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Predictors of alcohol-related negative consequences in adolescents: A systematic review of the literature and implications for future research

Timothy J. Grigsby, B.A.,

Institute for Health Promotion and Disease Prevention, Department of Preventive Medicine, Keck School of Medicine, University of Southern California, 2001, N. Soto St. 3rd floor, Los Angeles, CA 90032, 949-923-1499 [m]

Myriam Forster, PhD, MPH,

Interdisciplinary Research and Training in Child and Adolescent Primary Care, Department of Pediatrics, University of Minnesota, 717 Delaware St. SE, Minneapolis, MN 55414

Jennifer B. Unger, PhD, and

Institute for Health Promotion and Disease Prevention, Department of Preventive Medicine, Keck School of Medicine, University of Southern California, 2001, N. Soto St. 3rd floor, Los Angeles, CA 90032

Steve Sussman, PhD

Institute for Health Promotion and Disease Prevention, Department of Preventive Medicine, Keck School of Medicine, University of Southern California, 2001, N. Soto St. 3rd floor, Los Angeles, CA 90032

Timothy J. Grigsby: tjgrigsb@usc.edu

Abstract

Objective—To conduct a systematic review of the literature examining risk and protective factors of alcohol related negative consequences (ARNCs) among adolescents.

Methods—We conducted a systematic search of original empirical articles published between January 1, 1990 and June 1, 2015. The qualitative synthesis was performed using the Theory of Triadic Influence as a framework.

Results—Fifty-two studies were reviewed. Intrapersonal (e.g., personality traits, drinking motives and expectancies, depression), interpersonal (e.g., parental and peer alcohol use, violence exposure) and attitudinal factors (e.g., media exposure to alcohol, religiosity) influence ARNCs. Emerging evidence of new trends contributing to ARNCs include ready mixed alcohol drinks and childhood trauma and abuse.

Correspondence to: Timothy J. Grigsby, tjgrigsb@usc.edu.

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Conclusions—Risk factors from all domains of influence were observed. More research is needed on protective factors and how alcohol use interacts with preventive factors in predicting ARNCs. The conceptualization of negative consequences varies significantly between studies and may impact the external validity of previous research.

Keywords

alcohol; consequence; problem; adolescent; review

Despite a decline in alcohol use involvement among United States (U.S.) adolescents in middle school and high school in the last several years (Miech et al., 2015), the social costs of alcohol involvement among adolescents remain high. In 2011, almost 40% of adolescent emergency department visits for drug related issues were alcohol related (SAMSHA, 2013) and recent estimates suggest that 8–10% of adolescents report drinking and driving (CDC, 2012; Eaton et al., 2012). Moreover, early to mid adolescence is a normative time for alcohol use initiation and directly precedes the increase in rates of clinical alcohol abuse and dependence that are highest among late adolescents and emerging adults (Grant et al., 2004).

ARNCs are the proximal and deleterious effects of alcohol that impact a drinker psychologically (being unable to cut down on use, etc.), physically (needing a drink first thing in the morning, etc.), interpersonally (getting into fights with friends, etc.) and socially (neglecting responsibilities, being late for school/work, etc.). Previous literature reviews have documented risk and protective factors for alcohol use (rather than consequences) among adolescents—measured commonly as quantity or frequency of alcohol use in a specified time period—and have identified important biological, psychological, interpersonal, social, and cultural factors that lead to alcohol use (Donovan, 2004; Ryan, Jorm, & Lubman, 2010; Stautz & Cooper, 2013).

Zucker and colleagues (2008) reviewed early developmental processes in relation to underage drinking and problem drinking while other researchers have focused on predictors of co-occurring problems involving alcohol (Saraceno et al., 2009) or initiation of alcohol in adolescence leading to future problem alcohol use (Petit et al., 2013). However, no systematic review has focused on adolescent ARNCs despite a number of reviews that catalog risk and protective factors for ARNCs in college students (Perkins, 2002; Ham & Hope, 2003; Mallett et al., 2013). This gap within the scientific literature limits our understanding of alcohol misuse and hinders our ability to develop effective prevention and intervention programs for youth currently using alcohol. This is an important period in which effective interventions could substantially reduce the likelihood of progression towards chronic drinking and ARNCs later in the life course. Research and theory suggest that problem alcohol use—continuing to drink despite incurring negative consequences—is a disparate indicator of alcohol involvement (Smith, McCarthy, & Goldman, 1995), suggesting that those experiencing ARNCs are a distinct subgroup of alcohol users. Moreover, recent evidence indicates that experiencing higher levels of negative consequences from alcohol use predicts alcohol dependence in young adulthood (Dick, Aliev, Viken, Kaprio, & Rose, 2011) underscoring the need to understand problematic

drinking and the manifestation of ARNCs in adolescence to facilitate the development of efficacious secondary prevention programs for this subset of alcohol users.

Theoretical framework

We use the Theory of Triadic Influence (TTI; Flay & Petraitis, 1994) as a heuristic framework to guide the global research questions for the present line of inquiry. The TTI incorporates elements of many existing theories on health behavior and organizes the influences on behaviors into three substantive domains of influence (interpersonal, attitudinal/cultural, and intrapersonal) while discussing the extent to which different factors influence behavior as ranging from very proximal to distal and ultimate. The TTI is flexible in that it expects influences from multiple streams of influence to interact and have a combined effect on behavior. This, in combination with the exhaustive list of causal factors and applicability to continued behaviors, makes it desirable as a theory to explain substance use behaviors.

Within the interpersonal domain, ultimate variables can include stress in the household, distal variables include drug use role models, and proximal variables include peer norms (e.g., perceived social approval for drug use and estimates of prevalence of drug use). Within the attitudinal/cultural domain, ultimate variables include community disorganization (community stress), distal variables include development of hedonic values or alienation, and proximal variables include expectancies regarding drug use benefits minus costs. Finally, within the intrapersonal domain, ultimate variables include biological temperament (i.e., biological stress), distal variables include depression and poor coping, and proximal variables include refusal self-efficacy and intentions to use drugs. One may interpret this theory to describe the degree to which an individual may suffer negative experiences or stressors in the intrapersonal, interpersonal and cultural domains of their life.

Goal of review

We conducted a systematic review of the literature from 1990 to 2015 to evaluate risk and protective factors for adolescent alcohol-related negative consequences. This timeframe was selected as (1) prior reviews captured this phenomenon for studies conducted prior to 1990 (Hawkins, Catalano, & Miller, 1992) and (2) standardized alcohol consequence measures have become available and more widely used during this time frame (White & Labouvie, 1989). We organize the findings of the review, using the TTI as a theoretical framework, according to domain of influence.

Methods

To ensure accuracy and transparency, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement has been followed where applicable (Moher, Liberati, Tetzlaff, & Altman, 2009). In June 2015, computer based searches of Google Scholar, PubMed and PsycINFO were conducted. We combined search terms for alcohol consumption (alcohol OR drink OR “binge drinking”), negative consequences (consequence OR “negative consequence” OR “problem use”) and age group (adolescent OR teen OR “middle school” OR “high school”) factors.

The following inclusion criteria were used to select articles for the review: 1) measure predictors and outcomes during adolescence defined as the age group of 12–17 years old, 2) published between January 1, 1990 and June 1, 2015, 3) the outcome had to be measured using a self-report scale that captured the type and/or frequency of negative consequences experienced following the use of alcohol, and 4) presented results from non-clinical (i.e., community or school) samples. Studies that defined “problem use” as a risky drinking behavior (e.g., binge drinking) were not considered as we were not interested in alcohol use behavior, but rather in predictive factors for alcohol related consequences that result from drinking (e.g., accidents, injuries, neglecting responsibilities).

