation (mean
score)'
&T.MPARKNOW_CD_alt='PARENTAL KNOWLEDGE - Child Disclosure (mean
score) - items 1-4 only'
&T.MPARKNOW_PC_alt='PARENTAL KNOWLEDGE - Parental Control (mean
score) - items 1,2,4 only'
;

**********************************************************************
********
NOTE: PARENTAL SOLICITATION SCALE IS BASED ON ONLY FOUR ITEMS RIGHT
NOW --
PARPS3 IS NOT ON THE FILE THAT CHERYL PREPARED.
SENT EMAIL ON 07.29.10 TO ALERT HER.
FROM CHERYL: that's right, there is no data for that variable for
cohort 1.
             i believe there was a mistake in the illume program. it
was
             corrected for cohort 2.
**********************************************************************
*******;
```

Current version. *These print screens taken from Cohort 3 Wave 1. The wording is the same across all cohorts and all waves, except #5 of the parental control scale, which is different for Cohort 1 Wave 1 only.*

Please select one response for each statement.

	No, never (0%)	Some of the time (25%)	About half the time (50%)	More than half, but not always (75%)	Yes, always (100%)
1. Do you talk at home about how you are doing in the different subjects in school?	○	○	○	○	○
2. Do you usually tell how school was when you get home (how you did on different exams, your relationships with teachers, etc.)?	○	○	○	○	○
3. Do you keep a lot of secrets from your parents about what you do during your free time?	○	○	○	○	○
4. Do you hide a lot from your parents about what you do during nights and weekends?	○	○	○	○	○
5. If you are out at night, when you get home, do you tell what you have done that evening?	○	○	○	○	○

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Please select one response for each statement.

	No, never (0%)	Some of the time (25%)	About half the time (50%)	More than half, but not always (75%)	Yes, always (100%)
1. Do you need to have your parents' permission to stay out late on a weekday evening?	○	○	○	○	○
2. Do you need to ask your parents before you can decide with your friends what you will do on a Saturday evening?	○	○	○	○	○
3. If you have been out very late one night, do your parents make you explain what you did and whom you were with?	○	○	○	○	○
4. Do your parents always make you tell them where you are at night, who you are with, and what you do together?	○	○	○	○	○
5. Before you go out on a Saturday night, do your parents make you tell them where you are going and with whom?	○	○	○	○	○

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Please select one response for each statement.

	No, never (0%)	Some of the time (25%)	About half the time (50%)	More than half, but not always (75%)	Yes, always (100%)
1. In the last month, have your parents talked with the parents of your friends?	○	○	○	○	○
2. How often do your parents talk with your friends when they come to your home (ask what they do or what they think and feel about different things)?	○	○	○	○	○
3. During the past month, how often have your parents started a conversation with you about your free time?	○	○	○	○	○
4. How often do your parents start a conversation about things that happened during a normal day at school?	○	○	○	○	○
5. Do your parents usually ask you to talk about things that happened during your free time (whom you met while you were at the mall, free time activities, etc.)?	○	○	○	○	○

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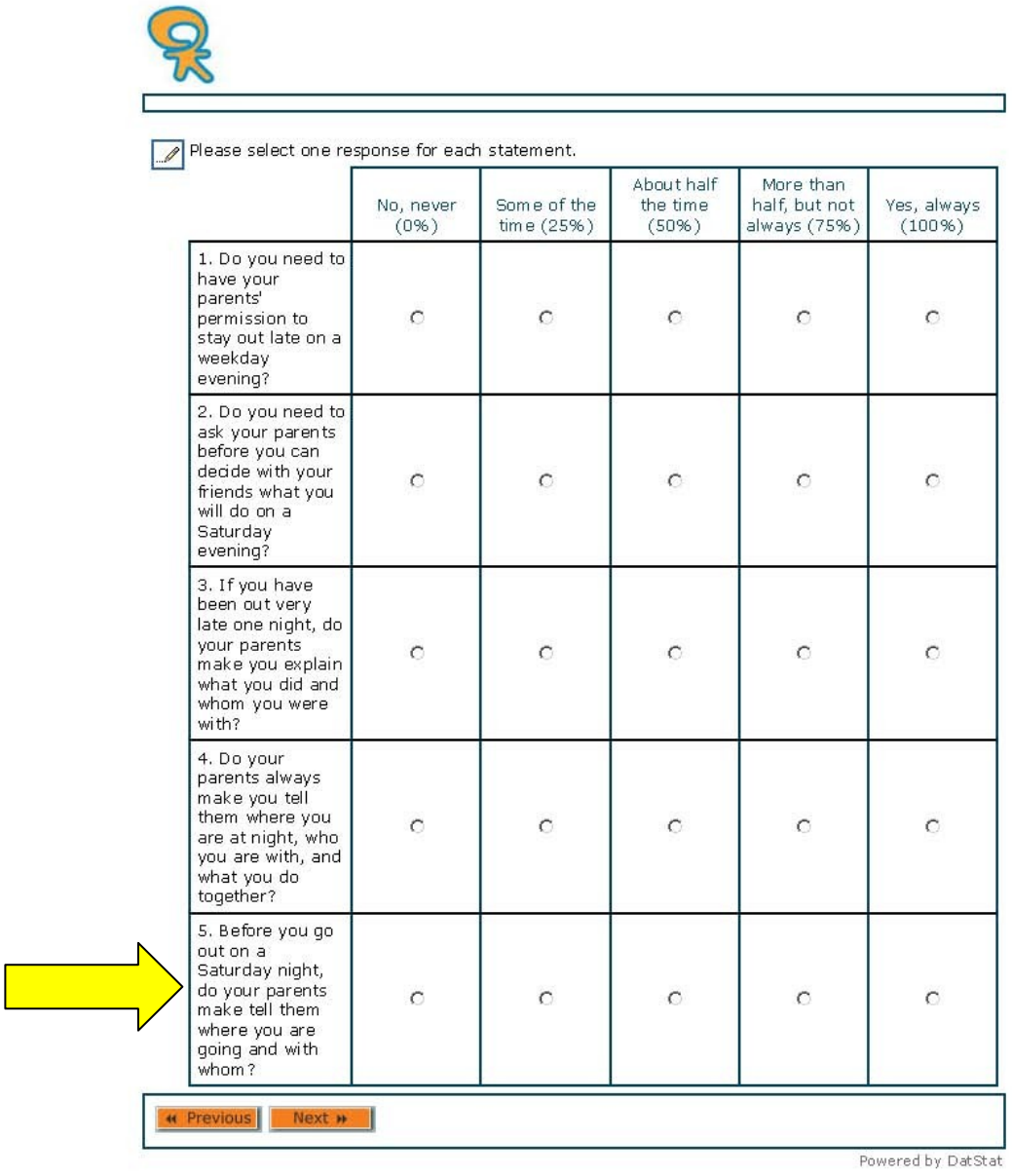

Please select one response for each statement.

	No, never (0%)	Some of the time (25%)	About half the time (50%)	More than half, but not always (75%)	Yes, always (100%)
1. Do you need to have your parents' permission to stay out late on a weekday evening?	○	○	○	○	○
2. Do you need to ask your parents before you can decide with your friends what you will do on a Saturday evening?	○	○	○	○	○
3. If you have been out very late one night, do your parents make you explain what you did and whom you were with?	○	○	○	○	○
4. Do your parents always make you tell them where you are at night, who you are with, and what you do together?	○	○	○	○	○
5. Before you go out on a Saturday night, do your parents make tell them where you are going and with whom?	○	○	○	○	○

Reasons for Abstaining and Limiting Drinking

A set of 12 items that assess cognitions associated with limiting alcohol consumption, with subscales assessing self-control, performance, and upbringing reasons for regulating alcohol use. The items were preceded by the following prompt: "How important would you say each of the following is to you as a reason for NOT drinking or LIMITING your drinking?" Response options included "Not true" (4), "True, but not at all important" (3), "True and fairly important" (2) and "True and very important" (1).

We used the items in Chassin & Barrera's Reasons for Limiting Drinking measure, which was administered to adolescents of ages 10 to 15 (1993). The 11 items in Chassin & Barrera's measure were taken from Greenfield, Guydish & Temple's Reasons for Limiting Drinking scale (RLD; 1989) which was developed with a college student population. Chassin & Barrera chose to include the entire Performance subscale, the entire Upbringing subscale, and 4 of the 6 items on the Self-Control subscale that emerged from factor analysis of Greenfield et al.'s measure. With adolescents, internal consistency (coefficient α) of the three subscales ranged from .66 to .82, and scores on all three subscales were negatively associated with frequency and quantity of adolescents' past year alcohol use (Chassin & Barrera, 1993).

The only change we made to Greenfield et al.'s wording was in #3 – we changed the original "a sign of personal weakness" to "a sign that you are a weak person" because we were concerned that this item would be difficult for middle school students to understand. In addition, we added a twelfth item: "Drinking is something that bad kids do." We also made changes to the instructions and response scale. Whereas the original measure asked about reasons for limiting drinking, we asked about reasons for *not drinking or limiting* drinking. We felt that this was an important change for a younger population in which many participants choose not to drink entirely. The original measure included a three-point response scale ranging from "Very Important" (1) to "Not at All Important" (3). We added a fourth response option, "Not true", and added "True but/and" to the three other response options. We intended to assess (1) whether the respondent felt each item expressed a valid reason that they chose to limit their drinking and (2) if so, how important the reason was to them.

The questionnaire was administered every 6 months.

Item	Wave 1 (BL)	Wave 2	Wave 3	Wave 4	Wave 5
1. I've seen the negative effects of someone else's drinking.	t1rfnd1	t2rfnd1	t3rfnd1	t4rfnd1	t5rfnd1
2. I like to feel in control of myself.	t1rfnd2	t2rfnd2	t3rfnd2	t4rfnd2	t5rfnd2
3. Drinking heavily is a sign that you are a weak person.	t1rfnd3	t2rfnd3	t3rfnd3	t4rfnd3	t5rfnd3
4. I don't want to get drunk.	t1rfnd4	t2rfnd4	t3rfnd4	t4rfnd4	t5rfnd4
5. I was brought up not to drink.	t1rfnd5	t2rfnd5	t3rfnd5	t4rfnd5	t5rfnd5
6. My religion discourages or is against drinking.	t1rfnd6	t2rfnd6	t3rfnd6	t4rfnd6	t5rfnd6
7. I'm not old enough to drink legally.	t1rfnd7	t2rfnd7	t3rfnd7	t4rfnd7	t5rfnd7
8. I'm part of a group that doesn't drink much.	t1rfnd8	t2rfnd8	t3rfnd8	t4rfnd8	t5rfnd8
9. Drinking reduces my performance in sports.	t1rfnd9	t2rfnd9	t3rfnd9	t4rfnd9	t5rfnd9
10. Drinking interferes with my studies.	t1rfnd10	t2rfnd10	t3rfnd10	t4rfnd10	t5rfnd10
11. I wouldn't want to disappoint my parents.	t1rfnd11	t2rfnd11	t3rfnd11	t4rfnd11	t5rfnd11
12. Drinking is	t1rfnd12	t2rfnd12	t3rfnd12	t4rfnd12	t5rfnd12

something that bad kids do.					
RFND: Sum of all items	t1rfndsum	t2rfndsum	t3rfndsum	t4rfndsum	t5rfndsum
Count of all items=True & Fairly/Very Impt.	t1rfndcnt	t2rfndcnt	t3rfndcnt	t4rfndcnt	t5rfndcnt
Sum of Upbringing items (4-8,11,12)	t1rfndupbr	t2rfndupbr	t3rfndupbr	t4rfndupbr	t5rfndupbr
Sum of Performance/Self-Control items (1-3,9,10)	t1rfndprfsc	t2rfndprfsc	t3rfndprfsc	t4rfndprfsc	t5rfndprfsc
RFND: Mean of all items	t1rfndmn	t2rfndmn	t3rfndmn	t4rfndmn	t5rfndmn
Mean of Upbringing items (4-8,11,12)	t1rfndmnupbr	t2rfndmnupbr	t3rfndmnupbr	t4rfndmnupbr	t5rfndmnupbr
Mean of Performance/Self-Control items (1-3,9,10)	t1rfndmnprfsc	t2rfndmnprfsc	t3rfndmnprfsc	t4rfndmnprfsc	t5rfndmnprfsc
Sum of Upbringing items - based on C1,2,3 data (4-7,11,12)	t1rfndupbrA	t2rfndupbrA	t3rfndupbrA	t4rfndupbrA	t5rfndupbrA
Sum of Performance items - based on C1,2,3 data (8-10)	t1rfndprfA	t2rfndprfA	t3rfndprfA	t4rfndprfA	t5rfndprfA
Sum of Social Control items - based on C1,2,3 data (1-3)	t1rfndscA	t2rfndscA	t3rfndscA	t4rfndscA	t5rfndscA
Mean of Upbringing	t1rfndmnupbrA	t2rfndmnupbrA	t3rfndmnupbrA	t4rfndmnupbrA	t5rfndmnupbrA

items - based on C1,2,3 data (4-7,11,12)					
Mean of Performance items - based on C1,2,3 data (8-10)	t1rfndmnprfA	t2rfndmnprfA	t3rfndmnprfA	t4rfndmnprfA	t5rfndmnprfA
Mean of Social Control items - based on C1,2,3 data (1-3)	t1rfndmnscA	t2rfndmnscA	t3rfndmnscA	t4rfndmnscA	t5rfndmnscA

References

Chassin, L. & Barrera, M. (1993). Substance use escalation and substance use restraint among adolescent children of alcoholics. *Psychology of Addictive Behaviors*, *7*, 3-20.

Greenfield, T.K., Guydish, J. & Temple, M.T. (1989). Reasons students give for limiting drinking: A factor analysis with implications for research and practice. Journal of Studies on Alcohol, 50, 108-115.

Scoring

