Moderators of the Association Between Peer and Target Adolescent Substance Use

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Abstract

Associating with substance using peers is generally considered as one of the most important predictors of adolescent substance use. However, peer association does not affect all adolescents in the same way. To better understand when and under what conditions peer association is most linked with adolescent substance use (SU), this review focuses on the factors that may operate as moderators of this association. The review highlighted several potential moderators reflecting adolescents' individual characteristics (e.g., pubertal status, genes and personality), peer and parental factors (e.g., nature of relationships and parental monitoring), and contextual factors (e.g., peer, school and neighborhood context). As peer association is a broad concept, important methodological aspects were also addressed in order to illustrate how they can potentially bias interpretation. Taking these into account, we suggest that, while the effects of some moderators are clear (e.g., parental monitoring and sensation seeking), others are less straightforward (e.g., neighborhood) and need to be further examined. This review also provides recommendations for addressing different methodological concerns in the study of moderators, including: the use of longitudinal and experimental studies and the use of mediated moderation. These will be key for developing theory and effective prevention.

Keywords

Peers; substance use; alcohol use; adolescence; moderation effect

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1. INTRODUCTION

Youth substance use is a problem commonly encountered in societies all around the world. By grade nine, 29.8 % of adolescents in the United-States had drank alcohol in the past 30 days, 14.0% had binge drank and 30.8 % had tried marijuana at least once in their lives (Eaton et al., 2012). These rates increase during later adolescence, and the prevalence of adolescent alcohol dependency can reach 5.6% between the ages of 15 to 19 years old (Tjepkema, 2004). Although prevalence of use is lower in early adolescence, the younger teenagers are when they first try alcohol or drugs, the greater their risk for future substance use disorders and/or future psychological disorders (Chassin, Pitts, & Probst, 2002; DeWit, Adlaf, Offord, & Ogborne, 2000; Grant & Dawson, 1997; McGue, Iacono, Legrand, Malone, & Elkins, 2001). Nevertheless, substance use initiation and growth occur in the context of numerous factors, including parental influence (Bahr, Hoffmann, & Yang, 2005), personality and temperament (Wills, Windle, & Cleary, 1998) and early puberty (Ge et al., 2006; Grant & Dawson, 1998).

The strongest proximal predictors of adolescent substance use are widely acknowledged as being peer substance use and peer deviance (Akers, Krohn, Lanzakaduce, & Radosevich, 1979; Bauman & Ennett, 1996; Fallu et al., 2010). For example, affiliation with substance-using-friends strongly correlated ($r=.43-.60$) with adolescents' own concurrent and future substance use (Allen, Donohue, Griffin, Ryan, & Turner, 2003; Barnow et al., 2004; Branstetter, Low, & Furman, 2011; Jackson, 1997; Reifman, Barnes, Dintcheff, Farrell, & Uhteg, 1998; Simons-Morton, 2004; Wills & Cleary, 1999). This makes peer association an ideal object of study in order to better understand influences on adolescent substance use. "Peer association" in this review, entails the ways by which substance using or delinquent peers are thought to influence, directly and indirectly, an adolescent's – technically referred as a "target"- own substance use. This influence consists of, but is not limited to, peer pressure, perceived peer norms on substance use and/or actual peer norms on substance use. Such a definition is quite similar to the one given for peer socialization (Hoffman, Sussman, Unger, & Valente., 2006.), but since peer socialization infers a directionality more suited for experimental studies, the term "peer association" has been chosen instead.

The relationship between peer and target adolescents is inherently reciprocal, with target adolescents also influencing their peers behavior. This reciprocity needs to be discussed in order to clarify how this review has been structured and what type of associations will be examined. Indeed, one of the most common debates in the study of peer association regards the opposition of the peer socializing (influence) theory to the peer selection theory. On the one hand, the socializing theory states that peers' deviant behaviors and substance use are important in explaining an individual's future actions. This theory is particularly important in explaining the role of peers on targets' substance use and is referred to in many longitudinal studies (Reifman, et al., 1998; Sieving, Perry, & Williams, 2000; Wills & Cleary, 1999). On the other hand, the peer-selection theory states that an individual's own deviance and substance use will influence which friends they select. This theory is also supported by a number of studies (e.g., Iannotti, Bush, & Weinfurt, 1996; Knecht, Burk, Weesie, & Steglich, 2010; Poelen, Engels, Van Der Vorst, Scholte, & Vermulst, 2007). These theories can be reconciled thanks to studies that have examined both models simultaneously

through the use of a cross-lagged (or transactional) or other longitudinal designs, showing that they both have their place in the substance use literature (Burk, van der Borst, Kerr & Stattin, 2012; Dishion & Owen, 2002; Duarte, Escario, & Molina, 2011; Fergusson, Swain-Campbell, & Horwood, 2002; Kiuru, Burk, Laursen, Salmela-Aro, & Nurmi, 2010; Mercken, Steglich, Knibbe & de Vries, 2012; Poelen, et al., 2007; Simons-Morton, 2007; Wills & Cleary, 1999). However, Jaccard and colleagues (2005) appropriately point out that cross-sectional designs confound the effects of peer socialization and peer selection. Therefore, longitudinal studies are required to circumvent the directionality issue inherent in cross-sectional studies. Moreover while some longitudinal observational studies can suggest causal links, experimental studies (e.g., using ethical proxies for adolescent substance use) are required to properly address them.

This review does not aim to clarify the debate between the relative contribution of peer socialization and selection, largely because the proportion of studies which examine moderation of the link between “peer socialization” and substance use in adolescence severely outweighs that of studies of “peer selection”, and the number of studies which compare both models is even further limited. This opposition however highlights the importance of putting greater emphasis on the results from longitudinal and experimental studies and it explains why the articles in this review are subdivided by study design. Thus, this review focuses on studies that investigated moderators of “peer association” rather than moderators of “peer socialization” or “peer selection”.

As stated previously, there is general consensus regarding the importance of peer deviance and peer substance use on the substance use behavior of targets. There is however, less agreement as to when and under what conditions peers are most influential. The variables representing these conditions are called moderators. A moderator refers to “a qualitative (e.g., gender, race, class) or quantitative (e.g., level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable” (Baron & Kenny, 1986). Studying moderators of peer association on target substance use behaviors such as substance use experimentation, quantity, and frequency is important. For instance, it can help to identify the conditions under which the effect of peer association varies, to clarify discrepancies across previous studies and to produce findings that could feed directly into prevention and early intervention approaches by pinpointing, for example, exacerbating factors that could be mitigated and protective factors that could be promoted. Accordingly, the main goal of this review is to examine how certain factors may exacerbate or dampen the link between peer substance use and adolescents’ substance use and help address the orientation future studies should take.

Moderators in this review are expected to function in one of three ways, in accordance with three theoretical models that account for the interplay between individual characteristics and the environment: the diathesis–stress model (Goldstein, Abela, Buchanan, & Seligman, 2000), the resilience model (Fergus & Zimmerman, 2005; Kaplan, 1999), also known as the social development model (Catalano, Kosterman, Hawkins, Newcomb, & Abbott, 1996), and the differential susceptibility model (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007). Firstly, the diathesis-stress model states that an individual’s vulnerability to

psychopathology and substance use (e.g., high impulsivity) will be exacerbated by a negative or stressful environment (e.g., deviant or substance-using peers). Secondly, the resilience and/or the social development models posit that individual factors may reduce sensitivity to adverse environmental factors, such as peer deviance. Thirdly, the differential susceptibility model states that, although an individual's vulnerability may be exacerbated by a negative environment or by stress, so called "vulnerable" individuals may benefit most from supportive environments. In this way, significant moderators could theoretically increase or decrease the effect of peers on substance use behaviors and the concept of "vulnerability" may be inappropriate for those whose "sensitivity" provides a benefit under certain conditions. Furthermore, it is important to note that the diathesis-stress and resiliency models can be complementary. That is, observing an interaction between an individual factor and an environmental stressor could support both the diathesis-stress and resiliency models, depending on how the valence of the individual factor is conceptualized, as in their simplest form, both of these models could be seen to be examining different ends of a same continuum. In addition, these models were developed to account for observed interactions between individual vulnerability factors and environmental factors. However, we also report environment by environment interactions, with either increasing or decreasing effects. Although the theoretical models summarized above do not specifically address environment by environment interactions, such interactions may be interpreted with these theoretical models. These three models were also chosen because most studies, in the literature on moderators of the effect of peer association on substance use, are not based on any a priori theoretical model. Rather, they are usually data driven and based on expected outcomes provided by previous studies (i.e., higher or lower target substance use). A summary of what model is best supported by the literature will be provided for each proposed factor in the summary and implication sections.

2. METHOD AND REVIEW STRUCTURE

In the current review, substance use refers to alcohol and other drug use (i.e., marijuana, cocaine, crack, tranquilizers, sedatives, psychedelics, amphetamines, LSD, speed). Tobacco use is outside the scope of this review and a number of reviews of potential moderators of the effect of peer association on adolescent tobacco use have been published (e.g., Hoffman, Sussman, Unger, & Valente, 2006; Kobus, 2003; Simons-Morton & Farhat, 2010).

Studies included in this review were identified through a literature search using Web of KnowledgeSM, Psych Info[®] and PubMed. Keywords included in the search were "adolescent substance use", "moderators of peer influence", "moderators of peer selection", "moderators of substance use", "moderators of alcohol use" and "moderators of peer association". To be included in the review, the selected study needed to have been published between 1991 and 2013 in a peer reviewed journal and be written in English. Studies were then sorted by title and abstract information, discarding irrelevant studies (i.e., not referring to substance use, adolescents or peers). This step resulted in over 350 studies being kept. The method and analysis sections were then examined: assuring that participants in those studies were within the right age range (i.e., the outcome variable being measured between 12 years and 18 years of age), that the outcome variable included substance use and that authors actually examined moderation with peer association or influence being the predictor variable. Relevant studies

on moderators of peer association or influence which were cited in those articles were also included in this review, bringing the total of articles retained for this review to 58.