Figure 1 demonstrates the literature search and selection process. An initial 1,114 records were identified after screening titles and abstracts for keywords in the initial search and 572 remained after removal of duplicates. Five additional articles were identified from the reference sections of identified papers. We screened 140 manuscripts and retained 65 full-text articles after applying inclusion restrictions. The primary justifications for excluding articles were either that the study samples were comprised of young adults rather than adolescents or that the dependent variable (ARNCs) was treated as a predictor not an outcome. Following full-text reviews, we included 52 articles in the final qualitative analysis.

Data extraction and information synthesis

We consulted the Matrix Method guidelines (Garrard, 2013) for data extraction and information synthesis of the literature. Items abstracted include: author names and year of publication, study design (cross sectional, follow-up with data from 2 time points or longitudinal with data from 3 or more time points), sample characteristics (sample size, age, gender, ethnicity), hypothesized predictors, mediators, moderators, and covariates, measurement and operationalization of negative consequences, and a summary of the main findings. We structured the results section and associated tables using the TTI as a framework (Flay & Petraitis, 1994). The results section is organized by alcohol use patterns in alcohol related negative consequences and subsequently by theoretical domain based on the level of influence (i.e., predictor) under investigation: intrapersonal (e.g., psychological, genetic), interpersonal (i.e., family use and communication, peer use), social/contextual/cultural (e.g., drinking settings, drinking behavior, acculturation). Finally, we explore gender and racial/ethnic differences in a) predictors of ARNCs and b) types and patterns of ARNCs experienced.

Results

Summary of studies

Alcohol-related negative consequences (ARNCs) were the main outcome of all studies; however, some papers describe this outcome as “problem use,” “alcohol use problems,” or “problematic alcohol use.” Validated and non-validated measures were used (see Table 1), and the conceptualization and operationalization of the outcome (ARNCs) varied as a result. Negative consequences were observed over different time periods (i.e., past week, past month, past year, etc.) and diverse sampling frames (i.e., school based, community based).

The reader should remain mindful of these measurement limitations when interpreting these findings.

Alcohol use behavior

Approximately 29 (55.8%) of the studies included in the review controlled for alcohol use (frequency or quantity) in their statistical models—though this includes studies that were primarily interested in the relationship between amount of alcohol use and experience of negative consequences as described below. Alcohol use was more commonly controlled for in cross sectional studies (59.1%) relative to follow-up and longitudinal studies (53.3%).

Higher amounts of alcohol use was a consistent predictor of experiencing alcohol-related negative consequences (Clapp & Shillington, 2001; Colder et al., 2002; Heron et al., 2012; Ko et al., 2008; Kuntsche et al., 2009; Mason et al., 2011; McMorris et al., 2011; Oullette et al., 1999; Reimuller et al., 2011; Rose et al., 2012; Swaim et al., 2011; Zoccolillo et al., 1999). Higher quantity of alcohol use may be more likely to lead to alcohol-related negative consequences for non-frequent drinkers as compared to regular drinkers (Rose et al., 2012). Alcohol use may also mediate and moderate the effects of other risk and protective factors (Kuntsche et al., 2009; McMorris et al., 2011; Reimuller et al., 2011; Stice et al., 1998; Windle et al., 2000) suggesting that alcohol use level is important to consider when evaluating the importance or causal effect of predictors.

There was additional evidence suggesting that earlier age of alcohol use initiation or regular use was a risk factor for ARNCs (Kuntsche et al., 2009; Mason et al., 2011; Song et al., 2012; Swaim et al., 2011). Drinking context may also have a significant relationship with the experience of specific alcohol-related negative consequences. Clapp & Shillington (2001) reported that private drinking contributes to school/work consequences. One study (Wicki et al., 2006) investigated an alternative alcohol product in a sample of Swiss adolescents known as alcopops (ready mixed soft drinks containing alcohol). The results showed that frequency of consumption was associated with an increase in the odds of experiencing any ARNC suggesting that, like other alcohol products, increased frequency is associated with an increase in the probability of experiencing negative consequences.

Biological/Intrapersonal factors

Biological influences—One study (Baer et al., 1998) presented biological evidence suggesting that prenatal alcohol exposure had a stronger association with future ARNCs than having a family history of alcohol use problems. Knopik and colleagues (2009) found that, among twins, the heritability of experiencing ARNCs was not significant whereas environmental factors were. However, a family history of alcoholism was a significant predictor supporting earlier research (Stice et al., 1998). This burgeoning evidence suggests that environmental influences may be more important in predicting ARNCs. The remaining studies focused on intrapersonal (i.e., psychological) factors.

Comorbid psychological problems—Several studies provided evidence that comorbid psychological problems contributed to the incidence, and prevalence, of ARNCs among teenage drinkers. Experiencing alcohol-related negative consequences were higher for those

meeting a clinical diagnosis for drug use or behavioral disorders (Rohde et al., 1996) and Internet addiction (Ko et al., 2008). A similar pattern of findings was made for those exhibiting internalizing or externalizing symptoms (Stice et al., 1998), conduct problems (Knopik et al., 2009), or antisocial problems (Bonomo et al., 2001; Marmorstein, 2010).

Two studies suggest that higher levels of depressive symptomology were associated with a higher level of ARNCs (Marmorstein, 2010; Rohde et al., 1996). Marmorstein's (2010) findings elaborate this general finding to suggest that comorbid depression and delinquency may have a greater impact for females than males.

Expectancies and motives—Drinking motives are reasons for drinking, whereas alcohol use expectancies describe the anticipated positive consequences of alcohol use. Windle (2000) observed that drinking to cope motives (i.e., drinking to reduce stress, depression, etc.) mediated the relationship between peer influence and ARNCs. Drinking to cope motives mediated the relationship between negative thinking, impulsivity and sensation seeking with ARNCs (Lammers et al., 2013). Coping motives also mediated the relationship between bullying victimization and ARNCs (Topper et al., 2011). Lammers and colleagues (2013) were the only group to investigate the role of other drinking motives, and found evidence that social and expectancy motives also contribute to the experience of ARNCs.

Drinking expectancies were investigated more frequently as a predictor of ARNCs. Having greater positive expectancies for alcohol use was a predictor of ARNCs cross-sectionally (Connor et al., 2011; Moulton et al., 2000) and longitudinally (Connor et al., 2011; Oullette et al., 1999; Wills et al., 2009). Oullette and colleagues (1999) posit that alcohol use expectancies are indirectly associated with ARNCs through such factors as behavioral willingness and alcohol consumption levels.

Perceived stress—The number of past-year stressful events was positively associated with ARNCs in one study (Eitle et al., 2013). Stress control was an important discriminator between drunk drivers and non-drunk drivers that varied by gender (Treiman & Beck, 1996) suggesting that one's ability to handle stress, or experience resilience, may predict susceptibility to experiencing ARNCs.

Self-regulation—Self-regulation is defined as a series of personality traits that contribute to self-maintenance and decision-making (Mason et al., 2011). Impulsivity (the inability to resist strong urges with a tendency to respond to stimuli without forethought) was directly and indirectly associated with ARNCs, through drinking motives, in the same study (Lammers et al., 2013) that found sensation seeking indirectly associated with ARNCs through drinking motives. Mason and colleagues (2011) suggested that self-regulation levels were an important prospective predictor of experiencing ARNCs for adolescents in the U.S. and Australia.