```
************************************************************
Reasons for Not Drinking/Limiting Drinking – MR emailed code 3/31/11
************************************************************;
*Greenfield et al. had 22 items that loaded on 4 factors;
*appears the items that loaded on self-reform factor were dropped;
*1-4: self-control, 4-8: upbringing, 9-11: performance;
*12=???;
*note: 8: loaded on SC and U for Greenfield;

*iSay factor loadings;
*items 1-3,9,10 loaded on performance/self-control;
*items 4-8,11,12 loaded on upbringing;

/*
create a sum score
create a count of RFND items endorsed as true and fairly important or true and very important
create two RFND factors (upbringing, performance/self-control)
*/

*01.28.11: factor analysis based on C1, 2, and 3 results in three factors;
*items 1-3="self-control", items 4-7,11-12="upbringing", items 8-10="performance";
*sent email to KJ today asking if I should change the scoring;

*per KJ, create both sets of variables;

*reverse-code all items;
array rfnd {12} &T.RFND1-&T.RFND12;
array rfndr {12} &T.RFNDr1-&T.RFNDr12;

do i=1 to 12;
 rfndr{i}=5-rfnd{i};
end;

format &T.RFNDr1-&T.RFNDr12 rfnd.;

*apply 80% rule;
*if answered 10 of 12 items;
missrfnd=nmiss(&T.RFNDr1-&T.RFNDr12);
missrfndU=nmiss(&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr8,&T.RFNDr11,
&T.RFNDr12);
missrfndP=nmiss(&T.RFNDr1,&T.RFNDr2,&T.RFNDr3,&T.RFNDr9,&T.RFNDr10);
```

```
missrfndU2=nmiss(&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr11,&T.RFNDr
12);
missrfndP2=nmiss(&T.RFNDr8,&T.RFNDr9,&T.RFNDr10);
missrfndSC=nmiss(&T.RFNDr1,&T.RFNDr2,&T.RFNDr3);

*sum score;
if missrfnd=0 then do;
 &T.RFNDsum=sum(of &T.RFNDr1-&T.RFNDr12);
end;
if (1 le missrfnd le 2) then do;
 &T.RFNDsum=round(mean(of &T.RFNDr1-&T.RFNDr12)*12);
end;

*count of true & fairly/very important;
array rfndA{12} &T.RFNDr1-&T.RFNDr12;
&T.RFNDcnt=0;
do i=1 to 12;
 if rfndA{i} in(3,4) then &T.RFNDcnt=&T.RFNDcnt+1;
end;
drop i;

*two factors -- sum scores (upbringing, performance/social control);
*upbringing;
if missrfndU=0 then do;
&T.RFNDupbr=sum(of
&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr8,&T.RFNDr11,&T.RFNDr12);
end;
*performance/social control;
if missrfndP=0 then do;
&T.RFNDprfsc=sum(of &T.RFNDr1,&T.RFNDr2,&T.RFNDr3,&T.RFNDr9,&T.RFNDr10);
end;

*apply 80% rule;
*if have 6 of 7 items;
if missrfndU=1 then do;
&T.RFNDupbr=round(mean(of
&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr8,&T.RFNDr11,&T.RFNDr12)*7);
end;
*if have 4 of 5 items;
if missrfndP=1 then do;
&T.RFNDprfsc=round(mean(of
&T.RFNDr1,&T.RFNDr2,&T.RFNDr3,&T.RFNDr9,&T.RFNDr10)*5);
end;

*mean - overall, upbringing, and performance/social control;
&T.RFNDmn=mean(of &T.RFNDr1-&T.RFNDr12);
&T.RFNDmnupbr=mean(of
&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr8,&T.RFNDr11,&T.RFNDr12);
&T.RFNDmnprfsc=mean(of &T.RFNDr1,&T.RFNDr2,&T.RFNDr3,&T.RFNDr9,&T.RFNDr10);


*three factors -- sum scores (upbringing, performance, social control);
*upbringing;
if missrfndU2=0 then do;
&T.RFNDupbrA=sum(of
&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr11,&T.RFNDr12);
```

```
end;
*performance;
if missrfndP2=0 then do;
&T.RFNDprfA=sum(of &T.RFNDr8,&T.RFNDr9,&T.RFNDr10);
end;
*social control;
if missrfndSC=0 then do;
&T.RFNDscA=sum(of &T.RFNDr1,&T.RFNDr2,&T.RFNDr3);
end;