Structurally, this review of moderators has been divided by level of influence in accordance to their degree of proximity to the adolescents as follows: 1) individual factors, 2) peer and parental factors and 3) broader contextual factors (see Table 1). This structure is similar to the one proposed in Bronfenbrenner's (1977) ecological model, which conceptualizes interpersonal interactions as part of broader socio/environmental contexts, and takes into account the reciprocal influences between them. Other models such as the triadic influence theory (Flay, 1999; Flay, Petraitis, & Hu, 1995) and the integrative model (Fishbein, 2000; Fishbein, 2009) also highlight the interplay between different levels of influence to predict behavior, and are particularly useful in explaining the sequence of mediated links between environmental or distal factors and behaviors. Since the focus of the review is on moderated effects, rather than mediation, and the main purpose of the model was to provide a simple and clear structure to the review, the Bronfenbrenner model was chosen over the other two models. Moreover, as mentioned previously each section has been further subdivided according to the methodological design of these studies as follows: 1) cross-sectional studies; 2) longitudinal studies, and 3) experimental studies. This distinction enabled us to organize the review more critically as a function of the strength of evidence. Finally, because most studies assessed peer association and behavior through target-reported data as a default (e.g., adolescents reporting on their friends' substance use), we have only specified when peer association or behavior was assessed through another means such as peer-reports or third-party informants (please see Table 1 for how peer association and behavior was assessed in each of the studies reviewed). This methodological issue has been further discussed in the methodological and theoretical framework section.

3. RESULTS

3.1. Findings overview

Out of the 58 studies retained, three were experimental, 28 were longitudinal and 27 were cross-sectional. Most studies reviewed (i.e., 44) examined at least one personal factor as possible moderator of peer association. Nine studies examined peer factors as possible moderators, 15 examined parental or family characteristics, and five studies tested broader contextual factors as possible moderators. Out of the 58 studies, four included boys only and one included girls only. For information on available study designs, number of articles and mean age of participants for each subcategory, see Table 2.

3.2. Individual Factors

3.2.1. Age—Alcohol and drug use initiation, as well as frequency of use, have been shown to increase substantially with the onset of adolescence, and to continue increasing with age throughout adolescence (Dubé, et al., 2009; Eaton, et al., 2012; Valente, et al., 2007). Peer association has also been shown to vary with age, with some studies highlighting age as a moderator of the link between peer substance use or delinquency and target substance use.

3.2.1.1. Cross-sectional evidence: Cross-sectional studies on the moderating effect of age on peer association were inconsistent. For example, in one study examining the link between peer and target substance use in adolescents aged 11 to 18 years, Ferguson and colleagues (2011) found that the correlation between peer delinquency and targets' substance use was strongest when the targets started using substances between the ages of 13 and 16 years (middle adolescence). Kelly and colleagues (2012) found lower alcohol use in adolescents who had both one peer who tried alcohol and were in 8th grade as opposed to adolescents who had one peer who had tried alcohol and were in 6th grade. On the other hand, Mennis & Mason (2012) found higher substance use in a group of 13 to 20 years olds who had both lower social network quality (perceived friends substance use, if friends had tried to influence their substance use, and positive activities with these friends), and were older. Finally, some cross-sectional studies found no significant interactions with age (Burk, Van Der Vorst, Kerr, & Stattin, 2012; Denault & Poulin, 2012).

3.2.1.2. Longitudinal evidence: In a longitudinal study following five cohorts (11 to 15 years old) over a 4-year period, Duncan and colleagues (1994) found that the link between peer substance use and targets' level of alcohol use was greatest when targets were aged between 12 and 13 years compared to when they were aged between 14 and 15 years. However, some studies have shown that peer association was particularly important during target's middle adolescence (2012; Fergusson et al., 2002). Moreover, Fergusson and colleagues (2002) found that peer association seemed to decline with age in a longitudinal sample of targets followed from 14 to 21 years. In that study the strength of peer association was greatest between 14 and 15 years old and weakest between 20 and 21 years old. In short, early- and mid-adolescence seem to be the developmental period when targets are most vulnerable to peer association.

3.2.1.3. Experimental evidence: A number of experimental studies have demonstrated that the influence of peers on target risk-taking behaviors varies by age (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Mrug, Hoza, & Bukowski, 2004). In the absence of experimental evidence directly examining adolescent substance use, some studies investigated adolescent risky behaviors using risky-driving paradigms because both behaviors involve reward seeking and have been linked with increased activation in reward-centers of the brain (e.g., ventral striatum; Chase, Eickhoff, Laird, & Hogarth, 2011; Leyton et al., 2002; Chein, Albert, O'Brien, Uckert, & Steinberg, 2011). For example, Chein and colleagues (2011) found that, compared to young adults, adolescents took more risks when observed by peers, and demonstrated greater activation in reward-related brain regions (i.e., ventral striatum and orbitofrontal cortex) while making risky decisions when observed by peers. The possible use of such ethical proxies for the study of adolescent substance use will be discussed further in the recommendation section.

3.2.1.4. Summary and implications: Longitudinal and cross-sectional studies seem to be consistent in indicating that early and middle adolescence are periods when targets are most vulnerable to peer association, and that this vulnerability is attenuated in late adolescence. Although age cannot be strictly considered as a predisposing vulnerability, results support both the diathesis stress model (with the association between peer and target deviance/

substance use being the greatest in early adolescence) and the resilience model (with the association between peer and target deviance/substance use being the weakest in later adolescence), illustrating the complementary nature of these models. Steinberg and Monahan (2007) speculated that the decreasing strength of peer association could be explained, at least in part, by the development of resistance to peer influence, which is concurrent with the development of a sense of identity, completed typically by late adolescence.

Furthermore, targets' age did not seem to act as a moderator independent of other important factors which should be further studied. For example, Li, Barrera, Hops and Fisher (2002) found that in adolescents with initial low levels of alcohol use at 14 years, the presence of deviant peers was concurrently and prospectively linked with increasing alcohol use across adolescence, whereas in adolescents with a high initial level of alcohol use at 14 years the presence of deviant peers was not linked with alcohol use across adolescence. This could indicate that adolescents have periods in which they can be more easily influenced by their peers but that the sensitivity of these developmental windows could depend on other factors (e.g., substance use history or social context). Along the same lines, the hypothesis proposed by Steinberg and Monahan (2007) that the moderating effect of age could be explained by lower resistance to peer association in early adolescence could be tested using a mediated moderation analysis (see first recommendation in section 5).

3.2.2. Gender—Most studies examining moderators of peer association either control for gender, or examine its effect on substance use behaviors directly. However, the results from adolescent studies seem to be some of the most inconsistent in the field, even when examining main effects. For instance, although the direct effect of gender has been demonstrated many times in adults, with males showing greater substance use and a greater prevalence of substance use disorders (e.g., Hall, Teesson, Lynskey, & Degenhardt, 1999), many studies of adolescents failed to find significant effects when looking at the direct role of gender on adolescent substance use (Costello, Sung, Worthman, & Angold, 2007; Cumsille, et al., 2000; Donovan, Jessor, & Costa, 1999; Schulte, Ramo, & Brown, 2009; Urberg, Degirmencioglu, & Pilgrim, 1997). Nonetheless, other variables could come into play and interact with gender during adolescence.

3.2.2.1. Cross-sectional evidence: Most cross-sectional studies examining gender as a possible moderator of concurrent peer association on substance use do not find significant effects (Bergh, Hagquist, & Starrin, 2011; Bobakova, et al., 2012; Burk, Van Der Vorst, Kerr, & Stattin, 2012; Denault & Poulin, 2012; Mennis, & Manson, 2012). Only two studies suggested that peer association may be greater in male as opposed to female adolescents who associate with delinquent and substance-using peers, as reported by teachers (Mrug & Windle, 2009) or the targets (Clark, Belgrave & Abell, 2012), and one study suggested that peer association may be greater in female adolescents associating with peers that use alcohol (Anderson, et al., 2011). In this last study though, a significant three-way interaction between gender, anxiety and peer association was found: highly anxious boys who had alcohol using friends reported the highest binge drinking rates in the last month. Finally, the only study that assessed cross-gender (male-female) peer association through peer-reported

drunkenness frequency, suggested that there was a stronger link between male friends and female target's substance use, than that of female friends and male targets' substance use (Gaughan, 2006). It might therefore be useful to also consider peer gender, which may further help reconcile these apparently inconsistent results of cross-sectional studies.

3.2.2.2. Longitudinal evidence: Here also, many studies find no moderating effect of gender on peer association using either target-reported peer antisocial behavior (Guo, Hill, Hawkins, Catalano, & Abbott, 2002), peer-reported substance use (Larsen, Overbeek, Vermulst, Granic, & Engels, 2010) or target reported substance use (Rabaglietti, Burk, & Giletta, 2012; Westling, Andrews, Hampson, & Peterson, 2008). However, some longitudinal studies suggest that peer-association is greater in male adolescent targets who associate with delinquent and substance-using peers (based on peer-report data) than their female counterparts (Crosnoe, Erickson, & Dornbusch, 2002). Further, and in contrast with the previous studies that examined two-way interactions, Marshal and Chassin (2000) observed in a three-way interaction between gender, parental discipline (i.e., consistency of parental discipline towards their child's misbehavior), and substance-using-peers, that parental discipline was linked with lower influence of peer association on future substance use for girls but higher influence for boys. The authors suggest that these findings could be the result of boys interpreting parental discipline as a form of control that goes against their desire for independence, and that this interpretation increases their susceptibility to the effects of peer association. However, this proposition has to be further tested empirically.

3.2.2.3. Experimental evidence: No experimental studies were found.

3.2.2.4. Summary and implications: Cross-sectional and longitudinal studies on the moderating role of gender on the link between peer deviance and target substance use also reflect the inconsistencies noted in studies of the direct effects of gender on substance use. Thus, there is mixed evidence that gender is an important moderator of the effect of peers on adolescent substance use, with only one longitudinal study showing a significant interaction between peer substance use and gender in the prediction of alcohol and tobacco use frequency. Perhaps, as suggested by Brechwald and Prinstein (2011), the effect of gender could be better studied in the context of three-way interactions that would include gender along with other moderators, as was the case in the studies by Anderson and colleagues (2011) and Marshal and Chassin (2000).