A study conducted by Connor et al. (2011) concluded that drink refusal self-efficacy was not protective against experiencing ARNCs although self-esteem has been inversely associated with ARNCs among Taiwanese adolescents (Ko et al., 2008).

Social/Interpersonal factors

Parental use and family alcohol norms—Parent alcohol use (Bonomo et al., 2001; Eitle et al., 2013; Ko et al., 2008; Mares et al., 2011; Windle, 2000; Yeh, 2006; Yen et al., 2008) was a strong risk factor for experiencing ARNCs, an association that has also been observed among children of parents diagnosed with alcoholism (Knopik et al., 2009; Stice et al., 1998; Swaim et al., 2011). Parental awareness and responsiveness to alcohol use also had an effect on drinking and driving among adolescents (Bogenschneider et al., 1998). McMorris and colleagues (2011) concluded that family contexts for alcohol use were similar between US and Australian teens. For adolescents in both countries, favorable parental attitudes toward alcohol and supervised drinking were risk factors for ARNCs. Only one study investigated the role of sibling alcohol use (Windle, 2000), and found a positive association between sibling use and experiencing ARNCs.

Parent-adolescent relationship—Family functioning may have protective effects for experiencing ARNCs. Increased parental monitoring, for example, may buffer against ARNCs (Arata, Stafford, & Tims, 2003). Evidence suggests that higher levels of perceived family functioning (Ko et al., 2008), parental involvement (Maldonado-Molina et al., 2011) or the quality of parent-adolescent relationships (Kuntsche et al., 2009) can protect against ARNCs for adolescents. Other family factors such as higher parental education are also protective against ARNCs for adolescents (Kendler et al., 2014). Reimuller and colleagues (2011) documented that, for adolescent alcohol users, permissive messages about alcohol use and outcomes contributed to the likelihood of experiencing ARNCs. Other work (Mares et al., 2011) found that parents were more likely to communicate about alcohol with their adolescent children when they reported more ARNCs themselves.

Peer use and norms—Peer influence, promoting a behavior through social reinforcement of attitudes, also showed a strong, positive relationship with ARNCs (Arata, Stafford, & Tims, 2003; Stice et al., 1998). In most cases, peer alcohol use (Maldonado-Molina et al., 2011; Mason & Windle, 2002; Wills et al., 2009; Windle, 2000), peer substance use (Eitle et al., 2013) or other peer influences had the strongest relationship with ARNCs among adolescents. Interestingly, Bonomo et al. (2001) found that parent and peer alcohol use contributed to the risk of different negative consequences, which suggests that social influences may contribute to different patterns of alcohol use.

History of physical violence—Experiencing physical abuse was positively associated with ARNCs among a sample of adolescents from Taiwan (Yen et al., 2008). Topper and colleagues (2011) found a direct and indirect association between bullying victimization and ARNCs. This finding is particularly interesting as the relationship was mediated by coping motives and the result was not replicated when quantity or frequency of alcohol use was examined as the outcome in the same sample. Violent youth, however, were no more or less likely to report ARNCs than non-violent youth (Maldonado-Molina et al., 2011), yet this is not true for delinquent youth (Marmorstein, 2010).

Cultural/attitudinal factors

Parent and peer alcohol use attitudes—Positive parental attitudes toward alcohol or providing access to alcohol were also important risk factors for experiencing ARNCs (Arata, Stafford, & Tims, 2003; Bailey & Rachal, 1993; Donovan et al., 1999; McMorris et al., 2011; Song et al., 2012; Stice et al., 1998). Parents can serve as a source of access to alcohol and increased positive attitudes toward alcohol may rationalize “supervised drinking” which has been shown to increase, rather than decrease, rates of ARNCs (McMorris et al., 2011). Perceived peer alcohol use and peer attitudes toward alcohol use was also investigated and the results of several studies show a positive association between normative peer use, or positive alcohol attitudes, and experiencing ARNCs (Arata, Stafford, & Tims, 2003; Bailey & Rachal, 1993; Donovan et al., 1999; Oullette et al., 1999; Song et al., 2012). Perceiving alcohol use as normative or as a socially desirable behavior may lead to increased consumption leading to a higher chance of experiencing ARNCs.

Non-alcohol attitudes—ARNCs were inversely related with positive attitudes toward school (Ko et al., 2008) and having an increased expectation for attending college (Maldonado-Molina et al., 2011). However, one study found that adolescents with a jock identity (showing a preference for athletics over academics) showed an increase in ARNCs (Miller et al., 2003). This finding supports other evidence showing an increased propensity for ARNCs in the context of sports involvement (Mays et al., 2012).

Religiosity—Song and colleagues (2012) conceptualized religiosity as the frequency of attendance to religious services and found that it was protective against driving under the influence of alcohol or riding with a driver under the influence of alcohol. A more thorough exploration of religiosity and alcohol use (Brown et al., 2001) found that frequency of prayer was the protective against problem drinking for black females, but not for black males. For white adolescents, the level of importance placed on religion was the most significant predictor of ARNCs. For white females, ARNCs were lower when importance increased but this relationship was inversely associated with ARNCs for white males. Engagement in spiritual activities may serve as an alternative coping mechanism for stress and provide adolescents with access to social networks where alcohol use is sparse.

Media exposure and marketing—In a longitudinal study of early adolescents, Wills and colleagues (2009) found that movie alcohol exposure was prospectively and positively associated with ARNCs after accounting for other relevant risk and protective factors. This finding suggests that adolescents may view alcohol in the media as a cue for alcohol use, increasing their perceptions of alcohol use as a normative behavior. Theoretically, this may also explain why parent alcohol use is a risk factor for ARNCs among adolescents though more work is needed to evaluate this theoretical assumption. In a study of African adolescents (Swahn et al., 2011), alcohol marketing, and specifically being provided free alcohol from a company representative, was significantly associated with experiencing an ARNC, and alcohol education was not protective.

Gender differences

There was a strong pattern of evidence suggesting that males experience more ARNCs relative to females (Bogenschneider et al., 1998; Copeland et al., 1996; Costa et al., 1999; Mancha et al., 2012; Maldonado-Molina et al., 2011; Martin et al., 1995; Smith et al., 1995; Yeh, 2006; Yen et al., 2008; Zoccolillo et al., 1999). However, several studies suggest that the patterns of negative consequences differ across gender. For example, Kendler and colleagues (2014) found that females had a higher rate of alcohol abuse/dependence symptoms, but a lower level of behavioral consequences (e.g., fighting) relative to males. In another study, males reported more arguments or fights while intoxicated whereas females reported memory loss after alcohol consumption more than males did (Oullette et al., 1999). These findings suggest that while males appear to be at greater risk for ARNCs, the manifestation of problematic alcohol use likely differs for males and females (Martin et al., 1995; Rose et al., 2012).

There were also several important gender differences observed in the prediction of ARNCs suggesting that males and females may vary in their level of susceptibility to certain risk and protective factors (Martin et al., 2000; Treiman & Beck, 1996). For instance, Marmorstein (2009) documented that depression was associated with higher initial levels of ARNCs for females, and faster increases in ARNCs over time among males. Brown et al. (2011) found that males and females were protected by different practices of religiosity. Some global psychosocial and behavioral influences were stable across genders. Donovan et al. (1999) suggests that friend models of drinking and drug use have a similar pattern of association for males and females. Social and enhancement motives for drinking also appear to have a similar relationship for males and females (Lammers et al., 2013). Marmorstein (2010) found that while delinquent behaviors and depressive symptoms predicted higher initial rates of ARNCs for males and females, that this combination of risk factors predicted a more rapid increase in ARNCs for males relative to females.