*apply 80% rule;
*if have 5 of 6 items;
if missrfndU2=1 then do;
&T.RFNDupbrA=round(mean(of
&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr8,&T.RFNDr11,&T.RFNDr12)*6);
end;
*if have 2 of 3 items;
if missrfndP2=1 then do;
&T.RFNDprfA=round(mean(of &T.RFNDr8,&T.RFNDr9,&T.RFNDr10)*3);
end;
*if have 2 of 3 items;
if missrfndP2=1 then do;
&T.RFNDscA=round(mean(of &T.RFNDr1,&T.RFNDr2,&T.RFNDr3)*3);
end;

*mean - overall, upbringing, and performance/social control;
&T.RFNDmnupbrA=mean(of
&T.RFNDr4,&T.RFNDr5,&T.RFNDr6,&T.RFNDr7,&T.RFNDr11,&T.RFNDr12);
&T.RFNDmnprfA=mean(of &T.RFNDr8,&T.RFNDr9,&T.RFNDr10);
&T.RFNDmnscA=mean(of &T.RFNDr1,&T.RFNDr2,&T.RFNDr3);


label
&T.RFNDsum='RFND: Sum of all items'
&T.RFNDcnt='RFND: Count of all items=True & Fairly/Very Impt.'
&T.RFNDupbr='RFND: Sum of Upbringing items (4-8,11,12)'
&T.RFNDprfsc='RFND: Sum of Performance/Self-Control items (1-3,9,10)'
&T.RFNDmn='RFND: Mean of all items'
&T.RFNDmnupbr='RFND: Mean of Upbringing items (4-8,11,12)'
&T.RFNDmnprfsc='RFND: Mean of Performance/Self-Control items (1-3,9,10)'
&T.RFNDupbrA='RFND: Sum of Upbringing items - based on C1,2,3 data (4-7,11,12)'
&T.RFNDprfA='RFND: Sum of Performance items - based on C1,2,3 data (8-10)'
&T.RFNDscA='RFND: Sum of Social Control items - based on C1,2,3 data (1-3)'
&T.RFNDmnupbrA='RFND: Mean of Upbringing items - based on C1,2,3 data (4-7,11,12'
&T.RFNDmnprfA='RFND: Mean of Performance items - based on C1,2,3 data (8-10)'
&T.RFNDmnscA='RFND: Mean of Social Control items - based on C1,2,3 data (1-3)'
;
```

Current version. *This print screen is from the C3 Baseline (Wave 1) survey. No changes have been made since beginning of the study, hence this is valid for all cohorts and all waves.*

How important would you say each of the following is to you as a reason for NOT drinking or LIMITING your drinking?

	Not true	True, but not at all important	True and fairly important	True and very important
1. I've seen the negative effects of someone else's drinking.	○	○	○	○
2. I like to feel in control of myself.	○	○	○	○
3. Drinking heavily is a sign that you are a weak person.	○	○	○	○
4. I don't want to get drunk.	○	○	○	○
5. I was brought up not to drink.	○	○	○	○
6. My religion discourages or is against drinking.	○	○	○	○
7. I'm not old enough to drink legally.	○	○	○	○
8. I'm part of a group that doesn't drink much.	○	○	○	○
9. Drinking reduces my performance in sports.	○	○	○	○
10. Drinking interferes with my studies.	○	○	○	○
11. I wouldn't want to disappoint my parents.	○	○	○	○
12. Drinking is something that bad kids do.	○	○	○	○

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Drinking Milestones and Alcohol Involvement

A scale designed to assess progression through drinking milestones and current alcohol use. The scale is administered progressively, that is, positive endorsement of earlier questions causes additional questions to be asked, while negative responses (e.g., never had a sip of alcohol, have not drunk in past 6 months) result in these questions being skipped.

We designed the scale using NIAAA's recommendations on alcohol consumption measures (Sobell & Sobell, 2004). The second part of the scale is a unidimensional Quantity-Frequency measure, assessing frequency (number of drinking days) and quantity (average drinks per drinking day) over two time periods, the past 6 or 12 months and the past 30 days. These two variables can be multiplied to derive a total drinking volume or 'QF' over the different time periods.

The first part of the scale is intended to assess progression through alcohol use milestones and age of attainment of each milestone. Because the lifetime drinking measures recommended by Sobell & Sobell are intended for adults, we had less guidance in developing the milestone measures. Sobell & Sobell (2004) recommended including items assessing drunkenness/intoxication, and in designing these questions, we followed Levitt, Sher & Bartholow's (2009) suggestion that moderate intoxication be assessed separately from heavy intoxication, using terms like "buzzed," "tipsy," and "light-headed." The way we defined "drunk" was also taken from a measure developed by Sher (2003).

During the course of the study, we added questions assessing the age of attainment of each milestone. We also changed some of the show-if logic during the course of the survey. We added a question to determine whether participants had drunk 3 or more drinks in one sitting, which was only shown if the question that assessed the maximum number of drinks ever drunk was skipped. In the Cohort 1 and 2 baseline surveys and Cohort 1 Wave 2 survey, Question #9 (mixing alcohol with energy drinks) was asked only if students endorsed having had a full drink of alcohol, as well as using products with caffeine – including energy drinks – at least once a day. For Cohorts 3 and later, Question #9 was displayed for everyone who had drunk a full drink of alcohol, regardless of their reported caffeine consumption.

We also changed the wording of some items during the course of the study. We found that some students asked what "e.g." meant when completing the baseline survey in our presence, so we changed these instances to "for example". We also changed our initial version of the question assessing the age of first drinking 3+ drinks, because the wording was not as clear as it could be.

The questionnaire is administered every 6 months. At baseline, we ask questions #10 and #11 about the past 12 months, but in every other assessment, we ask questions #10

and #11 about the past 6 months, i.e., the time since the last assessment. The response options for #10 also differ depending on the time period being assessed.

Item	Wave 1 (BL)	Wave 2	Wave 3	Wave 4	Wave 5
1. Have you ever had a sip of alcohol?	t1ainv1	t2ainv1	t3ainv1	t4ainv1	t5ainv1
1a. How old were you the first time you had a sip of alcohol?	t1ainv1a ^	t2ainv1a ~	t3ainv1a	t4ainv1a	t5ainv1a
2. Have you ever had a full drink of alcohol?	t1ainv2	t2ainv2	t3ainv2	t4ainv2	t5ainv2
2a. How old were you the first time you had a full drink of alcohol?	t1ainv2a ^	t2ainv2a ~	t3ainv2a	t4ainv2a	t5ainv2a
3. Have you ever felt a little buzzed, tipsy, high, or light-headed from alcohol?	t1ainv3	t2ainv3	t3ainv3	t4ainv3	t5ainv3
4. Have you ever felt drunk (e.g., speech was slurred or unsteady on your feet) from alcohol?	t1ainv4 [1]	--	--	--	--
4. Have you ever felt drunk (for example: speech was slurred or unsteady on your feet) from alcohol?	t1ainv4 ~	t2ainv4	t3ainv4	t4ainv4	t5ainv4
4a. How old were you the first time you felt drunk from alcohol?	t1ainv4a ^	t2ainv4a ~	t3ainv4a	t4ainv4a	t5ainv4a
5. What is the maximum number of drinks you have had in one sitting in your lifetime?	t1ainv5	t2ainv5	t3ainv5	t4ainv5	t5ainv5
6. Over what period of time did you drink this amount?	t1ainv6	t2ainv6	t3ainv6	t4ainv6	t5ainv6
(*if 2=Yes, but 5 is skipped*) Have you ever had three or more drinks of alcohol in one sitting in your lifetime?	t1ainv5n*	t2ainv5n^	t3ainv5n ~	t4ainv5n	t5ainv5n
5a. We are specifically interested in finding out about when you drank three or more drinks of alcohol on an occasion. How old were you when you did this?	t1ainv5a [3]	t2ainv5a [2]	t3ainv5a[1]	--	--
5a. We are interested in finding out about when you drank three	t1ainv5a*	t2ainv5a^	t3ainv5a ~	t4ainv5a	t5ainv5a

or more drinks of alcohol on an occasion. How old were you when you did this for the first time?					
7. Have you ever drank every week for six months or longer?	t1ainv7	t2ainv7	t3ainv7	t4ainv7	t5ainv7
8. Have you ever drank every month for six months or longer?	t1ainv8	t2ainv8	t3ainv8	t4ainv8	t5ainv8
9. Do you ever mix energy drinks (Red Bull, Monster, etc.) with alcohol?	t1ainv9	t2ainv9	t3ainv9	t4ainv9	t5ainv9
10. Think of all the times in the **past 12 months** when you had something to drink. How often have you had some kind of beverage containing alcohol?	t1ainv10	--	--	--	--
10. Think of all the times in the **past 6 months** when you had something to drink. How often have you had some kind of beverage containing alcohol?	--	t2ainv10	t3ainv10	t4ainv10	t5ainv10
11. In the **past 12 months**, when you were drinking alcohol, how many drinks did you usually have on any one occasion?	t1ainv11	--	--	--	--
11. In the **past 6 months**, when you were drinking alcohol, how many drinks did you usually have on any one occasion?	--	t2ainv11	t3ainv11	t4ainv11	t5ainv11
12. During the **past 30 days**, how often did you drink alcohol?	t1ainv12	t2ainv12	t3ainv12	t4ainv12	t5ainv12
13. During the **past 30 days**, when you were drinking alcohol, how many drinks did you usually have on any one occasion?	t1ainv13	t2ainv13	t3ainv13	t4ainv13	t5ainv13
14. What is the maximum number of drinks you have had in one sitting in the **past 30 days**?	t1ainv14	t2ainv14	t3ainv14	t4ainv14	t5ainv14
15. Over what period of time did you drink this amount?	t1ainv15	t2ainv15	t3ainv15	t4ainv15	t5ainv15
16. How many times in the **past 30 days** did you get a little	t1ainv16	t2ainv16	t3ainv16	t4ainv16	t5ainv16

buzzed, tipsy, high, or light-headed on alcohol?					
17. How many times in the **past 30 days** did you get drunk (e.g., speech was slurred or unsteady on your feet) on alcohol?	t1ainv17 [1]	--	--	--	--
17. How many times in the **past 30 days** did you get drunk (for example: speech was slurred or unsteady on your feet) on alcohol?	t1ainv17~	t2ainv17	t3ainv17	t4ainv17	t5ainv17
~ not administered to Cohort 1					
^ not administered to Cohorts 1 or 2					
* not administered to Cohorts 1, 2 or 3					
[1] only administered to Cohort 1					
[2] only administered to Cohort 1					
[3] only administered to Cohort 3					

Calculated/Coded Variables	Wave 1 (BL)	Wave 2	Wave 3	Wave 4	Wave 5
AINV: ever sipped, lifetime	t1alcltsip	t2alcltsip	t3alcltsip	t4alcltsip	t5alcltsip
AINV: ever full drink, lifetime	t1alcltdrk	t2alcltdrk	t3alcltdrk	t4alcltdrk	t5alcltdrk
AINV: ever buzzed, lifetime	t1alcltbuzz	t2alcltbuzz	t3alcltbuzz	t4alcltbuzz	t5alcltbuzz
AINV: ever drunk, lifetime	t1alcltdrunk	t2alcltdrunk	t3alcltdrunk	t4alcltdrunk	t5alcltdrunk
AINV: max drinks, lifetime	t1alcltmax	t2alcltmax	t3alcltmax	t4alcltmax	t5alcltmax
AINV: max drinks - period of time, lifetime	t1alcltmaxtm	t2alcltmaxtm	t3alcltmaxtm	t4alcltmaxtm	t5alcltmaxtm
AINV: ever weekly drinker, lifetime	t1alcltwkdrk	t2alcltwkdrk	t3alcltwkdrk	t4alcltwkdrk	t5alcltwkdrk
AINV: ever monthly drinker, lifetime	t1alcltmodrk	t2alcltmodrk	t3alcltmodrk	t4alcltmodrk	t5alcltmodrk
AINV: drinking frequency, past year	t1alcpydrkfreq	t2alcpydrkfreq	t3alcpydrkfreq	t4alcpydrkfreq	t5alcpydrkfreq
AINV: recoded drinks/month, past year	t1alcpydrkfreqr	t2alcpydrkfreqr	t3alcpydrkfreqr	t4alcpydrkfreqr	t5alcpydrkfreqr
AINV: usual drinking amount, past year	t1alcpydrkamt	t2alcpydrkamt	t3alcpydrkamt	t4alcpydrkamt	t5alcpydrkamt
AINV: drinking frequency, past month	t1alcpmdrkfreq	t2alcpmdrkfreq	t3alcpmdrkfreq	t4alcpmdrkfreq	t5alcpmdrkfreq
'AINV: recoded drinks/month,	t1alcpmdrkfreqr	t2alcpmdrkfreqr	t3alcpmdrkfreqr	t4alcpmdrkfreqr	t5alcpmdrkfreqr

past month'					
AINV: usual drinking amount, past month	t1alcpmdrkamt	t2alcpmdrkamt	t3alcpmdrkamt	t4alcpmdrkamt	t5alcpmdrkamt
AINV: max drinks, past month	t1alcpmmax	t2alcpmmax	t3alcpmmax	t4alcpmmax	t5alcpmmax
AINV: max drinks - period of time, past month	t1alcpmmaxtm	t2alcpmmaxtm	t3alcpmmaxtm	t4alcpmmaxtm	t5alcpmmaxtm
AINV: # times buzzed, past month	t1alcpmbuzz	t2alcpmbuzz	t3alcpmbuzz	t4alcpmbuzz	t5alcpmbuzz
AINV: # times drunk, past month	t1alcpmdrunk	t2alcpmdrunk	t3alcpmdrunk	t4alcpmdrunk	t5alcpmdrunk

References

Levitt, A., Sher, K.J., & Bartholow, B.D. (2009). The language of intoxication: Preliminary investigations. *Alcoholism: Clinical and Experimental Research*, 33, 448-454.

Sher, K.J. (2003). Studying the transition to college: A new prospective study. *Posters*. Paper 25. Samuel B. Guze Symposium on Alcoholism. Retrieved May 13 2011 from http://digitalcommons.wustl.edu/guzeposter2003/25.

Sobell. L. C., & Sobell, M. B (2004). Alcohol Consumption Measures. Retrieved May 13 2011 from http://pubs.niaaa.nih.gov/publications/Assesing%20Alcohol/measures.htm.

Scoring