3.2.3. Pubertal status—Longitudinal research seems to indicate that early puberty and physical maturation are risk factors for both girls' (Lanza & Collins, 2002) and boys' (Castellanos-Ryan, Parent, Vitaro, Tremblay, & Séguin, in press; Dick, Rose, Pulkkinen, & Kaprio, 2001) future substance use over and above chronological age. Specifically, girls with early pubertal maturation (e.g. menarche before the age of 12.5 years) have been shown to be at higher risk for future substance use (Ge, et al., 2006). Similarly, Costello, Sung, Worthman & Angold (2007) found that, for boys aged 12 years and older, and for girls in general, physical maturity and early puberty were linked with higher alcohol use. In another study, girls that had their first menarche at an early age (11 years or younger) were more likely to use alcohol and cigarettes earlier than those who started their menstruations after 11

years of age (Dick, Rose, Viken, & Kaprio, 2000). In contrast, in the same study, girls who started their menstruations late (after they turned 14) seemed to be “protected” from early alcohol use. Despite its apparent importance with regards to substance use behaviors, little research has been done on puberty as a moderator of peer association.

3.2.3.1. Cross-sectional evidence: A study by Fergusson and colleagues (2007) showed that delinquency, including substance use, at age 13 years was greatest in target boys and girls who matured early and affiliated with deviant friends. This same study also showed that the link between deviant peers and targets’ delinquency was weakest in those reporting late puberty. Finally, Stattin, Kerr, & Skoog, (2011) found higher delinquency scores (i.e., including cannabis use) in a group of girls that spent more time with peers and were early maturers.

3.2.3.2. Longitudinal evidence: Longitudinal studies seem to suggest that adolescents experiencing early puberty are more likely to affiliate with deviant or substance-using-friends. Moreover, in one study, the link between peer substance use at age 11 years and targets’ intention and willingness to use substances two years later was stronger for those reporting early puberty at age 11 years (i.e., more advanced pubertal stage relative to same age-peers; Ge, et al., 2006). Another longitudinal study has also shown an interaction between pubertal development and affiliation with deviant friends (Costello, et al., 2007). Using a sample of young adolescent girls and boys, they found that the link between deviant peer affiliation in early adolescence and targets’ own alcohol use by the age of 16 years was greater for those having reached Tanner stage IV by age 12.

3.2.3.3. Experimental evidence: No experimental studies were found.

3.2.3.4. Summary and implications: Longitudinal studies reviewed in this section provide support for the diathesis-stress model by showing that the effect of peer association on adolescent substance use was greater in girls and boys who mature early, independently from chronological age, with the age effect still reaching significance in the Ge, et al., (2006) study. Support for the resilience model was also provided by Fergusson et al.’s (2007) cross-sectional study, which assessed puberty on a continuum, and suggests not only that the effect of peer association is greater in early puberty, but also that the effect of peer association on adolescent delinquency, including substance use is weaker in late puberty. On a critical note, although results on pubertal status as a moderator of peer association on adolescent substance use and/or other problem behaviors seem consistent across the few studies that have examined puberty as a moderator, caution is warranted in the interpretation of these results, as other studies have shown that early pubertal development was linked with peer selection and that a mediation model may be more appropriate. For example, Costello and colleagues (2007) reported that, in addition to a greater prevalence of alcohol use, early physical maturity was linked with a higher number of deviant peers and conduct disorder for both genders. A more specific link was found in another study of adolescent boys, with high testosterone levels and advanced levels of physical maturity between ages 12 and 14 years predicting affiliation with deviant peers at age 16, which in turn predicted drug use at age 19 (Reynolds et al., 2007). Thus, these findings suggest that early puberty can increase the

likelihood of affiliating with deviant peers and also may exacerbate the association between peer substance use and target substance use.

3.2.4. Genetic vulnerability—Genetic factors have also been linked to adolescent alcohol and drug use. There is compelling evidence of the heritability or familial transmission of substance use disorders (Bierut et al., 1998; Goldman, Oroszi, & Ducci, 2005; Merikangas et al., 1998; Meyers, Dick, Rose, Kendler, & Kaprio, 2010) and that this transmission is thought to occur via both genetic and environmental (or psychosocial) pathways. Twin studies have documented moderate genetic links on adult and adolescent substance use and misuse (Goldman, et al., 2005; Hottelma, Corey, & Kendler, 1999; Hopfer, Crowley, & Hewitt, 2003; Kendler, Karkowski, Neale, & Prescott, 2000), with the strongest genetic links being found for alcohol use (50 – 70%; Cloninger, Bohman, & Sigvardson, 1981; Ducci & Goldman, 2008; Heath et al., 1997; Kaprio et al., 1987; McGue, Elkins, & Iacono, 2000; McGue, Slutske, & Iacono, 1999; Stacey, Clarke, & Schumann, 2009). In terms of candidate genes conveying vulnerability to substance use problems, it seems likely that over 100 genetic variants are implicated. Most prominent are those involved in alcohol metabolism (Osby, Liljenberg, Kockum, Gunnar, & Terenius, 2010; Reich et al., 1998), and in the regulation of dopamine and serotonin (Agrawal & Lynskey, 2009; Agrawal et al., 2011; Heinz, Mann, Weinberger, & Goldman, 2001; Heinz, Schafer, Higley, Krystal, & Goldman, 2003; Henderson et al., 2000; Hopfer et al., 2005; Koob & LeMoal, 1997; Snell, Glanz, Tabakoff, & Marker, 2002).

3.2.4.1. Cross-sectional evidence: In contrast to the relatively high number of studies on the univariate links between genes and substance use, there are very few studies that have examined the interaction between genes and peer association in predicting substance use. These few studies, all cross-sectional in nature, used a quantitative genetic (i.e., twin) design with peer-ratings (with the exception of Dick et al, 2007) and concluded that genetic liability was greatest in target adolescents whose peers use alcohol (Guo, Elder, Cai, & Hamilton, 2009; Harden, Hill, Turkheimer, & Emery, 2008; Kendler, Gardner, & Dick, 2011; Miranda et al., 2013). For example, in a sample of adolescent Finnish twins aged 14–17 year, Dick and colleagues (2007) found that the genetic link with alcohol use was higher (around 60%) in adolescents with many alcohol-using friends compared to those with only a few alcohol-using friends (around 20%). In most of these studies, peer association is generally considered the moderator of the gene-substance use link. However, an exception is a study by Harden, Hill, Turkheimer and Emery (2008) suggesting that adolescents with higher genetic liability to substance use may be more vulnerable to the adverse influences of their best friends' alcohol and tobacco use, even after controlling for the tendency of these adolescents to affiliate with friends who use substances. That is, this same study showed that genetic factors, linked with an adolescent's own substance use, were also linked with friends' heavier substance use (referred to as a gene-environment correlation). The authors took this link into account, yet still found that these adolescents seemed more vulnerable to the adverse association with these friends, which suggests a gene-environment interaction (Harden, Hill, Turkheimer, & Emery, 2008). Interestingly, they also found that adolescents with low genetic links with substance use reported very low levels of substance use, regardless of their best friends' substance use. These results clearly indicate that peer

association on substance use can vary according to genetic vulnerability, which suggests it is an important moderator of this association.

3.2.4.2. Longitudinal evidence: No longitudinal studies were found.

3.2.4.3. Experimental evidence: No experimental studies were found.

3.2.4.4. Summary and implications: All studies reviewed were cross-sectional and most investigated whether peer substance use could moderate heritability to substance use. Together, these studies suggest that the genetic contribution to adolescent substance use was strongest at higher levels of friends' substance use. These findings support the diathesis-stress model. However, the one study which explicitly examined the moderating effect of genetic liability on the link between peer association and adolescent substance use seemed to provide support for both the diathesis-stress and resiliency models, as it showed that the link between peer and target substance use was strongest and weakest for those at high and low genetic risk, respectively (Harden et al., 2008). This well-designed study, which controlled for the effects of peer selection (or gene-environment correlations), also illustrated nicely how the diathesis-stress and resilience models are complementary and potentially examine opposite ends of the same continuum.

3.2.5. Personality and individual characteristics of the target adolescent—

Much research has found direct links between temperament or personality traits and substance use (Castellanos-Ryan, Parent, Vitaro, Tremblay, & Séguin, in press; Cooper, Agocha, & Sheldon, 2000; Sher, Bartholow, & Wood, 2000). For example, Wills and colleagues (1998) emphasized the role temperament plays in substance use by demonstrating that high “negative emotionality” (i.e., the tendency to become easily and intensely upset) and low “task orientation” (i.e., the tendency to concentrate on tasks and work on them until completion) were concurrently linked with higher levels of substance use in adolescence. In terms of personality traits, a number of disinhibited traits have been shown to predict early onset substance use. Whereas impulsivity has been consistently linked with a number of substance use outcomes (Conrod, Pihl, Stewart, & Dongier, 2000), extraversion has been linked mainly with early alcohol use (Hill, Shen, Lowers, & Locke, 2000). In addition, risk-taking and sensation seeking, in particular, have both long been linked with alcohol and substance use in adolescence and young adulthood (Castellanos-Ryan & Conrod, 2011; Comeau, Stewart, & Loba, 2001; Conrod, et al., 2000; Gerra et al., 2004; Hittner & Swickert, 2006). Studies have also found that these and other personal characteristics operate as moderators of the link between peer and target adolescents substance use.

3.2.5.1. Cross-sectional evidence: In one study, Anderson and colleagues (2011) found that the association between peer and target alcohol use was greatest when the target had a strong need for affiliation (i.e., shown in a three-way interaction, indicating that alcohol use was highest in target adolescents that had alcohol-using peers and a strong need for affiliation, but only when they were also socially anxious; Anderson, Tomlinson, Robinson, & Brown, 2011). In another study, Epstein and Botvin (2002) found the link between friends alcohol use and target's drinking quantity and frequency to be moderated by target's risk taking. Furthermore, both extraversion and a combination of impulsivity and sensation seeking were

found to moderate the degree of peer association on drug use (Knyazev, Slobodskaya, Kharchenko, & Wilson, 2004). The link between peer association and adolescent substance use was found to be moderated by several other individual characteristics such as expectations about one's future (e.g., academic, professional and general optimism about the future; MacNeil, Kaufman, Dressler, & LeCroy, 1999), refusal assertiveness (e.g., the ability to refuse assertively someone's proposition; Epstein & Botvin, 2002), drug and alcohol refusal efficacy (Clark, Belgrave & Abell, 2012) and behavioral regulation (Wills, Pokhrel, Morehouse, & Fenster, 2011). Furthermore, identity commitment (including information on: future occupation, religion, politics, relationships, family, friends, dating partners, sex roles, and personal values; Dumas, Ellis & Wolfe, 2012), and adolescents' propensity to fantasize while listening to music (e.g., imagining that they were playing the music, or used the music to dream about being in a different place; Miranda, Gaudreau, Morizot, & Fallu, 2012) were two other factors which moderated the link between peer association and adolescent substance use.