Racial/ethnic differences

The majority of evidence suggests that White adolescents are more likely to report ARNCs relative to ethnic minority groups (Maldonado-Molina et al., 2011; Miller et al., 2003). One study found that White adolescents were less likely to experience ARNCs despite reporting higher frequency of use (Bailey & Rachal, 1993). Costa et al. (1999) found evidence, in a multiethnic but predominantly Hispanic sample, that being nonblack was associated with earlier initiation into ARNCs. While many samples were multiethnic, a disproportionate number of studies used White adolescents samples, making racial/ethnic comparisons of ARNCs difficult.

There was also mixed evidence of racial/ethnic differences in the pattern of risk and protective factors for experiencing ARNCs. Costa et al. (1999) reported no significant interactions between race/ethnicity and several risk factors for ARNCs cross-sectionally and longitudinally. Miller et al. (2003), however, found White students were at higher risk for ARNCs when having a jock identity relative to African-American adolescents. The protective effect of religiosity differed between African-American and White adolescents (Brown et al., 2001) as well as by gender within each ethnic group. Three studies were

carried out with non-White samples and found evidence of risk factors within the family context (Swaim et al., 2011; Yen et al., 2008) and in media exposure to alcohol (Swahn et al., 2011).

Discussion

The goal of this review was to identify and classify the factors that influence the experience of ARNCs for adolescents across domains of influence that could be useful for prevention and intervention programming.

It is difficult to pinpoint a precise level of alcohol consumption that would be associated with a meaningful increase in ARNCs because (1) multiple methods have been employed across studies to measure consumption, and (2) alcohol use quantity and frequency vary considerably between individuals and settings. This review also presents evidence that the relationship between alcohol use and consequences are probably mediated or moderated by other variables described in this review, such as drinking to cope or alcohol specific communication with parents. However, nearly half of the studies (44.2%) did not control for alcohol use frequency or quantity in their statistical models. The exclusion of alcohol use as a covariate may bias the estimates of hypothesized risk and protective factors for ARNCs, leading to over- or underestimation of their importance in predicting ARNCs.

At the intrapersonal/biological level, a consistent pattern of evidence suggests that coping and social enhancement motives play an important role in the misuse of alcohol in adolescent and young adult samples. Drinking to cope supports hypotheses that alcohol is used as a method of self-medication to handle psychological and physical problems (Swendsen et al., 2000; Bolton et al., 2009), although the empirical evidence presented here suggests it may introduce more harms than benefits. Specific motives or expectancies may be related to experiencing different forms of negative consequences and may be more relevant in predicting use within specific contexts where underlying psychological issues or quantity/frequency of use may be heightened although more work is needed to elucidate these relationships.

A wealth of research examined factors from the social/interpersonal stream of influence. The present review offers evidence that peers serve an important role in the experience of ARNC supporting earlier work that social factors contribute to alcohol use experimentation and regular use (Donovan, 2004; Mundt, 2011). However, active peer influence is likely more important during adolescence and becomes less important during early and later adulthood as social networks change and the importance of peer approval in one's sense of identity diminishes (Harakeh & Vollebergh, 2012). As such, peers may only serve as a risk factor for ARNCs at certain developmental phases, especially adolescence. Participating in athletics may or may not be a cause of ARNCs (Lisha & Sussman, 2010; Mays et al., 2012; Moulton et al., 2000), and it is possible that these findings reflect the importance of the social context in which alcohol is consumed, and possibly misused, with peers.

The results of several studies suggest that parental alcohol use and misuse is significantly related to experiencing ARNCs directly and indirectly through other relationship

mechanisms. These behavioral relationships support previous work on the heritability of alcohol and drug use disorders and the importance of behavioral genetics research (Enoch & Goldman, 2001; Urbanoski & Kelly, 2012). The emotional and physical relationships parents have with children can impact alcohol use behavior. Deficits in parental relationships may be exacerbated in situations where parents approve of alcohol use or use alcohol at a problematic level.

The association between exposure to physical violence and ARNCs observed in two studies (Topper et al., 2011; Yen et al., 2008) should encourage researchers to explore the processes that lead from the experience of abuse or trauma to ARNCs. Noll (2008) has suggested that delays in important emotional and social developmental processes are relevant to negative health behaviors for individuals that have experienced sexual trauma, and this work should be replicated in the examination of trauma and ARNCs. Strengthening resilience skills or enhancing delayed developmental processes may serve as targets for intervention programs with these populations.

There was less research on cultural/attitudinal variables in relation to ARNCs relative to other streams of influence. Attitudes toward alcohol in family and peer contexts may also serve as valuable intervention targets. However, further research is needed to establish viable alternative activities that can reduce alcohol use and the experience of ARNCs, as a result. Engaging in academic and religious activities could defer ARNCs, however more longitudinal studies with diverse samples are needed to understand these relationships. Moreover, additional research is needed to understand if media depictions cue alcohol use and influence the occurrence of ARNCs among adolescents.

Finally, we identified important gender and racial/ethnic differences that warrant discussion. Our finding that males and females experience different rates of specific ARNCs highlights the need for gender specific screening and intervention efforts for alcohol misuse. For males, more emphasis should be placed on youth using other substances or who are involved with delinquent, at-risk peers while also aiming to reduce social or behavioral consequences of alcohol use (i.e. getting into fights and missing school or work). For females, more attention toward comorbid psychological problems (e.g., depression or negative affect) and social influences with the goal of reducing intrapersonal consequences of alcohol use, such as blacking out or being unable to cut down on use. There was mixed evidence suggesting that differences in ARNCs differ among racial/ethnic groups, although preliminary evidence suggests that White adolescents experience more ARNCs. However, the current scarcity of rigorous multiethnic research disallows any conclusions regarding the role of ethnicity in ARNC rates and the importance of specific risk and protective factors from different streams of influence.

Theoretical implications

The Theory of Triadic Influence (TTI; Flay & Petraitis, 1994) was used as a framework for reviewing and organizing the results of this review. We found evidence of influence in all domains (intrapersonal, interpersonal and cultural/attitudinal), but with differing degrees of emphasis on proximal, distal and ultimate causes within each domain. For instance, the majority of the research on intrapersonal variables focused on distal factors (e.g., depression,

coping) with less work focusing on proximal factors such as intentions to use alcohol or ultimate causes, including biological measures of stress or genetic predisposition to alcohol misuse. At the interpersonal level, there was slightly more research on proximal factors (e.g., peer and parent use) as compared to distal or ultimate causes such as role models or household stress, respectively. Finally, there was very little research on cultural/attitudinal variables, but a growing body of evidence supports the role of cultural factors (e.g., familismo) and attitudinal factors (e.g., positive versus negative consequences) as meaningful predictors of ARNCs.

These patterns offer a fruitful line of future work that can address the theoretical limitations of previous work. First, more interdisciplinary work is needed to assess multiple influences—biological, psychological, social, and environmental—on ARNCs simultaneously. Second, the lack of work examining cultural and attitudinal variables needs to be addressed. Understanding alcohol use as a reaction to community level stressors or how expectancies vary between problem users and non-problem users may supply useful information that explains how individuals come to experience negative alcohol related consequences. Finally, more research examining the role of ultimate, underlying, causes of ARNCs may warrant opportunities for early primary prevention programs to be most successful.