```
************************************************************
Alcohol Involvement – MR emailed code 5/3/11
************************************************************;
/*
&T.ALCLTSIP (same as &T.AINV1, but sets 2 (relig reasons only) to 0)
***note: the response of relig. reasons only was added in T2 & C2
&T.ALCLTDRK (same as &T.AINV2, but set to 0 if &T.AINV1=0)
&T.ALCLTBUZZ (same as &T.AINV3, but set to 0 if &T.ALCLTDRK=0)
&T.ALCLTDRUNK (same as &T.AINV4, but set to 0 if &T.ALCLTDRK=0)
&T.ALCLTMAX (same as &T.AINV5, but set to 0 if &T.ALCLTDRK=0)
&T.ALCLTMAXTM (same as &T.AINV6, but set to .S if &T.ALCLTDRK=0)
&T.ALCLTWKDRK (same as &T.AINV7, but set to 0 if &T.ALCLTDRK=0)
&T.ALCLTMODRK (same as &T.AINV8, but set to 0 if &T.ALCLTDRK=0)


&T.ALCPYDRKFREQ (same as &T.AINV10, but set to 1 if &T.ALCLTDRK=0)
&T.ALCPYDRKFREQr (same as r&T.AINV10, but set to 0 if
&T.ALCLTDRK=0)
&T.ALCPYDRKAMT (same as &T.AINV11, but set to 0 if &T.ALCLTDRK=0 or
&T.ALCPYDRKFREQ=1)

&T.ALCPMDRKFREQ (same as &T.AINV12, but set to 1 if &T.ALCLTDRK=0
or &T.ALCPYDRKFREQ=1)
&T.ALCPMDRKFREQr (same as r&T.AINV12, but set to 0 if
&T.ALCLTDRK2=0 or &T.ALCPYDRKFREQ=1)
&T.ALCPMDRKAMT (same as &T.AINV13, but set to 0 if &T.ALCLTDRK=0 or
&T.ALCPYDRKFREQ=1 or &T.ALCPMDRKFREQ=1)
&T.ALCPMMAX (same as &T.AINV14, but set to 0 if &T.ALCLTDRK=0 or
&T.ALCPYDRKFREQ=1 or &T.ALCPMDRKFREQ=1)
```

```
&T.ALCPMMAXTM (same as &T.AINV15, but set to .S if &T.ALCLTDRK=0 or
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*/


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if &T.ALCLTDRK=0 then &T.ALCLTBUZZ=0;

&T.ALCLTDRUNK=&T.AINV4;
if &T.ALCLTDRK=0 then &T.ALCLTDRUNK=0;

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if &T.ALCLTDRK=0 then &T.ALCPYDRKFREQr=0;