3.2.5.2. Longitudinal evidence: Some longitudinal designs have also been used to examine under what conditions peer association varies. For example, Henry, Slater & Oetting (2005) found in a longitudinal sample of middle school US students, that having an increasing trajectory for risk-taking behaviors (i.e., willingness to engage in risky activities without concern about the consequences) appeared to be linked with a higher target's sensitivity to peers' alcohol use than having a stable or decreasing trajectory. In another study Rabaglietti, Burk and Giletta (2012) found lower levels of alcohol intoxication in targets with alcohol using friends with higher regulatory self-efficacy as opposed to targets with alcohol using friends with low regulatory self-efficacy. Further, Allen and colleagues (2012) found that many personal characteristics (i.e., low autonomy, low skills in handling deviancy and high susceptibility to peer influence) were all linked with higher alcohol and marijuana use in adolescents with alcohol and marijuana using peers. The popularity or social status of targets also seemed to play a role in how susceptible they may be to peers. For example, in their study Allen, Porter, McFarland, Marsh and McElhaney (2005) found stronger peer-association in popular as opposed to less popular targets. However, little research has been done on the concordance between targets' and peers' self-reported characteristics and targets' future substance use. One study that has examined this association found that substance use in mid-adolescence was at its highest when both targets' disruptiveness (i.e., aggressive, hyperactive and oppositional behavior) and friends' non-conformity (i.e., disliking school and having trouble with the police) were high, compared to when only one or the other was high (Fallu, et al., 2010).

3.2.5.3. Experimental evidence: Only one experimental study was conducted on temperament or personality factors as moderators of peer association and substance use and other problem behaviors. Cohen and Prinstein (2006) asked targets to answer questions about aggressiveness and health risk behaviors via an online chat-room in the presence of three same grade peers, which were actually being impersonated by a computer program. Targets were told that the aim of the study was to examine how the group interacts in an online chat room. They could therefore see the answers of other participants. Participants were randomized to conditions where they thought they were interacting with actual same

grade peers of either low or high social status (i.e., assessed via a classroom-wide peer nomination procedure). They were told that each of the four participants would have to answer the questions one at a time in a specific order and that this order would be determined randomly. However, the procedure was designed as to ensure that the target would be the last to answer all questions, allowing researchers to examine how the simulated pre-recorded answers would influence the targets answers. Findings showed that higher social anxiety moderated peer influence on health-risk behaviors, including substance use, with higher social anxiety being linked with higher conformity to peer norms independently of their social status. This effect differed in less socially anxious individuals, who showed a greater tendency to conform only to individuals of higher status (Cohen & Prinstein, 2006). The authors suggested that socially anxious individuals may be bending more rapidly to peer norms or pressure because of their need to lower or avoid an anxiety inducing situation. At the end of the study, targets were debriefed and experimenters made sure all participants understood the actual procedure and the aim of the study.

3.2.5.4. Summary and implications: In sum, many different personality and individual factors have been examined throughout the literature, with findings suggesting that most of these actually exacerbate the effect of peer association on adolescent substance use (e.g., risk-taking, sensation seeking, social anxiety), consistent with the stress-diathesis model. Both risk-taking and social anxiety have been shown to be significant moderators of peer association on adolescent substance use across different methodological designs, including longitudinal and experimental designs, making them particularly robust findings. Support for resilience models was also found, with some individual characteristics, such as high expectations about one's future and refusal assertiveness, dampening the effect of peer association. However, one critical problem in this literature is that the individual factors reviewed as moderators are not completely independent from each other and one factor could potentially explain (i.e., mediate) the role of another factor (e.g., poor refusal assertiveness could explain the potential exacerbating effect of high popularity). This does not discount these factors as important moderators, but highlights the need to simultaneously include other individual factors as potential explanatory variables of moderated effects (i.e., mediated moderation) in future studies. In addition, but with the exception of the studies by Cohen and Prinstein (2006) and Fallu et al. (2010), most studies have not examined peers and targets' characteristics simultaneously and interactively. Developing such designs may be important to clarify the complex links between peer and target personality characteristics.

Other personality and individual characteristics which should be further studied include self-esteem and resistance to peer influence. Although yet to be tested empirically, low self-esteem could be hypothesized as an important moderator of the link between peer association and adolescent substance use, as it has been shown to exacerbate an adolescent's general susceptibility to peer pressure (Zimmerman, Copeland, Shope, & Dielman, 1997) and to exacerbate the effect of peer association on other externalizing problems like aggression (Bukowski, Velasquez, & Brendgen, 2008). Assessing adolescents' propensity to resist peer pressure may be particularly important when examining the effects of peers on substance use in adolescence, as research suggests that "resistance to peer influence" is at its lowest in early adolescence (Steinberg & Monahan, 2007). Although not often assessed in

studies investigating substance use behavior, resistance to peer influence is likely to be an important moderator of the link between peer association and target substance use, and could help to determine which individuals will be more susceptible to peer substance use (Steinberg & Monahan, 2007).

3.2.6. Substance use expectancies and motives—Substance use expectancies have been found to moderate adolescents' propensity to be influenced by their peers. The hypotheses from studies of alcohol and substance use expectancies appear to be straightforward: if adolescents expect substances to affect them positively (e.g., to make parties more fun or to help people to relax), they will be more likely to use them. Conversely, if the opposite is expected (e.g., that people may lose control and be harmed after drinking alcohol) then adolescents will be less likely to use alcohol or substances (Barnow, et al., 2004; Fisher, Miles, Austin, Camargo, & Colditz, 2007; Musher-Eizenman, Holub, & Arnett, 2003; Shen, Locke-Wellman, & Hill, 2001; Willner, 2001).

3.2.6.1. Cross-sectional evidence: Although a few studies have looked at both the roles of concurrent peer substance use and target substance use expectancies on target substance use, cross-sectional studies have examined the role of substance use expectancies as a potential mediator, rather than moderator, of the link between peer association and target substance use. For example, some studies suggest that exposure to alcohol and substance-using-peers is linked with targets' alcohol expectancies and could potentially act on their motives for substance use (Cumsille, Sayer, & Graham, 2000; Kuntsche & Stewart, 2009). Consistent with this hypothesis, Kuntsche & Stewart (2009) found expectancies to mediate the link between peer association and target substance use. However, the cross-sectional design of these studies makes it impossible to interpret the directionality of effects and thus do not provide a true test of mediation.

3.2.6.2. Longitudinal evidence: In contrast to cross-sectional evidence, one longitudinal study found direct support for expectancies moderating the link between peer association and targets' substance use. In this study, Henry and colleagues (2005) found that when targets expected alcohol use to cause harm, alcohol use was low, regardless of peer association. However, some authors of longitudinal studies have also emphasized that expectancies could play a more direct role than that of a moderator (e.g., Scheier & Botvin, 1997). These authors showed that alcohol expectancies in grade 9 mediated the link between five predictor variables in grade 8 (past alcohol use, knowledge of alcohol effect, knowledge of alcohol prevalence, friends' attitudes to alcohol and perceived friends' alcohol use) and alcohol use in grade 10.

3.2.6.3. Experimental evidence: No experimental studies were found.

3.2.6.4. Summary and implication: In short, only one longitudinal study identified target substance use expectancies as a significant moderator and supports the resilience model. It remains unclear then whether substance use expectancies would be better conceptualized as a mediator or a moderator of the link between peer association and adolescent substance use. Ideally, a moderator needs to be uncorrelated with the predictor variable for a moderation effect to be clearly interpretable (Baron & Kenny, 1986; Cohen, Maier-Sperger, Gower, &

Turner, 2003; Tucker et al., 2012). However, it is possible for a variable to act both as a moderator and mediator, as seems to be the case for substance use expectancies. In the case of expectancies, the evidence suggests: 1) that having substance using peers may increase targets' positive substance use expectancies, which in turn explains a subsequent increase in target substance use; and 2) that when a target has high negative substance use expectancies they will engage in lower substance use, regardless of their friend's substance use. Further information on how variables can be conceived as both a moderator and a mediator, and how they should be measured and analyzed, is provided in the recommendation section.

3.3. Peer and Parental Factors

3.3.1. Peer Relationship characteristics—It is well established that having relationships with substance-using-peers in adolescence is related to both current and future substance use (Allen, Donohue, Griffin, Ryan, & Turner, 2003; Barnow et al., 2004; Branstetter, Low, & Furman, 2011; Fallu et al., 2010; Jackson, 1997; Reifman, Barnes, Dintcheff, Farrell, & Uhteg, 1998; Simons-Morton, 2004; Wills & Cleary, 1999). Less well understood are the relationship features that affect peer association, and thus potentially act as moderators of the link between peer and target substance use.

3.3.1.1. Cross-sectional evidence: Only two cross-sectional studies examining friendship characteristics as a potential set of moderators of peer association on adolescent substance use were found. In one study by Burk, Van Der Vorst, Kerr, & Stattin (2012) no significant interactions were found between peers' self-reported frequency of alcohol intoxication and reciprocity of the relationship (i.e., both target and nominated peer considered each other as a friend) in the prediction of target's frequency of alcohol intoxication. The second study examined if the type of activity target adolescents conducted with peers (i.e., sport or non-sport) could moderate the link between deviancy (including alcohol and drug use) and target's own substance use frequency (Denault & Poulin, 2012). Authors found higher substance use frequency in adolescents who interacted with deviant peers in sport-related activities as opposed to non-sport related activities.