Recommendations for future research

While the present review identified important risk and protective factors for alcohol-related negative consequences at different levels of influence, there remain important gaps in the literature that require further attention. First, we observed a lack of longitudinal research. This is somewhat expected as a long-term pattern of negative consequences would be identified as an alcohol use disorder (First et al., 2012). However, evidence from the present review using follow-up (2 time points) or longitudinal (3 or more time points) designs have provided evidence for temporal associations for factors that have otherwise been studied cross-sectionally.

Second, an overwhelming proportion of the research included in the present review came from non-Hispanic White and female samples. While national data suggests that non-Hispanic Whites are more likely to engage in binge drinking and heavy drinking patterns (SAMHSA, 2008), the lack of research with minority populations makes it difficult to translate prevention efforts for multiethnic populations. Males have been consistently documented as drinking more, and experiencing more ARNCs, than females (Nolen-Hoekesema, 2004); yet, the majority of the literature examined in this review came from samples with more females than males. Several studies stratified the analyses by gender—or created interaction terms to investigate effect modification—revealing important gender differences in patterns of risk and protective factors.

Third, some risk and protective factors have been the topic of multiple investigations while others remain understudied. For instance, previous traumatic experiences and the use of prepared alcohol mixes or mixing of alcohol with other drinks (such as energy drinks) have a strong relationship with alcohol-related negative consequences but have been studied sparingly compared to other variables such as impulsivity, depression or parental influence.

A final gap in the literature stems from the conceptualization and operationalization of negative alcohol use consequences. The majority of manuscripts (n=24) utilized standalone measures despite the wealth of validated measures of alcohol-related negative consequences that exist. We also documented a varied approach to the operationalization of alcohol-related consequences including a dichotomous outcome (never/ever experience a consequence from drinking), an index score (total number of consequences experienced), a total score (total frequency of any number of consequences experienced) or latent factors used for structural equation models (combining multiple facets of alcohol use involvement or focusing on consequence items with highest factor loadings—those that explain the most variance in the outcome). These myriad approaches change the scope of the analysis (linear vs. nonlinear) and produce different substantive findings as a result. Researchers should remain cognizant of what it means to be a “problem user.” This is an important limitation that should be considered when preparing for a statistical analysis where ARNCs are an outcome variable of interest.

Limitations

There are limitations to the current review that should be considered. First, we limited the review to survey based studies published between January 1, 1990 and July 1, 2015 using three search engines, and relevant studies may have been overlooked. Second, we chose to focus exclusively on adolescents, and these findings may not translate to younger or older populations. Third, there is a dearth of longitudinal studies (i.e., temporal ambiguity) and no published meta-analyses on these relationships making it difficult to draw any cause and effect conclusions. Finally, the present review focused on negative consequences of alcohol and cannot be generalized to other substances.

Conclusions

The majority of work to date has focused on risk factors for ARNCs—a pattern that has been seen in work with college students and young adults (for review, see Mallet et al., 2013)—calling for more work that can identify protective factors that could be integrated into prevention and intervention programs for youth at risk of experiencing alcohol-related negative consequences. While the present review contributes to previous findings in young adult samples, some priority areas for further exploration include: 1) more work investigating biological antecedents from a multidisciplinary perspective, 2) more prospective investigations identifying indirect associations between factors from different levels of influence concurrently and 3) more gender-specific and culturally competent research to identify individual risk and protective factors.

A large proportion of studies evidenced important gender differences in the quantity or frequency of alcohol-related negative consequences and differences in susceptibility to risk and protective factors. As such, we recommend more research to investigate gender specific risk and protective factors for adolescent alcohol users to aid in the development of tailored intervention programs to reduce or eliminate ARNCs. White adolescents appear to be at a higher risk for ARNCs relative to African American teens, but more work is needed to investigate racial/ethnic differences across other minority groups (i.e. Hispanic/Latino, Asian and Middle Eastern ethnicities). In particular, cultural risk and protective factors for

experimentation and regular use of alcohol (Castaldelli-Maia & Bhugra, 2014; Cook et al., 2013; Unger, 2014) should be investigated in relation to ARNCs within and between these groups.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Flowchart to identify articles for inclusion.

Table 1

Names and abbreviations of scales used to measure alcohol related negative consequences across studies included in review.

Scale abbreviation	Scale – full name	# of studies using scale
AUDIT	Alcohol Use Disorder Identification Test	2
CRAFFT	Acronym for items in measure	1
–	Drinking Styles Questionnaire	1
DSM	Diagnostic and Statistical Manual abuse/dependence criteria	6
–	National Longitudinal Study of Adolescent Health (subscale)	1
PDS	Problem Drinking Scale	1
PEI	Personal Experience Inventory	1
RAPI	Rutgers Alcohol Problem Index	9
–	Victoria Adolescent Health Survey (subscale)	1
—	Drinking and driving only	4
–	Items developed by research team	25

Note: 'Items developed by research team' category also includes studies where researchers borrowed items from multiple scales to create an index of negative consequences.

Table 2

Summary of studies included in review

Author(s) and year	Study design	Sample characteristics	Main Findings
Arata, Stafford, & Tims (2003)	CS; High school student sample	n = 654 Age: M = 15.6 (SD=1.13) 48% female Ethnicity: Unknown	Controlling for gender and year in school, parental access, approval and monitoring, but not permissiveness, were associated with ARNCs. Peer norms and susceptibility to peer pressure were significantly associated with ARNCs.
Baer et al. (1998)	L; Community based sample	n = 439 Age: M = 14.4 47% female 90% Caucasian (based on biological mother self-report)	Prenatal alcohol exposure had a stronger relationship with adolescent ARNCs than family history of alcohol problems after controlling for additional covariates.
Bailey & Rachal (1993)	L; School based sample	n = 2,771 Age: unknown, students followed from grades 6, 7 & 8 to grades 9, 10, 11 50% female 70% Caucasian	White students reported fewer ARNCs despite reporting more frequency of use. Lifetime use of cigarettes, marijuana or illicit drugs was associated with more ARNCs. Friends' approval of use was also a significant factor and males reported more ARNCs than females. Parental approval and academic factors (grade level and academic performance) were not related with experiencing ARNCs.
Bellis et al. (2009)	CS; School based sample	n = 8,263 Age: 15–16 years 52.1% female Ethnicity unknown	Experiencing violence when drunk, alcohol-related regretted sex and forgetting things, or reporting drinking in public places, increased with drinking frequency, binge frequency and number of drinks consumed per week. At similar levels of consumption, experiencing any negative alcohol-related outcome was lower for those whose parents provided alcohol. Drunken violence was disproportionately higher among males and greater deprivation while regretted sex and forgetting things after drinking were associated with being female. Independent of drinking behaviors, consuming cheaper alcohol was related to experiencing violence when drunk, forgetting things after drinking and drinking in public places.
Bogenschneider et al. (1998)	CS; School based sample	n=1,227 Age: M=16 (SD unknown) 48% female ~90% Caucasian	<i>Drinking and driving results</i> Males reported more drinking and driving than females. For those with a father that was aware of their adolescent's alcohol use, more responsiveness was associated with a lower likelihood of drinking and driving. The same was not true for those with unaware fathers. Having a mother that was unaware of their alcohol use, more maternal responsiveness was associated with a greater likelihood of drinking and driving. This was not seen when examining those with mothers that were aware of their alcohol use. Also among those with unaware mothers, older adolescents were more likely to report drinking and driving than younger adolescents
Bonomo et al. (2001)	CS; High school student sample	n=658 Age: M=16.5 (SD = 0.6) 56% female Ethnicity: Unknown	Accidents/injuries and sexual risk-taking were most commonly reported negative consequences, and frequency varied by gender. Peer and parent use had different effects for different consequences, and psychiatric morbidity and antisocial behavior contributed to the presence of specific ARNCs.
Brown et al. (2001)	CS; High school student sample	n = 899 Age: M = 14 (SD = 0.7) 54% female 57.5% Caucasian	In terms of religiosity, frequency of prayer was the significant predictor of ARNCs for black adolescents, and there was evidence that this relationship was stable for black females, but not for black males. For white adolescents, the level of importance placed on religion was the most significant predictor of ARNCs. For white females,