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&T.ALCPMMAX=&T.AINV14;
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&T.ALCPMMAXTM=&T.AINV15;
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&T.ALCPMBUZZ=&T.AINV16;
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if (&T.ALCLTDRK=0|&T.ALCPYDRKFREQ=1|&T.ALCPMDRKFREQ=1) then
&T.ALCPMDRUNK=1;

format
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&T.ALCLTWKDRK &T.ALCLTMODRK yesno.
&T.ALCLTMAX &T.ALCPMMAX &T.ALCPYDRKFREQr
&T.ALCPMDRKFREQr missfmt.
&T.ALCLTMAXTM &T.ALCPMMAXTM ainvtm. &T.ALCPYDRKFREQ
ainvfreqpy.
&T.ALCPYDRKAMT &T.ALCPMDRKAMT ainvamtpy. &T.ALCPMDRKFREQ
ainvfreqpm.
&T.ALCPMBUZZ &T.ALCPMDRUNK ainvfreqpmbz.;

label
&T.ALCLTSIP='AINV: ever sipped, lifetime'
&T.ALCLTDRK='AINV: ever full drink, lifetime'
&T.ALCLTBUZZ='AINV: ever buzzed, lifetime'
&T.ALCLTDRUNK='AINV: ever drunk, lifetime'
&T.ALCLTMAX='AINV: max drinks, lifetime'
&T.ALCLTMAXTM='AINV: max drinks - period of time, lifetime'
&T.ALCLTWKDRK='AINV: ever weekly drinker, lifetime'
&T.ALCLTMODRK='AINV: ever monthly drinker, lifetime'
&T.ALCPYDRKFREQ='AINV: drinking frequency, past year'
&T.ALCPYDRKFREQr='AINV: recoded drinks/month, past year'
&T.ALCPYDRKAMT='AINV: usual drinking amount, past year'
```
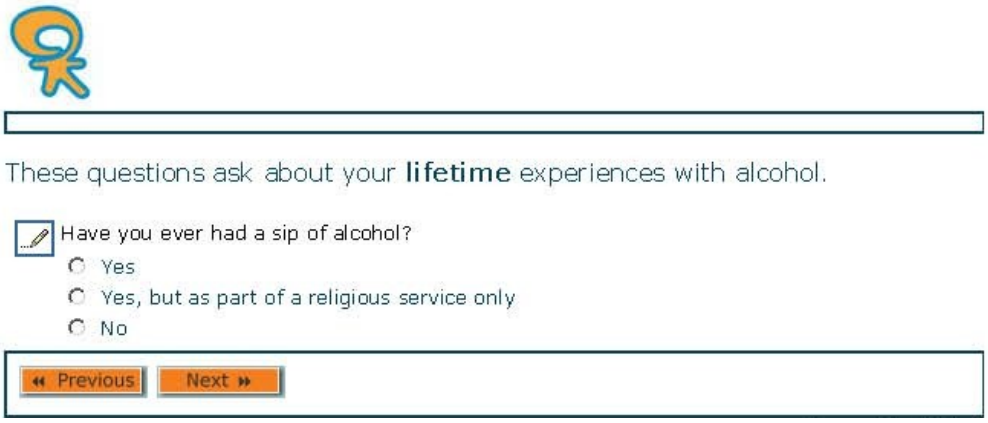
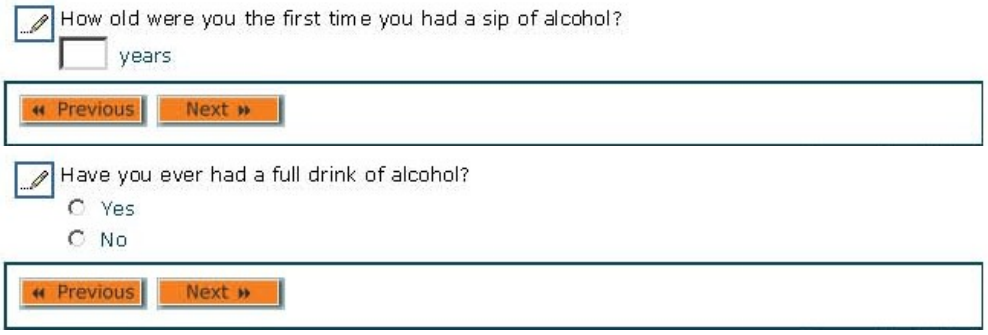

&T.ALCPMDRKFREQ='AINV: drinking frequency, past month'
&T.ALCPMDRKFREQr='AINV: recoded drinks/month, past month'
&T.ALCPMDRKAMT='AINV: usual drinking amount, past month'
&T.ALCPMMAX='AINV: max drinks, past month'
&T.ALCPMMAXTM='AINV: max drinks - period of time, past month'
&T.ALCPMBUZZ='AINV: # times buzzed, past month'
&T.ALCPMDRUNK='AINV: # times drunk, past month'

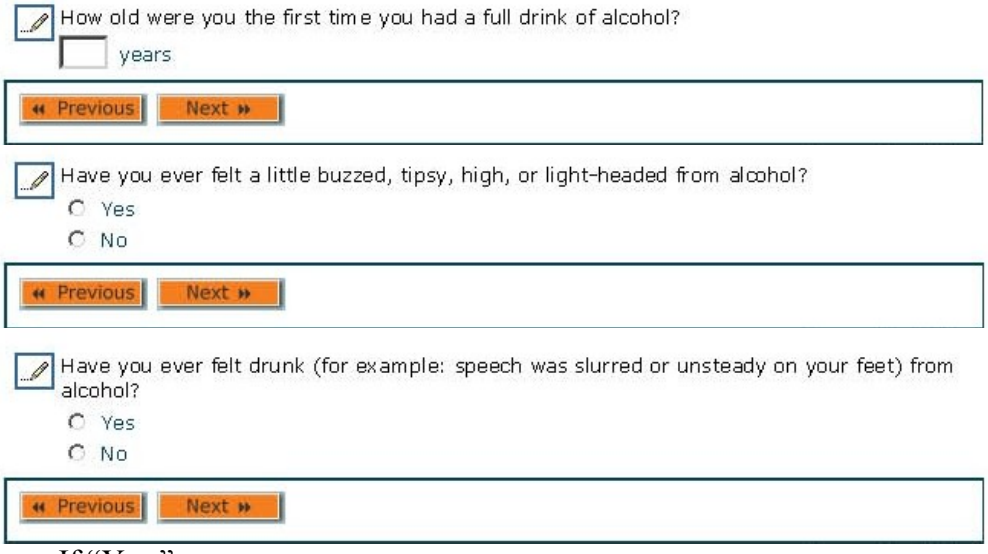
Current version. *These print screens were taken from the Cohort 4 Baseline (Wave 1) survey. This version is also valid for Cohort 1 Wave 4, Cohort 2 Wave 3, and Cohort 3 Wave 2, except for the 12-month questions, which are replaced with 6 month questions, seen directly after the full version of the questionnaire.*



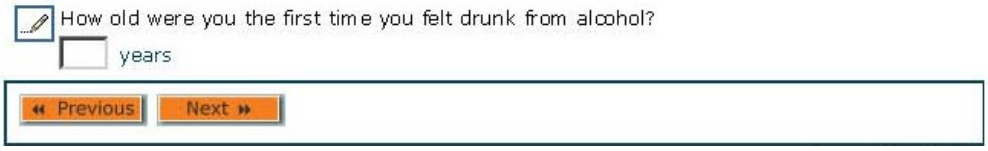
If "No," or "Yes but religious only," questionnaire ends here. If "Yes",



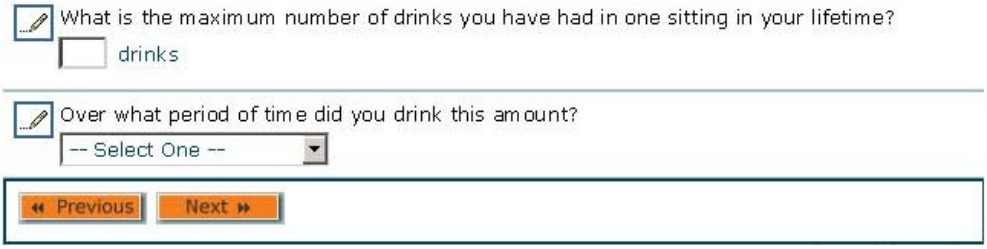
If "No," questionniare ends here. If "Yes,"



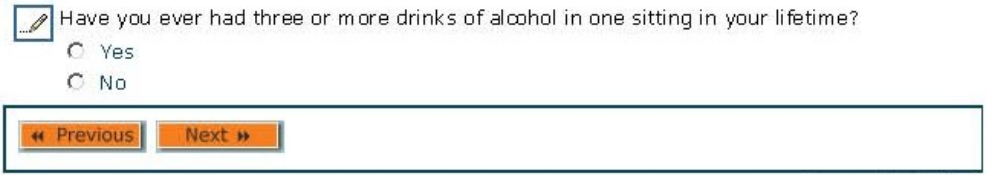
If "Yes,"



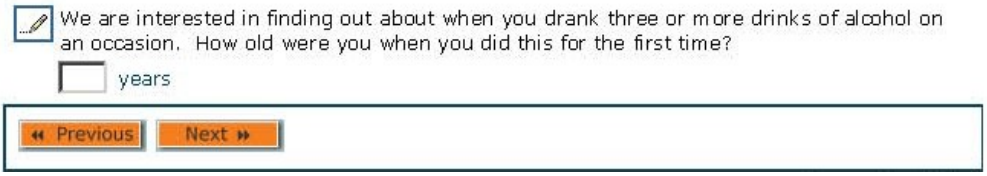
(shown to all who endorse having had a full drink)



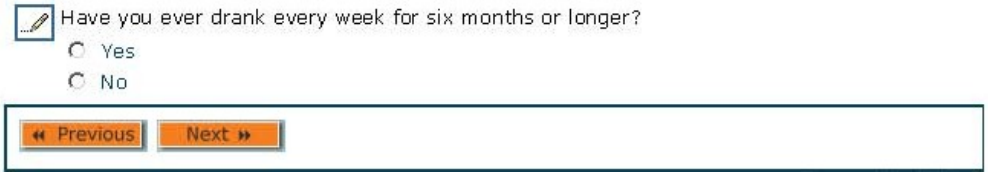
If maximum number of drinks is SKIPPED but participant endorsed having had a full drink,



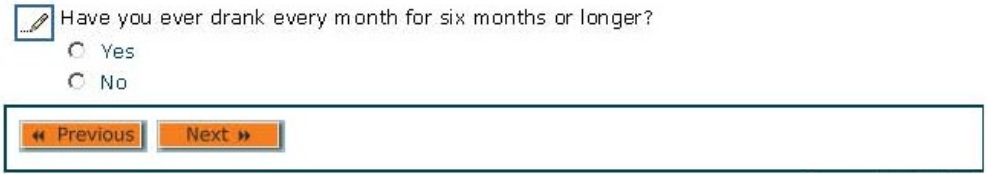
If maximum number of drinks is 3 or more, or previous question is answered "Yes,"



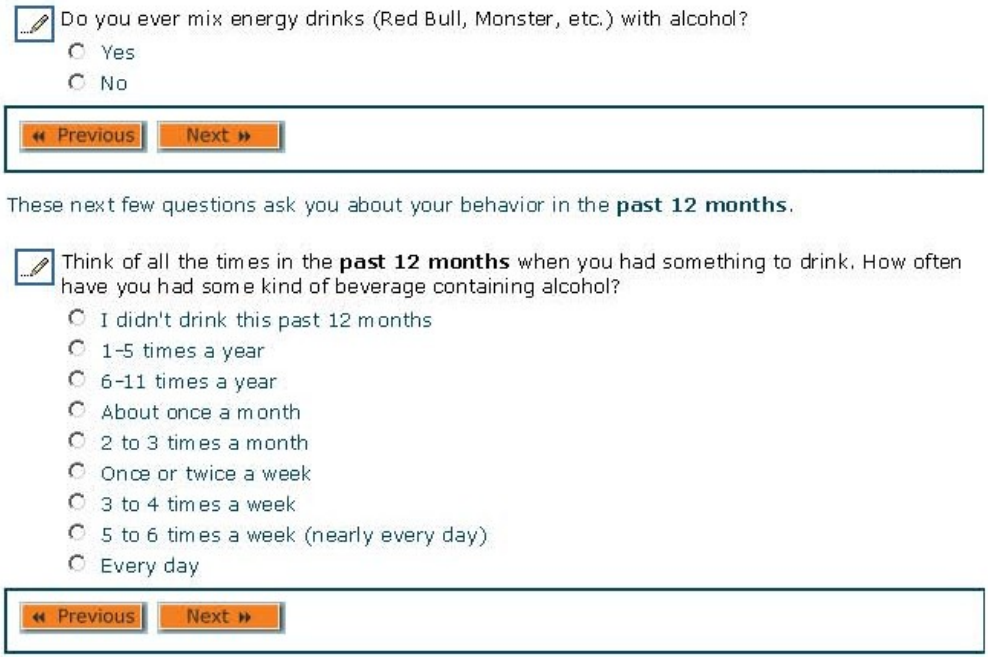
(shown to all who endorse having had a full drink)



If "No" (or skipped),

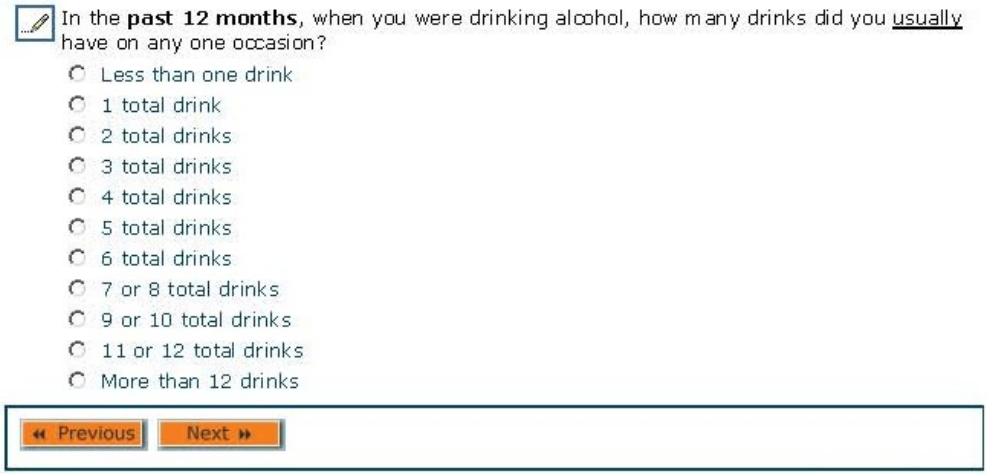


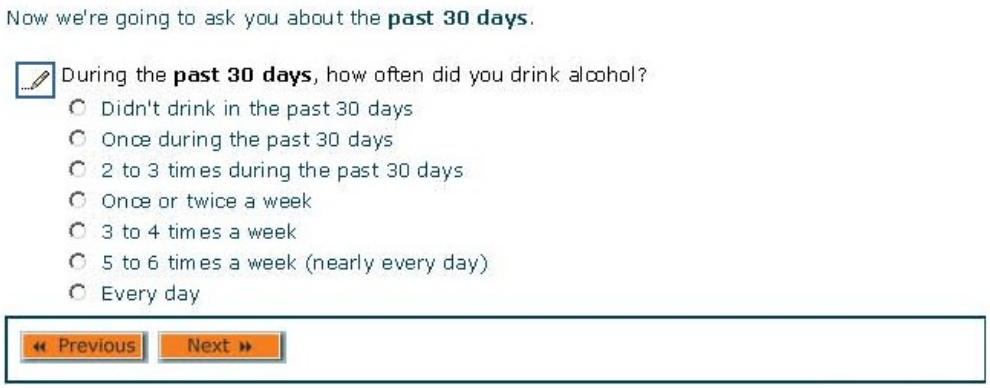
(shown to all who endorse having had a full drink)



If response is “I didn’t drink this past 12 months,” questionnaire ends here.

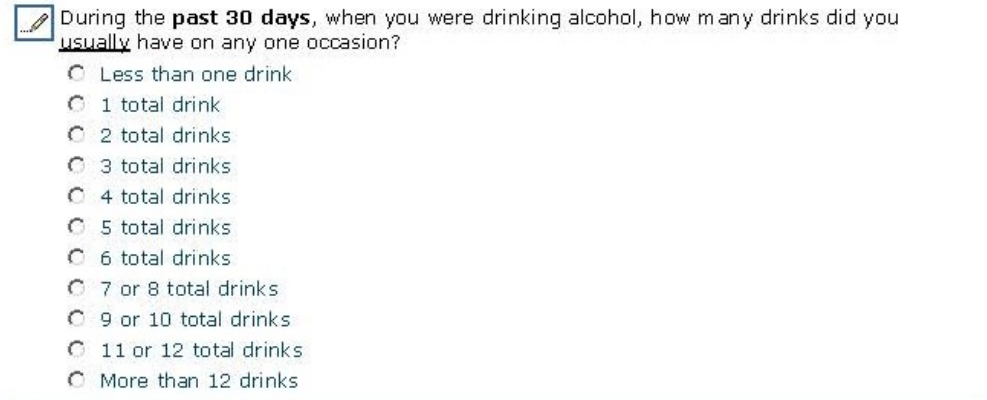
If previous question is “1-5 times a year” or more,

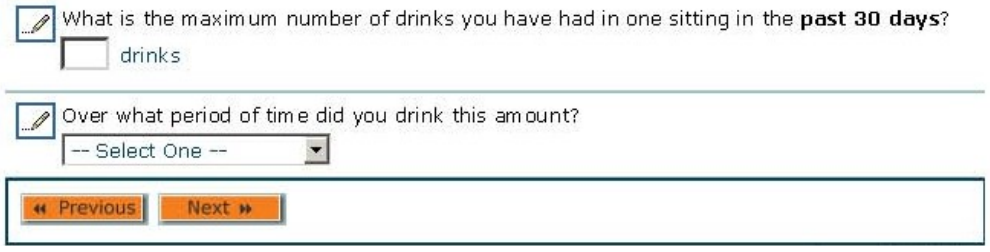




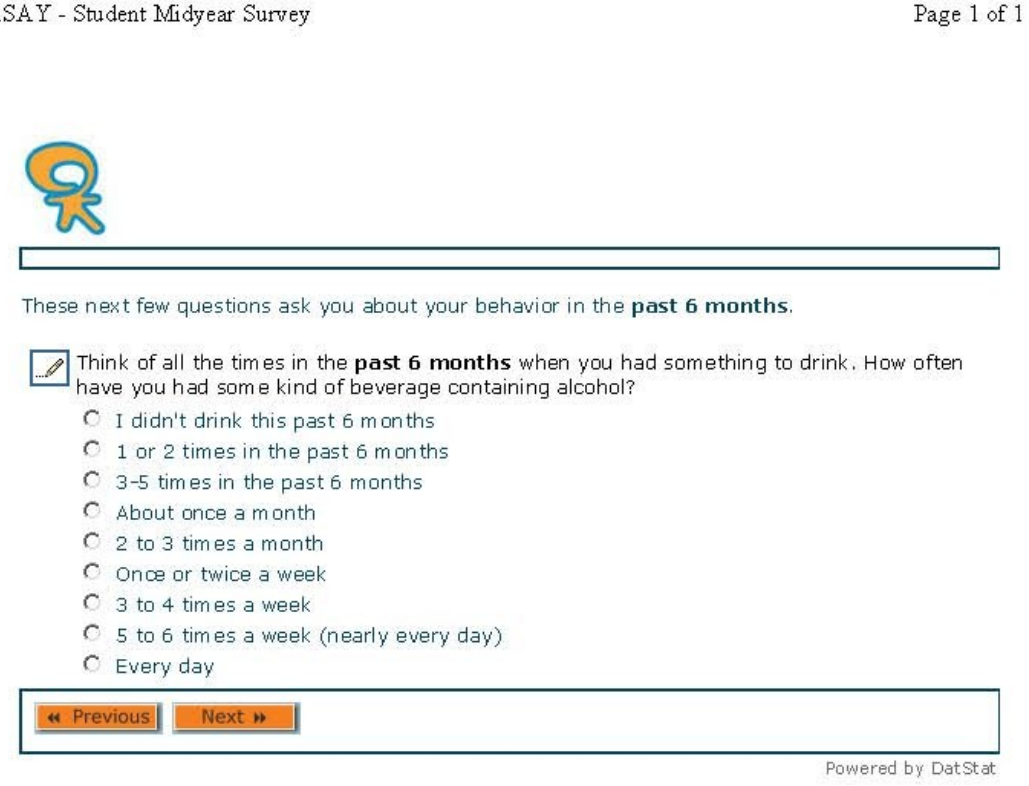
If response is "Didn't drink in the past 30 days," questionnaire ends here.

If response to past 30 days question is "Once" or more,





Current version, 6 month questions. *These 6-month questions are taken from the Cohort 2 Wave 2 survey. They are valid for all administrations of Wave 2+ questionnaires.*



If response to above question is "1 or 2 times" or greater,

In the **past 6 months**, when you were drinking alcohol, how many drinks did you usually have on any one occasion?

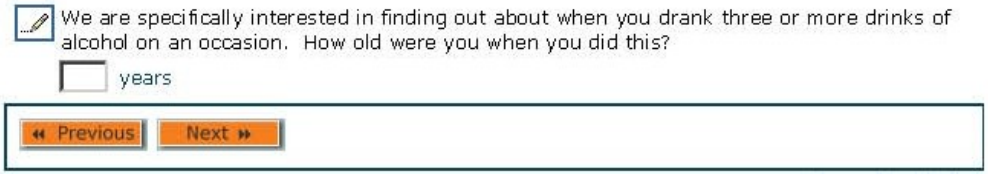
- Less than one drink
- 1 total drink
- 2 total drinks
- 3 total drinks
- 4 total drinks
- 5 total drinks
- 6 total drinks
- 7 or 8 total drinks
- 9 or 10 total drinks
- 11 or 12 total drinks
- More than 12 drinks

« Previous Next »

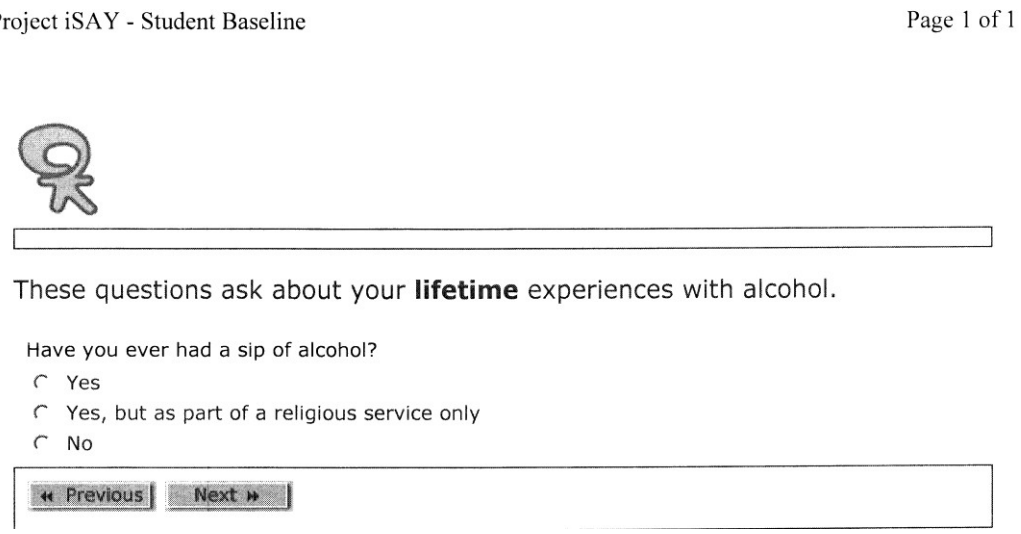
Previous versions.

Cohort 3 Wave 1/ Cohort 2 Wave 2 / Cohort 1 Wave 3.

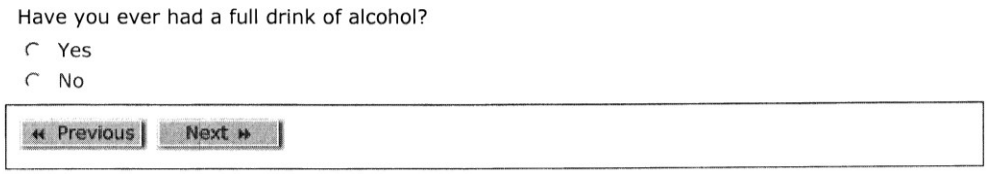