3.3.1.2. Longitudinal evidence: Almost all of the potential moderators identified in cross-sectional studies have also been investigated in longitudinal studies, some of which examined whether a friendship was reciprocal (i.e., the target's nominated friend also nominated the target as their friend) or unilateral (i.e., the target's nominated friend did not nominate the target as their friend). In one study, Bot and colleagues (2005) found results suggesting that unilateral friendships had the greatest exacerbating effect on the targets' drinking habits over a six month period. The authors suggested that the unreciprocated friend may have been trying to be accepted by their peer by imitating their actions. Other friendship characteristics have also been shown to be important moderators in the association between peer and target substance use. For instance, in Urberg and colleagues' (1997) longitudinal study, while no differences were identified between stable (i.e., close friends at T1 were still friends at T2) and unstable friendships (i.e., close friends at T1 who were no longer friends at T2), differences were found as a function of some features of the quality of the friendship (i.e., closeness and level of conflict). More specifically, the association between peer alcohol use (peer reported) and target alcohol use one year later

was greatest when friendships were close, with low levels of conflict and friendship quality was perceived to be moderate to high by the target (Urberg, Luo, Pilgrim, & Degirmencioglu, 2003). In another study by Allen, Chango, Szwedo, Schad, & Marston (2012) a stronger link between peer substance use at age 15 and targets' substance use at age 16 was found for targets with socially accepted peers (i.e. using a limited nomination sociometric procedure similar to those used to assess popularity) than lower accepted peers. However, in a study by Poelen and colleagues (2007) examining two different cohorts, quality of friendship (i.e., satisfaction and commitment to the relationship with one's best friend), and friend's popularity (reported by the target's sibling), assessed at baseline (i.e. at 13 and 15 years old in each cohort, respectively), were not found to moderate the link between friend's alcohol use frequency at baseline and target's alcohol frequency twelve months later. Finally, an interesting finding by Fallu and colleagues (2010) showed that substance use in mid adolescence was lower in adolescents that had more conventional friends (i.e., friends who liked school and friends that had not had trouble with the police) and high attachment to these peers in early adolescence. This taps into the more general idea that peer association can be positive as well as negative, with adolescent substance use varying depending not only on the relationship between friends, but also on the individual characteristics of the peers, suggesting again the need to examine three- or more-way interactions.

3.3.1.3. Experimental evidence: One experimental study examined classroom peers' popularity as a possible moderator of peer association. In this study the peer association variable consisted of a measure of pro and anti-alcohol norms in a simulated internet classroom, in which adolescents interacted online with experimenters pretending to be their class-mates (who had been previously rated on popularity). The deception procedure used here was quickly followed by proper debriefing within a week after all data was collected, allowing authors to collect the data ethically. Authors found that targets were more inclined to follow the influence of popular peers such that they had a higher willingness to drink alcohol when pro-alcohol norms were given by popular peers, and lower willingness to drink when anti-alcohol norms were given by more popular peers (Teunissen, Spijkerman, Prinsteen, Cohen, Engels, & Scholte (2012).

3.3.1.4. Summary and implications: Although friendship factors such as reciprocity, closeness and levels of conflict have been shown to be significant moderators of peer association on adolescent substance use, no two studies have measured or operationalized these factors in the same way, making it difficult to compare findings and to ascertain how consistent or generalizable they are across studies. Although the longitudinal findings still require replication, they do suggest that the quality of relationship between peers can moderate the link between peer substance use and targets' future substance use in accordance with the differential susceptibility model (Belsky, et al., 2007; Belsky & Pluess, 2009), as they show how individual factors (e.g., attachment to friends or popularity) can be detrimental or beneficial dependent on exposure to different environmental factors (i.e., deviant or conventional friends, or pro- or anti-alcohol norms). It also seems likely that these factors could be best studied in combination with other peer characteristics, besides just their deviance and substance use, as suggested by Fallu et al's (2010) findings.

3.3.2. Parental factors—Different features of parental behavior and of the parent-child relationship have been shown to be linked with adolescents' substance use (e.g., Kingon & O'Sullivan, 2001). For instance, a positive relation with one's parents (i.e., a self-reported combination of feeling accepted by one's parents, good communication with one's parents and parental monitoring) has been shown to be linked with lower future alcohol consumption (Nash, McQueen, & Bray, 2005). Results also showed that positive parental relations are linked with a target's strong sense of self-efficacy in refusing peer alcohol offers (Nash, McQueen & Bray, 2005). The link between targets' prior disruptiveness and their later substance use has also been shown to be lower in adolescents who are well monitored by parents (usually operationalized as parents' knowledge of the activities or whereabouts of a child, and/or of the friends he or she is with; Fallu, et al., 2010). Moreover, high parent-reported expectancies for their children's behavior (Simons-Morton, 2004) and expressing clear disapproval of substance use (Martino, Ellickson, & McCaffrey, 2009) both seem to be linked with a higher likelihood of adolescents abstaining from substance use.

3.3.2.1. Cross-sectional evidence: The role of parental monitoring as a moderator of the link between peer association and substance use has been supported in cross-sectional studies (e.g., Bergh, Hagquist, & Starrin, 2011; Bobakova et al., 2012; Clark, Belgrave, & Abell, 2012; Kiesner, Poulin, & Dishion, 2010; Mason, Cauce, Gonzales, & Hiraga, 1994; Nash et al., 2005; Wood, Read, Mitchell, & Brand, 2004). Findings by Warr (1993) suggest that, in the case of delinquency including alcohol and cannabis use, week-end time spent with one's family may significantly reduce the influence exerted by deviant peers on substance use. Thus, parents also seem to be able to limit exposure to the contexts in which their children are able to spend time with peers. It has been suggested that this process may prevent an escalation of their adolescent's delinquent behavior (Patterson, Forgatch, & DeGarmo, 2010). However, Denault & Poulin (2012) did not find a significant interaction between association with deviant peers and degree of adult supervision during activities with peers on target substance use frequency. Parental attitude toward substance use has also been studied as a potential moderator of peer association on target substance use by Clark, Belgrave, & Abell (2012), but this interaction also did not reach significance.

3.3.2.2. Longitudinal evidence: Longitudinal studies also support the notion that parental monitoring is an important moderator of the link between peer association and adolescent substance use. For instance, longitudinal studies indicate that the link between peer association (e.g., peer substance use or delinquency) in early adolescence and later adolescent substance use was lower at high levels of parental monitoring (Mason, et al., 1994; Sullivan, Kung, & Farrell, 2004). Authoritative parenting (i.e., a composite measure of parental acceptance-involvement and strictness-supervision) has also been shown to moderate the relationship between peer drug use (peer-reported in grades 9 to 11) and target drug use one year later, with authoritative parenting buffering the effect of peer association (e.g., Mounts & Steinberg, 1995). Similarly, maternal support was found to moderate the link between friends' and targets' (both self-reported) frequency of alcohol and marijuana use (Allen, Chango, Szewedo, Schad, & Marston, 2012). Authors found lower frequency of substance use in targets who had substance using friends and who also had greater maternal support. Although not all studies found significant interactions with parental monitoring,

they did find other results going in a similar direction. Such is the case of a study by Lee (2012), in which an interaction with parental monitoring was not significant, but an interaction with parent-adolescent relationship quality was. Results showed that adolescents with substance using friends who had a good relationship with their parents reported significantly lower substance use compared to those with a poor parent-adolescent relationship. Finally, Trucco, Colder, & Wieczorek (2011), did not find a significant interaction between perceived peer approval and peer use of alcohol and either target parental control or parental warmth on alcohol use initiation.

3.3.2.3. Experimental evidence: No experimental studies were found.

3.3.2.4. Summary and implications: The literature on the possible moderating role of parental features is consistent, regardless of design, in showing that parental monitoring and control are important factors that likely mitigate the link between peer association and adolescent substance use. In this way, and consistent with resilience models, positive parental influence could conceptually make adolescents more resilient to the influence of associating with deviant peers, possibly by limiting the amount of time spent with deviant friends or increasing their offspring's concern about the consequences of following the example of substance-using-peers. Furthermore, it could be that offspring who are easy to monitor may also be those who possess better personal resources to resist peer pressure. Further studies are needed to provide empirical support for these hypotheses.

As stated previously, studies have examined the effects of parental monitoring and authoritative parenting, but few studies have examined other parental factors as potential moderators (e.g., attachment to parents, disclosure, etc.) of the link between peer association and adolescent substance use. In line with Marshall and Chassin's (2000) study, which suggested that some factors like gender should be examined in three-way interactions, the moderating role of parental factors on the link between peer association and adolescent substance use could also be better understood by being examined in three-way interactions (e.g., testing interactions between peer substance use, parental monitoring and attachment to parents or interactions between peer substance use, parental monitoring and gender).

3.4. Broader Contextual Factors

3.4.1. School context—School factors, such as poor school climate (i.e., lack of enforcement of school rules, low levels of social norms against substance use, low participation in extracurricular activities, and unsafe places in and around the school), and low school connectedness (i.e., low bonding with teachers, low academic achievement and low orientation to school) have been linked with adolescent substance use (Crosnoe, et al., 2002; Reid, Peterson, Hughey, & Garcia-Reid, 2006). For example, higher bonding with teachers in high-school students has been linked with lower levels of alcohol use in boys (Crosnoe, et al., 2002). Moreover, some specific aspects of the school context could impact peer association. However, very few studies have examined the moderating role of school factors on the link between peer association and substance use.

3.4.1.1. Cross-sectional evidence: Crosnoe and colleagues (2002) showed that the link between associating with delinquent peers (peer-reported) and target problem behaviors including substance use was moderated by school connectedness. However, the effect of peer deviance on problem behavior were not decomposed and examined at various levels of school connectedness, making it difficult to interpret the extent to which school connectedness moderated the link between deviant peers and adolescent problem behaviors. Dickens, Dieterich, Henry, & Beauvais (2012) showed an interaction between peer alcohol use and target school bonding on targets' alcohol use. Authors found that within targets under 16 years of age that had alcohol-using peers those with higher school bonding had lower alcohol use than those with low school bonding.

3.4.1.2. Longitudinal evidence: A longitudinal study by Mrug & Windle (2009), did not support a moderating role of school connectedness (using five items from the School Connectedness Scale) on the link between teacher-reported peer deviance in grade five and target externalizing behaviors, including substance use, two years later. In this study, school connectedness was correlated with both the predictor (i.e., earlier teacher-reported peer deviance) and the outcome (later targets' substance use) variables, suggesting that mediation rather than moderation could be more appropriate in this case.

3.4.1.3. Experimental evidence: No experimental studies were found.

3.4.1.4. Summary and implications: Although there is some evidence for good school connectedness dampening the effects of concurrent deviant peer association on target substance use, supporting resilience models, this evidence is rather weak, and has rarely been replicated in other cross-sectional studies or across methodological designs. Further studies on the potential moderating effects of school climate and/or connectedness are clearly needed due to the limited number of studies on this subject.