Author(s) and year	Study design	Sample characteristics	Main Findings
Clapp & Shillington (2001)	CS; Community sample	n = 1,080 Age: M=16.3 (SD=1.7) 51.5% female 48.3% African-American	ARNCs were lower when importance increased but this relationship was inverse for white males. Alcohol use intensity had the strongest direct effect on ARNCs in each component. Drinking in private had a direct inverse association with school/work problems and loss of control and peer drinking was positively associated with loss of control.
Colder et al. (2002)	L; Middle-high school sample	n = 1,918 Age: unknown (students followed from grades 7–12) 52% female 41.8% Hispanic	Drinkers categorized as rapid escalators had the highest predicted probability of experiencing 2+ alcohol consequences followed by escalators and different subtypes of heavy drinkers.
Connor et al. (2011)	F-U; High school sample	Baseline n = 192 Age: M=13.8 (SD = 0.5) 55.7% female 65% Australian	At time one, alcohol use expectancies (AE) were significantly associated with greater alcohol use involvement, but there was no association with drink refusal self-efficacy (DRSE). At time two, the inverse was true such that no relationship was present with time one AE, but DRSE at time one was negatively associated with alcohol use involvement at time two. AE and DRSE explained 69% and 64% of the variance in time one and time two alcohol use involvement, respectively. Note: Outcome was measured as a latent factor comprised of frequency and quantity of alcohol use and total AUDIT score for items 3–9.
Copeland et al. (1996)	CS; High school sample	n = 2,922 Age: unknown (high school seniors) 47% female 92% Caucasian	Outcome measured was drinking and driving. Frequent binge drinking and riding with a drunk driver consistently predicted drinking/driving. Other risk factors, varying by year of graduation, included being male, smoking cigarettes, frequent use of a motor vehicle, having a driving offense on record, and years since receiving license.
Costa et al. (1999)	CS & L; School based sample	n = 1,404 Age: unknown (students followed from grades 7, 8, 9 to 10, 11, 12) 54% female 40% Hispanic	Problem drinking defined as getting drunk <u>and</u> experiencing ARNCs. Cross sectional findings: Females were less likely than males to experience ARNCs. Stress was a significant risk factor while peers as models of substance use behavior, hopelessness and dropout proneness were marginally significant. Engaging in prosocial activities was the only significant protective factor while intolerance to deviance was marginally significant. Also some evidence that having a positive orientation toward school may increase risk for problem drinking. Longitudinal findings: Being younger and being nonblack predicted earlier initiation into ARNCs. Controlling for demographic features, peers as models of substance use behavior was a significant risk factor for earlier initiation into ARNCs. Having higher levels of intolerance toward deviance was inversely related with earlier initiation into ARNCs. There were no differences in findings by gender or race/ethnicity.
Donovan et al. (1999)	CS; Two nationally representative studies and 4 community based studies compared	n = 5,477 males; 6,905 females Age: unknown (grades 10–12) 32.2%-91.2% Caucasian across cohorts	Note: Results based on analysis of common negative consequences assessed in six cohorts between 1972–1992. Males and females demonstrated similar psychosocial and behavioral factors related to ARNCs—and these findings were stable over time among the different cohorts. For males the only factors that changed over time were friend's approval of drinking. For females, the following factors changed over time: respect for independence, parent-peer compatibility, parent approval of drinking, friend models for drinking and drug use, frequency of marijuana use and general deviant behavior. The Problem Behavior

Author(s) and year	Study design	Sample characteristics	Main Findings
Eitle et al. (2013)	F-U; Community based sample	n = 660 Age: unknown (grades 7–12) Gender: unknown 100% Native American	Theory explained about 40% of the variance in ARNCs across the different cohorts. In the final statistical model, past year stressful events, peer substance use, parental drinking, and having an extended family member of non-family member under 21 in the household were associated with an increased risk of experiencing ARNCs. Living in a non-parent family was the only protective factors.
Heron et al. (2012)	L; Community based sample	n = 4,092 Age: Median = 16 Gender: unknown Ethnicity: unknown	When predicting scores in the hazardous range (a total of 8–15 on the AUDIT), the unadjusted odds increased as frequency and typical consumption increased. The same pattern was observed when examining the odds of having a harmful AUDIT score (16+ points on the AUDIT) for both frequency of use and typical consumption.
Kendler et al. (2014)	L; Community based sample	n = 4,117 Age: 16 Gender: unknown Ethnicity: unknown	Results from multivariate models at age 16 show that females have a higher odds of reporting alcohol-dependence symptoms, but a lower odds of reporting alcohol behavioral problems, relative to males. Higher parental education was related to a lower odds of reporting alcohol behavioral problems, but was not related to reporting alcohol-dependence symptoms. Parental income and occupational status were not associated with either outcome.
Knopik et al. (2009)	L; Community based sample	n = 1,446 twin pairs Age: M = 15.2 100% female Ethnicity: unknown	Parental alcoholism and smoking was positively associated with ARNCs. Maternal substance use during pregnancy was not associated with future ARNCs. The heritability of alcohol use problems was not significant, but shared environmental factors (for twins) was a significant predictor of ARNCs. Conduct problems were correlated with ARNCs and believed to be due to environmental, rather than genetic, factors.
Ko et al. (2008)	CS; High school sample	n = 2,114 Age: M = 16.3 (SD=0.99) 43% female Ethnicity: unknown	Univariate analyses showed a relationship between internet addiction and ARNCs (no direction assumed). Additional univariate analyses showed associations between categorical predictors (gender, family alcohol use, parent-adolescent conflict, inter-parental conflict, friend's alcohol use and deviant behavior) and continuous predictors (age, behavior inhibition system, behavior approach system, attitude toward school, self-esteem, perceived family functioning) with ARNCs.
Kuntsche et al. (2009)	L; Community based sample	n = 364 Age: 15.2 (SD=0.6) 47.3% female 95.6% Dutch	Alcohol use significantly mediated the relationship between age at first drink and ARNCs for adolescents reporting a high-quality relationship with parents, but this was not evidenced among those reporting low-quality relationships with parents.
Lammers et al. (2013)	CS; School based sample	n = 3,053 Age: M=14.0 (SD=0.95) 47.1% female 86% Dutch	There is a direct association between impulsivity and ARNCs. The relationship between impulsivity and sensation seeking with ARNCs were mediated by social and enhancement motives for males and females. Social and enhancement motives also mediated the path from negative thinking to ARNCs for both genders. Finally, coping motives mediated the relationship between negative thinking, impulsivity and sensation seeking with ARNCs.
Maldonado-Molina et al. (2011)	L; Community based sample	n = 10,828 <i>Baseline</i> Age: M=15.3 52.9% female 63.6% Caucasian	There was no evidence that violence was predictive of ARNCs. The odds of experiencing ARNCs was higher for males, Whites, those with increased expectations of college attendance, higher levels of parental involvement, increased neighborhood safety,