This version of the questionnaire was identical to the version above, but did not include the "t_ainv5n" question, "Have you ever had three or more drinks of alcohol in one sitting in your lifetime?" It also included an earlier version of the "t_ainv5a" question that we later changed to "We are interested in finding out about when you drank three or more drinks of alcohol on an occasion. How old were you when you did this for the first time?" This version of the question was:



Cohort 2 Wave 1 / Cohort 1 Wave 2. *This version of the questionnaire was quite different from the current version, with fewer questions. These print screens are taken from the Cohort 2 Baseline (Wave 1) survey. The 6-month questions that were in the Cohort 1 Wave 2 survey are identical to the 6-month questions in the current version (see above).*



If "No" or "Yes but religious," questionnaire ends here. If "Yes,"



If "No," questionnaire ends here. If "Yes,"

Have you ever felt a little buzzed, tipsy, high, or light-headed from alcohol?

- Yes
- No

Have you ever felt drunk (for example: speech was slurred or unsteady on your feet) from alcohol?

- Yes
- No

« Previous | Next »

What is the maximum number of drinks you have had in one sitting in your lifetime?

[ ] drinks

Over what period of time did you drink this amount?

[-- Select One --]

« Previous | Next »

Have you ever drank every week for six months or longer?

- Yes
- No

« Previous | Next »

If "No,"

Have you ever drank every month for six months or longer?

- Yes
- No

« Previous | Next »

(shown to all participants who endorse having had a full drink AND consuming products containing caffeine at least once a day [t_caf1>0] AND consuming energy drinks [t_caf2.c=1] – see Caffeine documentation for specific questions)

Do you ever mix energy drinks (Red Bull, Monster, etc.) with alcohol?

- Yes
- No

« Previous | Next »

(shown to all participants who endorse having had a full drink)

These next few questions ask you about your behavior in the **past 12 months**.

Think of all the times in the **past 12 months** when you had something to drink. How often have you had some kind of beverage containing alcohol?

- I didn't drink this past 12 months
- 1-5 times a year
- 6-11 times a year
- About once a month
- 2 to 3 times a month
- Once or twice a week
- 3 to 4 times a week
- 5 to 6 times a week (nearly every day)
- Every day

« Previous | Next »

If response is "I didn't drink this past 12 months," questionnaire ends here.
If previous question is "1-5 times a year" or more,

In the **past 12 months**, when you were drinking alcohol, how many drinks did you usually have on any one occasion?

- Less than one drink
- 1 total drink
- 2 total drinks
- 3 total drinks
- 4 total drinks
- 5 total drinks
- 6 total drinks
- 7 or 8 total drinks
- 9 or 10 total drinks
- 11 or 12 total drinks
- More than 12 drinks

« Previous | Next »

Now we're going to ask you about the **past 30 days**.

During the **past 30 days**, how often did you drink alcohol?

- Didn't drink in the past 30 days
- Once during the past 30 days
- 2 to 3 times during the past 30 days
- Once or twice a week
- 3 to 4 times a week
- 5 to 6 times a week (nearly every day)
- Every day

« Previous | Next »

If response is "Didn't drink in the past 30 days," questionnaire ends here.

If response to past 30 days question is "Once" or more,

During the **past 30 days**, when you were drinking alcohol, how many drinks did you usually have on any one occasion?

- ○ Less than one drink
- ○ 1 total drink
- ○ 2 total drinks
- ○ 3 total drinks
- ○ 4 total drinks
- ○ 5 total drinks
- ○ 6 total drinks
- ○ 7 or 8 total drinks
- ○ 9 or 10 total drinks
- ○ 11 or 12 total drinks
- ○ More than 12 drinks

« Previous | Next »

What is the maximum number of drinks you have had in one sitting in the **past 30 days**?

[ ] drinks

Over what period of time did you drink this amount?

[-- Select One -- ▾]

« Previous | Next »

How many times in the **past 30 days** did you get a little buzzed, tipsy, high, or light-headed on alcohol?

- ○ Never in the past 30 days
- ○ Once during the past 30 days
- ○ 2 to 3 times during the past 30 days
- ○ Once to twice a week
- ○ 3 to 4 times a week
- ○ 5 to 6 times a week (nearly every day)
- ○ Every day

How many times in the **past 30 days** did you get drunk (for example: speech was slurred or unsteady on your feet) on alcohol?

- ○ Never in the past 30 days
- ○ Once during the past 30 days
- ○ 2 to 3 times during the past 30 days
- ○ Once or twice a week