3.4.2. Neighborhood context—Findings are also inconsistent when context studies are broadened to include the direct effect of neighborhood. Some cross-sectional research has found no effect of neighborhood on adolescent alcohol use (e.g. Allison et al., 1999). However, Leventhal and Brooks-Gunn's (2000) quantitative literature review on the effects of living in disadvantaged neighborhoods found that neighborhoods accounted for 5% to 10% of the variance in adolescents' future conduct problems and delinquency, including substance use. These results suggest that neighborhoods could be related in a small but significant way to behavioral and substance use problems in adolescence. Again, in cross-sectional studies, living in disadvantaged communities has been shown to be linked to greater affiliation with antisocial peers (Brody et al., 2001). Some cross-sectional and one longitudinal study also support neighborhood as a moderator of the effect of peer association on target substance use.

3.4.2.1. Cross-sectional evidence: Findings from one cross-sectional study suggest that living in a disadvantaged neighborhood could possibly protect against, rather than exacerbate, the link between peer association and target substance use (e.g., Snedker, Herting, & Walton, 2009). This effect could be partly explained by a link between

disadvantaged neighborhoods and higher parental monitoring, which in turn has been linked with lower peer and target alcohol use (e.g., Chuang, Ennett, Bauman, & Foshee, 2005).

3.4.2.2. Longitudinal evidence: Only one longitudinal study in this category was found. In this study, Zimmerman and Vasquez (2011) examined the interaction between neighborhood opportunities for crime and friends substance use on target's own substance use two years later. The authors found that the effect of peer association on target substance use varied as a function of neighborhood. That is, within neighborhoods with lower opportunities for crime, the effect of peers was initially small (i.e. target substance use only increased slightly in those with one or two friends who used substances versus those with none), but as peer substance use increased, the effect of peers increased multiplicatively. In contrast, within neighborhoods with more opportunities for crime, the effect of peers was initially strong, but decreased as peer substance use increased, suggesting a ceiling or saturation effect.

3.4.2.3. Experimental evidence: No experimental studies were found.

3.4.2.4. Summary and implications: The literature on the different social contexts as possible moderators of the link between peer association and adolescents substance use remains limited. Most studies that have been conducted were cross-sectional in design. Because of this, it is harder to evaluate the consistency across study designs and therefore further studies on this subject are needed. Nonetheless, the results do suggest that the effect of neighborhoods on the link between peer association and target substance use could vary depending on individual or other contextual factors in accordance with the differential susceptibility model. This would mean that disadvantaged neighborhoods may not, by themselves, directly influence adolescents' future substance use, but may enhance other risk or protective individual or environmental factors. Studies addressing the complexity of the developmental effects of neighborhood and other contextual factors, as well as their potential moderating effects, are still in their infancy. Even so, there are suggestions throughout the literature as to the direction in which these studies could go. For example, it has been shown that children living in low socioeconomic neighborhoods have lower self-esteem than those from more well-off families and neighborhoods (Harter, 1998). It has then been suggested by Bukowski and colleagues (2008) that peer association could be stronger in impoverished neighborhoods because the individuals living there have lower self-esteem. Conversely, some studies show that teen alcohol use was higher in more advantaged neighborhoods when compared to disadvantaged neighborhoods (e.g., Ennett, Flewelling, Lindrooth, & Norton, 1997), which may reflect the fact that norms towards alcohol may be more positive in advantaged neighborhoods than in disadvantaged neighborhoods, or that adolescents from advantaged neighborhoods have more financial resources to buy alcohol. These findings illustrate the potentially complex role of studying larger contexts such as neighborhoods in the link between peer association and substance use, and suggest that disadvantaged neighborhoods may not affect adolescent substance use directly, but may operate in synergy with other individual and family risk factors. This also highlights the importance of considering a number of risk factors for substance use which are at different levels of analyses or influence (e.g., individual and family). Potential risk factors are likely to vary from one neighborhood to another, from one culture to another and from one country

to another. Henceforth there are many different ways neighborhood factors could moderate the link between peer association and target substance use, but most of these would need to be examined in more complex three way interactions or by using mediated moderation.

4. DISCUSSION

4.1. Summary

Findings from this review suggest that a number of factors (i.e., age, puberty, genetic vulnerability, popularity, social anxiety, risk-taking and other personality and individual characteristics, peer relationship characteristics such as friendship reciprocity, and parental factors such as parental monitoring and control) clearly act as significant moderators in the link between peer association and adolescent substance use (see Figure 1. for a graphical summary of the moderators studied in this review and the nature of their effect on the link between peer association and target substance use). Many of these factors - specifically early puberty, genes, risk-taking, sensation-seeking and or impulsivity, and parental control and monitoring – have also been shown to be significantly and directly linked with peer association. That is, with the exception of parenting factors which have been directly linked with affiliating with less deviant peers, all of the personal characteristics listed in the previous line have been shown to be directly linked with higher deviant peer affiliation. In contrast, substance use expectancies has been identified not only as a moderator but also a mediator in the link between peer association and adolescent substance use, helping explain, at least in part, how peer substance use is linked with higher adolescent substance use. These factors which have been identified not only as moderators, but also as either having a direct effect on peers or acting as a mediator, seem to be particularly good targets for prevention/intervention. Finally, for the remaining factors (i.e. school and neighborhood context and gender) the evidence was too weak (either insufficient or had too many conflicting results) to clearly support their role as moderators of the link between peer association and adolescent substance use.

Although the smoking literature was outside the scope of the present review, it is interesting to note that similar parental factors (e.g. parental monitoring) and individual characteristics (e.g., popularity) have been identified as important moderators of the effects of peer association and adolescent smoking (Hoffman, Sussman, Unger, & Valente, 2006; Kobus, 2003; Simons-Morton & Farhat, 2010). There are however some differences among findings in both sets of literatures: while the current review found inconsistent results for the moderating role of gender, Hoffman, Sussman, Unger, & Valente, (2006) concluded that a strong effect of peer association on adolescent smoking was only found for boys.

Identifying the conditions under which the effect of peer association varies is crucial in order to improve current theoretical models, as well as prevention and early intervention programs. For example, studies reviewed showed consistent support for both increasing and decreasing moderating effects, with greater support for the diathesis-stress model when individual factors were studied as moderators (e.g., most individual characteristics reviewed found increasing links with peer association) and greater support for resilience models when environmental factors were studied as moderators (e.g., most environmental factors reviewed found decreasing links with peer association). The fact that one set of studies supported the

diathesis-stress model while another set supported the resilience model can be accounted for by the way individual and contextual factors were conceptualized and measured. When studying individual characteristics, most studies reviewed examined differences on “negative” individual characteristics, or those related to increased risk for substance use. In contrast, when studying environmental factors, studies generally assessed the supportive aspects of a target’s environment which could potentially protect them from the effect of peers on substance use problems. Thus, as mentioned in the introduction, these two models are complementary, with results showing that they are both useful in the study of moderators of peer association on adolescent substance use. However, support for the differential susceptibility model was much sparser. This may reflect the fact that most studies did not investigate positive and negative aspects of peers simultaneously, with studies focusing mainly on association with deviant and substance using friends. A fuller test of the differential susceptibility model requires an assessment of positive and negative environmental factors (in this case, association with good (or conventional) as well as deviant friends), so this model could be further tested in studies that investigate positive and negative aspect of peers simultaneously.

4.2. Methodological and theoretical framework

A common difficulty in comparing studies of peer association and moderators of its link with adolescent substance use can be attributed to how “peers” and “peer association” are defined. This operationalization brings up two issues. First, in most studies, peers were defined as either “the best friend” or a group of friends. Studies that relied on the best friend (Bot, et al., 2005; Branstetter, et al., 2011; De Kemp, Scholte, Overbeek, & Engels, 2006; Henry, Kobus, & Schoeny, 2011; Jackson, 1997; Larsen, et al., 2010; Rees & Pogarsky, 2010; Sieving, et al., 2000) did so because it was hypothesized that this friend usually shared a more intense and intimate relationship with the target and thus had a stronger influence (Rybak & McAndrew, 2006). However, there was little evidence supporting this hypothesis, with only a few studies showing that best friends had a strong influence on adolescents’ alcohol use (Jackson, 1997; Urberg, et al., 1997), whereas other studies found only trivial or no effects (Bot, et al., 2005; Jaccard, et al., 2005; Larsen, et al., 2010). More consistent findings were noted in studies assessing association with a group of friends (Bahr, et al., 2005; Rees & Pogarsky, 2010; Wills & Dishion, 2004). The significant effect of peer association, assessed by considering a larger group of friends, has also been supported by studies examining other adolescent behaviors such as risky sexual behaviors (see Bearman & Brückner, 1999). Therefore, future studies of peer association should prioritize collecting data on groups of friends rather than just the best friend.

The second key issue in studies investigating peer association consists in asking the target adolescents questions about their friends’ substance use (Cumsille, et al., 2000; Dick, et al., 2007; Epstein & Botvin, 2002; Fallu, et al., 2010; Ferguson & Meehan, 2011; Fergusson, et al., 2002; Fergusson, Woodward, & Horwood, 1999; Fite, Colder, & O’Connor, 2006; Guo, et al., 2002; Henry, et al., 2011; Henry, et al., 2005; Musher-Eizenman, et al., 2003; Nash et al., 2005; Patterson, Dishion, & Yoerger, 2000; Sieving, et al., 2000; Simons-Morton, 2004; Vitulano, Fite, & Rathert, 2009; Warr, 1993). This way of assessing peer behavior may reflect more a target adolescents’ perceived norms about substance use than an objective

measure of friends' actual substance use. One alternative consists in asking target adolescents to nominate and list their friends, whom will then be contacted individually and asked to report on their own substance use. The number of friends nominated usually varies from one (Branstetter, et al., 2011) to between five and ten (Henry, et al., 2011; Jaccard, et al., 2005; Larsen, et al., 2010; Rees & Pogarsky, 2010; Urberg, et al., 1997; Urberg, et al., 2003). This extra procedure also helps reduce bias because adolescents have been found to misestimate their friends' and peers' substance use (Henry, et al., 2011; Iannotti & Bush, 1992; Prinstein & Wang, 2005). There are, different ways of assessing peers' self-reported data, including evaluating an entire classroom or school (e.g., Henry, et al., 2011), or even assessing an entire community, so all possible friendships are included in the study. (e.g., Kerr & Stattin, 2000; Vitaro, Pedersen, & Brendgen, 2007).