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Mancha et al. (2012)	CS; School based sample	n = 1,229 Age: M=15.1 (SD=1.7) 53.6% female 87.7% Hispanic	marijuana and drug users, and having peers that use alcohol. African-Americans and older adolescents had lower odds of experiencing ARNCs. The average age for the highest problem severity group (3+ abuse/dependence criteria) was significantly older, on average, relative to lesser problem severity groups. There were significantly more males in the highest two problem severity groups (1–2 abuse/dependence criteria and 3+ abuse/dependence criteria), and those in the highest problem severity group were more likely to report lifetime marijuana use, lifetime sexual intercourse or past year arrest/law trouble than lower problem severity groups
Mares et al. (2011)	L; Community sample	n = 325 families Age: <i>Younger adolescents</i> -M=13.4 (SD=0.5) <i>Older adolescents</i> -M=15.2 (SD=0.6) Gender: unknown 100% Dutch	<i>Younger adolescents</i> There were lower levels of adolescent ARNCs when mothers communicated with their children about alcohol. Mothers and fathers were more likely to discuss alcohol-specific communications with their children when they reported more ARNCs themselves. <i>Older adolescents</i> Paternal alcohol use was the only factor positively associated with ARNCs for older adolescents.
Marmorstein (2009)	L; Community based sample	<i>Baseline</i> n = 20,728 Age: M=15.7 (SD=1.8) Gender: unknown 61% Caucasian	A high level of depressive symptoms was associated with higher initial levels of ARNCs for females, and faster increases in ARNCs over time among males. Reverse associations were also observed.
Marmorstein (2010)	L; Community based sample	<i>Baseline</i> n = 20,728 Age: M=15.7 (SD=1.8) Gender: unknown 61% Caucasian	<i>Males</i> Interaction effect indicates higher levels of both depressive symptoms and delinquent behaviors are associated with high initial levels of ARNCs. In addition, more delinquent behavior was associated with a faster rate of growth in experiencing ARNCs. <i>Females</i> There was a high risk for ARNCs when females reported high rates of delinquent behavior and high rates of depressive symptoms. This combination also predicted a slower rate of change in ARNCs.
Martin et al. (1995)	CS; Community based sample	n=181 Age: M=16.9 (SD=1.6) 49.7% female 73.5% Caucasian	Male subjects had more alcohol-related legal consequences, physical fights, and physically hazardous use. Female subjects had higher rates of alcohol-related drops in school grades, loss of social/recreational activities, and continued drinking despite a physical or psychological consequence.
Martin et al. (2000)	CS; Community based sample	n = 710 Age: M = 16.1 (SD = 1.6) 52.4% female 77% Caucasian	<i>Community sample findings</i> Females had lower behavioral control and higher negative emotionality scores than males and the scores increased between non-drinkers, regular drinkers and problem drinkers (using DSM-IV alcohol abuse criteria) with the highest scores belonging to those in the "problem drinking" group. The results were similar to the analysis for the entire sample that included a clinical subsample.
Mason et al. (2011)	L; School based sample	<i>US sample</i> n = 961 Age: 13.1 (SD = 0.4) 51% female 64.9% Caucasian <i>Australian sample</i> n = 984 Age: 12.9 (SD = 0.4) 51% female 90.6% Australian	For both states, peer deviance at age 14 predicted ARNCs at age 15 with the effect being stronger for the Australian sample compared to the US sample. The total indirect effect of self-regulation at age 13 on alcohol use problems at age 15 was significant for both the US and Australian sample due to significant mediation through self regulation and peer deviance at age 14 (note: low self regulation is a factor comprised of measures on impulsivity, sensation seeking and emotional control). Alcohol use at age 13, but not age 14, was related with

Author(s) and year	Study design	Sample characteristics	Main Findings
Mason & Windle (2002)	F-U; School based sample	n = 840 Age: M=15.9 (SD=0.8) 47% female 98.5% Caucasian	alcohol use problems at age 15 though the effect was small for both samples. The final statistical models accounted for 18% and 38% of the variance in ARNCs for the US and Australian samples, respectively. <i>Cross sectional results</i> Associations between religiosity and ARNCs were attenuated after accounting for other variables. Of note, peer use had the strongest association with alcohol problems at both time points and both family social support and school commitment were negatively associated with ARNCs. <i>Prospective analysis results</i> Prior alcohol problems, gender, school commitment and peer alcohol use were prospectively predictive of ARNCs with peer use being have the strongest association.
Mays et al. (2012)	L; Community based sample	n = 8,721 Age: M=14.4 (SD=0.1) 51.1% female 69.6% Caucasian	For adolescents participating only in sports, more sports involvement was associated with faster average ARNCs. Those with low levels of ARNCs at baseline had more rapid growth in ARNCs over time. ARNCs were higher for boys compared to girls, but gender did not moderate other observed relationships.
McMorris et al. (2011)	L; School based sample	<i>US sample</i> n = 961 Age: 13.1 (SD = 0.4) 51% female 64.9% Caucasian <i>Australian sample</i> n = 984 Age: 12.9 (SD = 0.4) 51% female 90.6% Australian	Relationships between family context and alcohol use and ARNCs were similar between the US and Australian samples. Adult-supervised settings for alcohol use in grade 8 were associated with higher levels of ARNCs in grade 9. Adult-supervised alcohol use in grade 8 mediated the links between favorable parental attitudes to alcohol use at grade 7 with ninth-grade alcohol use and ARNCs for students in both the US and Australia.
Miller et al. (2003)	F-U; Community based sample	n = 611 Age: 12–17 at baseline 55% female 65% Caucasian	<i>Social-alcohol related problems findings</i> Physical and social maturity were positively related to experiencing ARNCs as was age. Being African-American, as opposed to White, was inversely related to ARNCs while having a jock identity was associated with experiencing ARNCs. Significant interaction terms indicate that the relationship between race and social maturity with ARNCs is moderated by gender.
Moulton et al. (2000)	CS; School based sample	n = 455 Age: unknown (grades 7–12) 58% female Ethnicity: unknown	Social expectancies were significantly associated with ARNCs, but there was no association by gender or athletic participation and no significant interactions between these variables.
Oullette et al. (1999)	L; Community based sample	n = 357 Age: M = 15 at baseline 51.2% female Ethnicity: unknown	Males reported more arguments or fights while intoxicated while females reported not remembering part of the evening more than males. Perceived peer drinking at time 1 was associated with more ARNCs at time 4 independently of consumption level. Alcohol expectancies were indirectly related with ARNCs through behavioral willingness and consumption level. Alcohol consumption was also directly related to alcohol-related life problems.
Reimuller et al. (2011)	L; High school sample	n = 1,511 Age: M=14.0 (SD=1.2) 52.3% female 56.1% Caucasian	Previous level of adolescent alcohol use moderated the relation between permissive messages and alcohol use outcomes. Specifically, greater alcohol use and ARNCs were observed as permissive messages increased, from parents to adolescents, between higher versus lower levels of previous alcohol use. The relationship for ARNCs was weaker than it was for alcohol use.
Rohde et al. (1996)	F-U; Community based sample	n = 1,709 Age: Range = 14–18 years 53.7% female	Rates of ARNCs were significantly higher for adolescents with a lifetime history of depression, disruptive behavior disorders, drug use disorders or