- ○ 3 to 4 times a week
- ○ 5 to 6 times a week (nearly every day)
- ○ Every day

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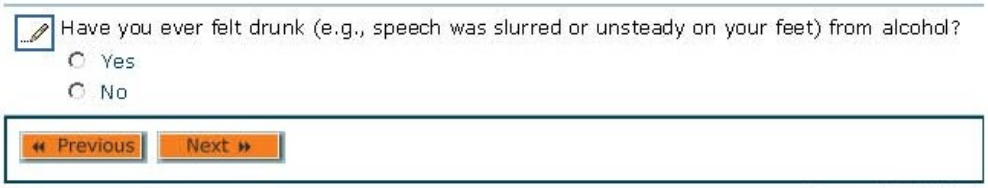
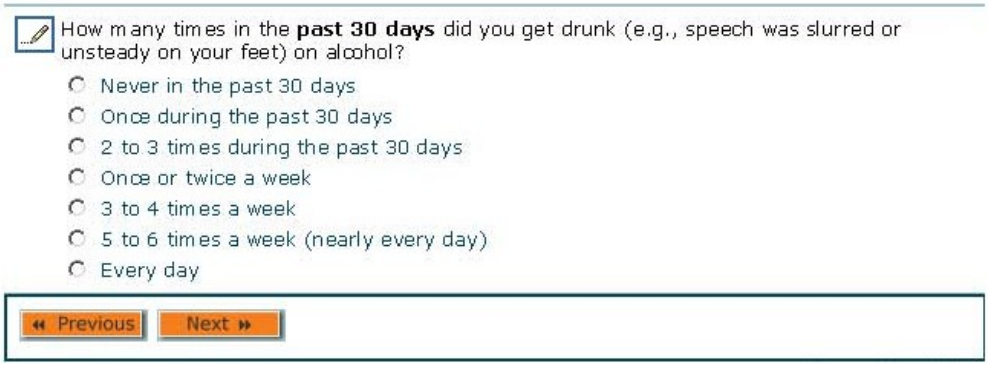
Cohort 1 Wave 1. *The earliest version of the questionnaire was quite similar to the Cohort 1 Wave 2/Cohort 2 Wave 1 questionnaire (directly previous). The only differences were in questions #4 and #17, seen below; we changed "e.g.," to "for example:" because participants asked us questions about this abbreviation during the baseline survey sessions that were conducted in person.*

(Question #4)



(Question #17)



APPENDIX B

SURVIVAL ANALYSES

Survival analyses were utilized to assess the proposed models and test for covariate affects on the attainment of each drinking milestone. Survival analyses estimate the probability, or hazard, that individuals will experience a non repeatable event. Hazard is the conditional probability of experiencing an event, such as consuming the first full drink of alcohol. It is conditional upon experiencing an event at or before a time period, having not experienced an event previously. Survival analyses are particularly useful because they model the longitudinal progression of the probability that an event occurs (Muthén, & Masyn, 2005) while taking into account covariate effects on that probability. This focus is ideal for studying the progression of adolescents in initiating alcohol use, heavy use, and getting drunk as this study proposes.

Rather than using an estimate of hazard at one given time point the cumulative hazard is utilized. Cumulative hazard, "the total amount of accumulated risk that an individual has faced from the beginning of time until the present time" (Singer and Willett, 2003, p. 488) is a more useful conceptualization of the risk of experiencing an event because it takes into account the increased risk given the amount of time someone has not experienced an event. In a typical sample the cumulative hazard can fluctuate with period differences. It is beneficial to smooth the hazard function for reporting an overall trend in the data (Singer, & Willett, 2003). Kernel smoothing was

applied to estimate cumulative hazard. Kernel smoothing is the aggregation of all the estimates of hazard near a focal time point and utilizes this collected value to estimate the average value of hazard in the range around that focal point. This range, above and below the focal time point, is known as the bandwidth, or spread in distance around a particular point estimate of the hazard. For instance, calculating the hazard at year 12 gives a point estimate. Kernel smoothing then aggregates the hazard scores around year 12, for example from years 10 through 14 and uses this collected score as the average hazard for that range. The bandwidth in this example is equal to 2, for estimates of hazard calculated ± 2 from year 12 (Singer, & Willett, 2003). No bandwidth is necessarily "better" than another, but the larger the bandwidth the smoother the shape of the hazard function. However, it is important to note that in making the hazard more smooth variability around a data point is lost as widening the bandwidth decreases the link of the value to a specific time point. Also, the greater the bandwidth the larger the temporal region the smoothed function describes, so the graph of hazard spans less time points. The smoothed value does not estimate the population value of the hazard, but rather an average of the hazard in the temporal vicinity.

As hazard is a probability it is therefore bounded and cannot be greater than 1. Hazard is utilized when reporting models with no covariates or when models are stratified by group, but when interpreting covariate effects in a model instead of reporting hazard or even the cumulative hazard, a transformation of hazard is reported, the hazard ratio. A hazard ratio is the ratio of the hazard rates corresponding to two different levels of an explanatory variable. For dichotomous variables, the hazard