It is important to note that although these alternative methods for obtaining peer data may have greater validity, using targets' perception of peer substance allows researchers to tap peer social norms on substance use. This is similar to what is done when targets are asked to rate their neighborhood characteristics (Lambert, Brown, Phillips, & Ialongo, 2004). Furthermore, because norms vary from one context to another (Bukowski, et al., 2008), asking for targets' perception and rating of these different contexts could allow the study of interactions between norms at different levels of influence (i.e., how opposing or similar norms at different levels – group of friends vs neighborhood - interact and influence target substance use). For these reasons, it is suggested that future studies include both target and peers' self-reported data in order to better estimate both the perceived norms and the actual norms on substance use.

Another interesting way of assessing the link between peer association and target substance use consists of only considering the effect of new substance-using-friends (Poulin and colleagues, 2011). This novel method showed that substance-using-targets had a tendency to affiliate with adolescents that had similar substance use habits to theirs and suggested that although these friendships were new, they still seemed to influence targets' substance use either by stabilizing it or by exacerbating it. This methodology allowed better testing of both the peer selection theory and peer association theory. It also took into account the body of literature demonstrating that portions of friendship networks change constantly (Berndt, Hawkins, & Hoyle, 1986; Berndt & Hoyle, 1985; Chan & Poulin, 2007). This is important because most longitudinal studies asked targets to report on their friends' substance use at each wave but did not ask targets if these friends were the same friends as the year before, making it harder to establish if the peers that were assessed were the ones actually associating with the target.

5. RECOMMENDATIONS

This review has identified several general conceptual and methodological issues which can guide recommendations. First, it highlighted the important role some moderators play in either increasing or decreasing the links with peer association, specifically, the role of individual, peer, family and contextual factors (see Figure 1.). While the effects of some moderators seem robust, others need to be further investigated. Brechwald and Prinstein (2011) have recently suggested that the specific role of some moderators needs to be

observed through more complex three-way interactions. For example, a three-way interaction between age, gender and peer association has been identified, suggesting that adolescents who report the most substance use are 13 to 15 year-old girls who have substance using peers. This suggestion can be further extended by also examining three-way interactions in accordance to Bronfenbrenner's (1977) multi-level ecological model (i.e., examining moderator effects of combined levels) or the triadic influence theory (Flay, 1999; Flay, Petraitis, & Hu, 1995).

Second, very few studies examined the putative mediators of moderating factors (i.e., mediated moderation), which could help clarify the mechanisms through which moderators link target and deviant and/or substance-using-peers. That is, while moderators help determine under what "conditions" individuals are more or less affected by peer association, mediators help explain through which processes the link between target and peer substance use work (Muller, Judd, & Yzerbyt, 2005). For example, mediated moderation could shed light on the mechanisms by which the link between peer association and target substance use is decreased as a function of parental monitoring (e.g., parental monitoring could help limit peer interactions in contexts more conducive to substance use). In more general terms, some models such as the Prototype/Willingness model (Gibbons, Gerrard, Blanton, & Russell, 1998) suggest that many moderators of the link between peer association and target substance use will be mediated by or work through two important factors: target adolescents' willingness to drink and their prototype of someone who drinks. In this case, a prototype refers to the image the target has of someone who uses substances (e.g., positive or negative and acceptable or unacceptable).

Third, to address the complex issues of change in friendships and peer groups across adolescence and the effects exerted by different levels of influence, future research should prioritize the use of longitudinal designs, assessing peer substance use data from both targets and peers. Analytical strategies such as multi-level/multi-wave cross-classified models (Fielding & Goldstein, 2006; Goldstein, 1994) as well as agent-based simulations and social network analysis (Ennett & Bauman, 2000; Henry & Kobus, 2007; Schroeder & Prentice, 1998; Smith & Conrey, 2007) could prove useful. An excellent review by Valente, Gallaher, & Mouttapa (2004) illustrates how the social network approach can help clarify complex social influences on substance use.

Fourth, in most studies examining directionality, only unidirectional links were addressed, which would imply the questionable assumption that peers influence targets but targets do not influence peers. Thus, there is a need for transactional models (i.e., cross-lagged models), in which bi-directional links and two-way moderators can be examined.

Fifth, few studies examined whether moderators varied according to age. As suggested by Brechwald and Prinstein (2011), age and gender should be routinely tested as moderators in three or four way interactions, as the role of moderators could change with age and with gender, or some other factor such as socioeconomic status. There is no reason not to include these factors since almost all studies measure them and studies should be sufficiently powered a priori to include these interactions. Moreover, friends' substance use and the moderators studied are often only measured at one time point. As it is highly likely that

friends and moderators may change throughout adolescence, they should be measured at several time points and also included in transactional (e.g., cross-lagged models) or trajectory models.

Sixth, in many studies, variables were conceptualized as moderators when they could also have been conceptualized as mediators of peer association; this is particularly true in the case of moderators that are not independent of friends' deviancy or substance use. An example highlighted in this review was the role of alcohol expectancies which were shown to partially mediate the link between friends' alcohol use and adolescent's own substance use (Scheier & Botvin, 1997). For a moderation effect to be clearly interpretable, it is desirable that the moderator be uncorrelated with the predictor (Baron & Kenny, 1986; Cohen, et al., 2003; Tucker, et al., 2012). If the predictor and moderator are not uncorrelated, then this link should be taken into account, as exemplified by the study on genetic heritability by Harden et al. (2008), or controlled for. Thus, researchers are recommended to test for the link between independent variables (peer deviancy/substance use) and the hypothesized moderators, to confirm whether they are independent from each other or whether mediation should also be tested.

Seventh, although the expression "peer association" can imply a direction of effect, most studies reviewed were correlational in nature, including the longitudinal studies. It is clear that more experimental and clinical studies are needed to help clarify some of the complex links between peer association and substance use behaviors. Granted, experimental studies on adolescent substance use are difficult to conduct for ethical reasons that restrict providing adolescents with alcohol or using alcohol- or drug-related cues. However, the use of ethical proxies of substance use can provide valuable information. For instance Steinberg and colleagues (e.g., Chein, et al., 2011) used behaviors/phenotypes shown to be heavily implicated in adolescent substance use, such as risky behavior, reward-processing, and disinhibition, to better understand the mechanism's underlining adolescent substance use. Similarly, Cohen and Prinstein's (2006) study, focusing on aggressive and health risk behavior, also described earlier in the text, illustrates how another type of experimental study can be adapted specifically for substance use. In those cases, the outcome variable is replaced by an ethical proxy referring to substance use (e.g., willingness to drink) or highly linked with it (e.g., risk-taking).

Furthermore, theoretical and practical knowledge could also be obtained with clinical and randomized control trials that assign adolescents to interventions designed to reduce peer influence (e.g., those that dispel "pluralistic ignorance", see Prentice, 2008), or assign them to adult- or peer-led interventions targeting substance use behaviors and/or known risk factors for substance use. For example, Schroeder & Prentice (1998) presented college students with evidence that they all overestimated their peers' comfort with heavy drinking in group settings. That intervention designed to reduce or dispel erroneous social norms was significantly more effective in reducing drinking quantity than an individual-oriented control condition in which college students were exposed to a more general discussion on responsible drinking decisions. These authors also found that the intervention effect was moderated by social anxiety: the intervention was most effective at reducing heavy drinking in students who were socially anxious, which are those hypothesized to be the most

influenced by peer norms. Another study by Valente and colleagues (2007) showed that peer-led interventions were more effective in reducing adolescent substance use than adult-led interventions and a no intervention control group. Although much more research is needed, experimental studies illustrate how peer characteristics (positive or negative) could not only be used as a grouping criterion in prevention or treatment studies, but also be used as an integral part of the treatment itself.

Finally, this review also illustrates the usefulness of conceptualizing moderating effects according to diathesis-stress, resilience or differential susceptibility perspectives, all of which have important theoretical and clinical implications in terms of selection of the vulnerable/susceptible population (e.g., who is more or less likely to benefit from interventions) and intervention content. On the one hand, the diathesis-stress model helps determine *who* should be the object of interventions or may benefit most from intervention programs (e.g., targets with substance using friends that are high in sensation-seeking), as well as *what* the focus of the intervention could be (in this example, reducing sensation-seeking tendencies). On the other hand, the resilience model helps determine factors that should be encouraged or promoted in interventions in order to dampen the effect of peer association on adolescent substance use (e.g., interventions designed to promote resistance to peer pressure and encourage parental monitoring). Lastly, the differential susceptibility model helps determine *who* should be part of an intervention and *how* adolescents should be grouped. For example, it would be important that adolescents at risk be exposed to non-deviant friends, and thus, in group-based intervention studies, groups should have a majority (or at least a good balance) of non-deviant and deviant adolescents to avoid possible iatrogenic effects (Castellanos-Ryan, Séguin, Vitaro, Parent, & Tremblay, 2013).

6. CONCLUSION

Overall, although the important role of peer association on target adolescent substance use remains supported, the studies reviewed show that the magnitude of this influence is dependent on a number of individual and environmental factors, some of which could potentially eliminate the influence of associating with deviant peers altogether (e.g., when targets are well monitored by parents).

The conditions under which peer association varies can directly feed into prevention and intervention approaches by narrowing down the focus of interventions and setting treatment priorities, as well as narrowing down the population to whom these interventions should be applied. The selection of priorities for interventions could be further enhanced by testing mediated moderation models, which would provide a further understanding of the underlying mechanisms by which these moderators may work. However, because the research reviewed above is mostly correlational, experimental and clinical studies are recommended. For example, future experimental research aiming to boost protective factors and/or reduce risk factors could prove useful in determining the more causal links between the proposed moderators and targets' future alcohol use. For this last recommendation to be successful, future research needs to prioritize the use of randomized controlled designs including direct observations of interactions between targets and peers in order to better understand how peers affect each other in general and how this influence evolves over time.

Furthermore, studies should evaluate targets' personal and environmental characteristics on a full continuum, including positive and negative aspects of peers in order to simultaneously test all theoretical models, and to be able to better confirm which model best represents how moderators of peer association on target substance use function. Finally, while keeping in mind the methodological considerations stated previously, studies also need to simultaneously examine multiple environmental levels of peer association (e.g., group of friends, family, classroom, school and neighborhood level) and examine the effects these levels have on each other in order to better grasp how they influence adolescent substance use.