Author(s) and year	Study design	Sample characteristics	Main Findings
		91.2% Caucasian	daily tobacco use. Temporal order was not established for the problem-drinking group; however, having a non-alcohol-related psychiatric disorder was not significantly related to moving toward a problematic drinking group between time 1 and time 2.
Rose et al. (2012)	CS; Community based sample	n=9,356 Age: M=17 (SE=0.03) 52.7% female 66.1% Caucasian	Comparing adolescents that drank more than seven days in the last month to those who drank less than 7 days in the last month showed that being female and younger were significantly related to higher AUD severity, but there were no differences by ethnicity in either group. Higher quantity of alcohol use was associated with higher AUD severity for less frequent drinkers, but not more frequent drinkers. Criteria that best discriminated among levels of AUD for both groups of adolescent drinkers were “reduce activities” and “family/friend problems,” “home problems” and “health problems.”
Smith et al. (1995)	L; School based sample	n = 461 Age: Range = 12 – 14 years 53.6% female 82% Caucasian	Males reported significantly higher drinking and ARNCs compared to females, but this association was not significant over time.
Song et al. (2012)	CS; Community based sample	n = 6,958 Age: M=16.3 (SD=1.7) 49% female 81% Caucasian	Religiosity was protective of DUI or riding with a DUI driver as were positive parental and community norms. Having a successful purchase of alcohol, friend’s parents provide alcohol during a party, reporting most friends drink/get drunk and having an age of first drink under 13 were significantly associated with DUI or riding with a driver under the influence of alcohol.
Stice et al. (1998)	F-U; Community based samples	n = 216 Age: M = 14.2 (range 12–17 years) 48.1% female 73% Caucasian	Maternal report, but not self-report of internalizing and externalizing symptoms at time 1 were directly associated with ARNCs at time 2. Parental approval of alcohol use and peer influence was also directly related to ARNCs at time 2. Several variables were indirectly and positively related to ARNCs at time 2 as a function of alcohol use including maternal and adolescent report of externalizing symptoms, parental alcoholism, peer influence. Parental support as reported by the mother was inversely related with ARNCs indirectly through alcohol use.
Swahn et al. (2011)	CS; School based sample	n = 2,257 Age: 11–16+ 47.7% female 100% Zambian	Alcohol education was not associated with ARNCs, but alcohol marketing (specifically being provided free alcohol from a company representative) was associated with an increase in the odds of experiencing an ARNC.
Swaim et al (2011)	L; Community based sample	Time 1 n = 251 Age: M=13.7 (SD unknown) 49.4% female 100% Native American	Adolescents with two parents diagnosed with alcohol abuse/dependence were more likely to report ARNCs at age 18 compared to no parental diagnosis. Higher rates of perceived family norms against alcohol use protected adolescents from high rates of use at age 13, but higher rates of alcohol use at age 13 predicted more ARNCs at age 18.
Topper et al. (2011)	F-U; School based sample	n = 324 Age: M = 13.7 (SD = 0.7) 71.7% female 36.6% white British	Bullying victimization is directly and indirectly associated, through coping motives, to ARNCs. This was not observed when quantity and frequency of alcohol use was evaluated as the outcome. Baseline victimization was significantly correlated with baseline ARNCs and predictive of future problems at 12 months. Drinking to cope at 12 months partially mediated the relationship between baseline victimisation and ARNCs at 12 months.
Treiman & Beck (1996)	CS; School based sample	n = 879 Age: (range from 14 to 18) 53.9% female	<i>Drunk driving or riding with drunk driver findings by social context of drinking</i>

Author(s) and year	Study design	Sample characteristics	Main Findings
		65.6% Caucasian	For females, school defiance was the most important discriminator between those who did and did not drive while intoxicated. Less important discriminators included social facilitation and stress control. For males, school defiance and stress control discriminated non-DWI and DWI drivers better than social facilitation and peer acceptance. Social facilitation was the greatest discriminator for males and females between those who did and did not ride with a driver under the influence of alcohol.
Van der Voorst et al. (2010)	L; Community based sample	n = 428 families Age: 15.2 (SD=0.7) for older siblings and 13.4 (SD=0.5) for younger siblings Gender unknown Ethnicity unknown	For younger and older siblings, drinking at home and drinking outside the home prospectively predicted ARNCs after controlling for alcohol use inside and outside the home cross-sectionally.
Wicki et al. (2006)	CS; School based sample	n = 5,444 Age: Range = 13–16 years 50.1% female 100% Swiss	Being a consumer of alcopops (ready mixed soft drinks containing alcohol) was associated with an increase in the odds of experiencing any ARNC, but this effect was mainly explained by frequency of consumption suggesting that, like other alcoholic beverages, more use leads to an increased chance of experiencing ARNCs.
Wills et al. (2009)	L; Community based sample	<i>Baseline</i> n = 6,522 Age: M=12.1 (SD=1.4) 49% female 62% Caucasian	Movie alcohol exposure at time 1 was associated with ARNCs at times 3 & 4 through self and peer alcohol use at time 2. There was also a direct effect of movie alcohol exposure at time 2, as well as rebelliousness at time 1, with ARNCs at those time points. Other prospective risk factors included alcohol expectancies, peer alcohol use, and availability of alcohol in the home. Protective factors included mother's responsiveness for adolescent's school performance and self-control.
Windle (2000)	L; School based sample	n = 975 Age: M=15.5 (SD=0.7) 52% female 98% Caucasian	Approximately 54% of the variance in ARNCs was explained by the predictor variables, and there was evidence that coping motives and alcohol use mediated the relationship between parent, sibling and peer alcohol use with the experience of ARNCs.
Wong et al. (2006)	L; School based sample	n = 514 Age: 15–17 at outcome 29% female 100% Caucasian	Having an alcoholic parent was associated with higher number of ARNCs. Controlling for parental alcohol diagnosis and age, behavioral control negatively predicted number of ARNCs. Resilience was not associated with early onset of ARNCs. Including externalizing and internalizing problems in the analyses did not influence the results.
Yeh (2006)	CS; High school sample	n = 779 Age: unknown 57.6% female 56.7% Hans	ARNCs were significantly higher for males relative to females, for native Taiwanese students compared to Hans, and having a father involved with alcohol was associated with an increased risk for ARNCs.
Yen et al. (2008)	CS; School based sample	n = 1,684 Age: M=14.4 (SD=1.0) 50.9% female 44.9% indigenous to Taiwan	Males, older adolescents, experiencing physical abuse, having parents who drink or being indigenous to Taiwan was associated with experiencing ARNCs. There was no evidence of moderation when examining the interaction between physical abuse and having an indigenous ethnicity.
Zoccolillo et al. (1999)	CS; Community based sample	n = 509 Age: Range 14–17 years 51.7% female Ethnicity: unknown	Males reported more ARNCs than females and had higher rates of individual ARNCs compared to females. Of those who had used alcohol more than 5 times, 16.9% of the disruptive sample and 13.4% of the representative sample had gone to school drunk ($p = .135$). The distribution of the number of ARNCs among those using drugs more than 5 times did not differ significantly ($p = .079$) between the 2 groups.

Note: For study design: CS = cross-sectional, F-U = follow up (2 time points), L = longitudinal.

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