ratio is the ratio of the hazard rate for those with the risk factor. For example, in this study being male is a "risk" group (male= 1). The hazard ratio for a continuous variable is the ratio of the hazard rates for a one unit increase in the explanatory variable. If the 95% hazard ratio confidence interval includes 1 the hazard ratio is not significant because a hazard ratio of 1 means that event rates are the same for the comparison groups. The hazard ratio can be an integer greater than 1, or less than 1 and is similar to interpreting odds. For example, if a hazard ratio of 2.5 were found for initiating alcohol use among boys compared to girls than boys would be estimated to be two and a half times more likely to initiate alcohol use. Overall goodness-of-fit statistics also measure the adequacy of a survival model. When comparing the baseline model that has no covariates to a model including covariates the change in the -2 Log Likelihood (-2LL) and Akaike Information Criterion (AIC) are scrutinized to help determine model fit. There is not a definitive rule about magnitude of the change in these fit statistics, because values are dependent upon the model, however; when comparing previous model(s) the greater the change and the lower the values of these figures the better (Singer, & Willett, 2003).

A continuous-time survival analysis approach was used for the analysis of this data because milestone attainment can happen theoretically at any time- to days of the year or hours and minutes of the day; however, these assessments were conducted on an annual basis. Accordingly, these data were structured as *grouped-time* survival data (Masyn, 2003). Drinking may occur at any given time, but the unit of time measured in this study is made in larger categories, here in one year intervals.

Survival analyses were first conducted to calculate hazard and survival curves associated with the three drinking milestones without predictor variables to assess the baseline function (Singer, & Willett, 2003). This is done to determine the overall change in hazard and survival of alcohol use for this sample. Though gender is not a primary focus of this study the probability of experiencing each milestone was assessed between genders, then in subsequent models gender effects were controlled for by including gender along with other predictors. This was done for the models grouping like predictors and for the final models with all predictors together. Following a more general model without predictors and gender comparisons, models including covariates were added and covariate effects were tested in a stepwise manner. This included testing the influence of each variable individually, followed by independent variables grouped together, a model for each outcome with all predictors, and finally a model for each outcome including interactions.

Cox proportional hazards modeling were used for testing base models and models with covariates. Cox proportional hazards modeling is particularly useful because there are no assumptions about the baseline survival distribution. It is a non parametric approach and does not require specific assumptions of the functional form of the baseline model. This is different when covariates are added, but the flexibility of the baseline model makes these analyses different than other statistical tests. Assumptions of the Cox proportional hazards models with covariates are discussed later and in the text explaining this study. Cox models also have the flexibility to include multiple covariates and take into consideration the influence of each in a single model.

The cohort design of this study includes variation of participants' grade at enrollment so that adolescents differ in their baseline age. This impacts the assessment of drinking milestones such that some adolescents may experience an outcome prior to their baseline assessment. This interferes with typical of survival analysis which assumes temporal ordering of covariate effects on response variables. To address this potential issue, chi-square tests of demographics and t-tests of the mean scores for predictor variables were compared between early milestone initiators (those reporting drinking milestone attainment prior to their baseline study assessment) and those not reporting early milestone attainment to determine if there is a significant difference between the two groups. No significant differences were found therefore early initiators were kept in the survival models along with the remainder of the sample.

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