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Highlights

- Moderators of peer association on adolescent substance use are reviewed.
- Individual, peer, family and broader contextual factors are reviewed as moderators.
- Further methodological considerations in the study of these moderators are addressed.
- Areas for further investigation and clinical implications are discussed.

Figure 1. Summary of the moderators of peer association on adolescent substance use

Note: A “+” depicts factors that increase the link; a “-” depicts factors that decrease the link; a “?” identifies those factors which require further investigation to confirm them as moderators (or may only be significant in three- to four-way interactions); Pred: predictor, and identifies factors that not only act as moderators but have also been shown to be significantly linked with peer association; Med: mediator, and identifies factors that not only act as moderators but have also been shown to mediate (at least in part) the link between peer association and adolescent substance use.

Studies [†] examining moderators of the effect of peer association on adolescent substance use by level of moderating factor and study design.

Table 1

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
Individual	Experimental	Cohen & Prinstein, 2006	43 Caucasian boys (age 16–17 years) from USA.	High vs low status Peers, experimental conditions	Social Anxiety Scale for Adolescents (SAS-A)	Public and private self-reported conformity with regard to aggressive and health risk behavior, including substance use; hypothetical scenario instrument	Low status peers exerted influence on public conformity to health risk behaviors only for adolescents high in social anxiety. While high status peers exerted influence on all participants regardless of social anxiety.
		Chein et al., 2011	40 girls and boys, 3 groups: adolescent (mean age 15.7), young adult (mean age 20.6) and adult (mean age 25.6)	Presence of peers during experiment vs. alone	Target's age	Risk taking assessed with a stop driving task. Activation in reward-related brain regions.	Adolescents, but not adults, took more risks when observed by peers. Adolescents demonstrated greater activation in reward-related brain regions when observed by peers.
		Henry et al., 2005	1065 boys and girls (mean age 12.35 at baseline) from the USA	Self-report proportion of friends that drink	Perceived Harm: beliefs about the effect of alcohol use on future aspirations. Risk-taking: willingness to engage in risky activities.	Self-reported drinking frequency, intoxication, number of drinks, extent of typical drinking, self identification as a user, intention to use alcohol in the future.	The link between friends' and targets' alcohol use was lower with increases in perceived harm, but greater with increases in risk-taking.
Longitudinal		Allen et al., 2005	185 girls and boys (mean age 13.36) from the USA	Self-reported peer valuing of behavioral misconduct: Peer Pressure Inventory	Popularity: adolescents named 10 individuals they most and least would like to spend time with on weekend	Self-reported alcohol and substance use frequency (last 30 days)	Stronger link between perceived peer valuing of behavioral misconduct and targets' alcohol and substance use frequency with high popularity.
		Rabaglietti et al., 2012	457 girls and boys, aged 14 to 20 years old (M = 16.1) from Italy	Peer reported alcohol Intoxication Frequency	Regulatory Self-efficacy (RSE) Gender	Alcohol Intoxication Frequency	Lower levels of alcohol intoxication in adolescents with alcohol using friends who had higher RSE, compared to those with average or low RSE. No significant interaction with gender.
		Fiallu et al., 2010	1037 Caucasian boys (from ages 6 to 15	Self-reported Peer conventionalality: Friends' school liking and Friends	Childhood disruptiveness: Teacher-rated Social Behavior Questionnaire.	Self-reported heavy Substance use: Frequency of tobacco and drug use by frequency of alcohol intoxication episodes in	Stronger link between low peer conventionality and targets' heavy substance

Moderator Level	Study Design	Measures				Results
		Authors, Year	Sample	Peer association	Moderator	Outcomes
			years) from Canada	having trouble with the police (reversed).		the past 12 months, at 14–15 years.
		Larsen et al., 2010	1,232 girls and boys (11- to 15-year-old) from the Netherlands.	Friend's reported alcohol use.	Gender Self-esteem and self control: assessed via the Rosenberg Self-Esteem Scale	Self-reported number of alcoholic beverages consumed in the last week No significant interaction.
		Marshall & Chassin, 2000	300 girls and boys (mean age 12.7) from the USA	Self-reported peer group affiliation assessed by peer substance use and peer tolerance of adolescents' substance use	Gender Consistency of Parental Discipline: Parent-reported, adapted from the Children's Reports of Parental Behavior Inventory	In a three-way interaction only: link between peer influence on future substance use decreased for girls but increased for boys as a function of good parental discipline. No significant interaction.
		Guo et al., 2002	808 boys and girls (mean age 10.8) from USA	Self-reported peer antisocial activities	Gender	Self-reported illicit drug use and alcohol use (yes/no): crack, cocaine, amphetamines, tranquilizers, sedatives, psychedelics, alcohol, tobacco
		Crosnoe et al., 2002	3,046 adolescent girls and boys (grades 9 to 12) from USA	Friend-reported Deviancy and substance use, alcohol use and marijuana	Gender	Self-reported delinquency including: substance use cigarette use, alcohol use and marijuana Stronger link between friend's alcohol use and target's Delinquency in boys
		Duncan et al., 1994	517 girls and boys (mean age 13.11) from the USA	Self-reported peer encouragement of alcohol use.	Age	Self-reported alcohol use frequency and present alcohol use Stronger link between deviant peer affiliation and targets' alcohol abuse/dependence in early as opposed to later adolescence.
		Fergusson et al., 2002	1,265 girls and boys (followed from 14 to 21 years) from New Zealand	Self-reported deviant peer affiliation: friends' substance use, truancy and/or law breaking	Age	Self-reported alcohol abuse/dependence assessed with the Alcohol Problem Index (RAPI; White & Labouvie, 1989) Stronger link between deviant peer affiliation and targets' alcohol problems in mid as opposed to later adolescence/early adulthood.
		Li et al., 2002	188 girls and boys (mean age 14) from the USA	Self-reported exposure to Deviant Peers (including alcohol and substance use)	Alcohol trajectory: initial low levels of alcohol use frequency from 14 to 18 years	Stronger link between peer influence and target's alcohol use across adolescence in those who showed low levels of alcohol use at age 14.

Moderator Level	Study Design	Measures				Results
		Authors, Year	Sample	Peer association	Moderator	Outcomes
		Ge et al., 2006	896 girls and boys (mean age 11.10) from the USA	Self-reported number of friends who use substances	Pubertal timing using the Pubertal Development Scale (self-report)	Stronger link between friends' substance use and intention and willingness to use substances in early puberty.
		Costello et al., 2007	1420 girls and boys (aged 9–13) from the USA	Association with self-reported deviant peers	Early maturation: tanner stage IV by age 12	Stronger link between deviant peers and targets' alcohol use with early maturation.
		Mrug et al., 2009	500 girls and boys (followed from 11 to 13 years) from the USA	Teacher-rated peer deviancy	Childhood antisocial behavior: Parent-reported targets' oppositional behavior and conduct problems at 11 years	Stronger link between peer deviance and targets' externalizing behaviors with a history of childhood antisocial behavior. Gender, n.s.
		Allen et al., 2012.	157 adolescents (M= 13.35) from Southeastern US.	Self-reported friends alcohol and marijuana use frequency (past 30 days).	Gender Observed autonomy difficulties with mothers (recantation from original point of view). Autonomy difficulties (in general) Self-reported social skills in handling deviancy Susceptibility to peer influence (composite measure of all other measures).	Weaker link between peer substance use and target substance use for those with better skills in handling deviance. Stronger link between peer substance use and target substance use for those who more easily recanted on their position (Autonomy difficulties). Stronger link between peer substance use and target substance use for those who had higher scores on the composite susceptibility risk measure.
		Westling et al., 2008	528 boys and girls from the US (mean= 10.5)	Deviant peer association (target, parent and teacher reported)	Gender	No significant interactions with peer association were found.
Longitudinal and Cross-sectional		Stattin et al., 2011	634 (cross-sectional) and 434 girls for Sweden (longitudinal; mean age= 14.42)	Peer involvement	Pubertal timing (age of first menarche) Youth center participation (Attending youth center in town)	Longitudinal: no significant interactions were found. Cross-sectional: Higher delinquency in girls that spent more time with peers and were early matures. Higher delinquency in girls that spent more time with peers and frequented

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
Cross-sectional		Denault et al., 2012	185 8 th and 9 th graders (M= 14.34) from Quebec Canada	Deviancy in the activity peer group (including alcohol and drug use).	Gender Age	Substance use frequency in the past month (alcohol, drugs and cigarettes)	more regularly the youth center, especially those that were early matures. No significant interactions.
		Epstein & Botvin, 2002	2400 early adolescent boys and girls (mean age 12.4) from the USA	Self-report proportion of friends that drink	Risk-taking (RT) : 7 items from the Eysenck IVE scale. Refusal assertiveness (RA) : 3 items from the Gambrell-Richey Assertion Inventory	Self-reported drinking quantity, drinking frequency and drunkenness	Stronger link between friends' alcohol use and drinking quantity and frequency with high RT and poor RA. Stronger link between peer alcohol use and target drunkenness with poor RA.
		Fergusson et al., 2007	265 early adolescent boys and girls (mean age 13.4) from Canada	Friend's reported delinquent and SU behaviors	Puberty: Pubertal Development Scale (self-report)	Self-reported delinquent and SU behavior	Stronger link between peer delinquency and target delinquency with earlier pubertal development.
		Wills et al., 2011	1 307 boys and girls from the US	Friends substance use (alcohol, marijuana and cigarette)	Good behavioral self-control Poor behavioral regulation Good emotional self-control Poor emotional regulation Academic involvement Negative life events	Substance use level (alcohol, marijuana and cigarettes)	Lower substance use in those with lower behavioral regulation. No other significant interactions were found.
		MacNeil et al., 1999	779 adolescents (mean age 12.81) from the US	Self-report proportion of friends use alcohol, or drugs	Future expectations : Scale created by Brooks, Stuewig, and LeCroy (1998).	Self-reported lifetime Substance Use scale from the Youth Plus Survey	Weaker link between friend's substance use and targets Lifetime substance use with higher future expectations.
		Knyazev et al., 2004	4501 students (14 to 25 years old) from Russia	Self-reported friends' drug use	Behavioral activation system (BAS) : self-reported impulsivity and sensation seeking using the Gray-Wilson Personality Questionnaire Extraversion : self reported using a shortened Russian version of the Eysenck's personality factors.	Self-reported composite score of having used drugs, wanting to use drugs, type of drug use and frequency of drug use	Stronger link between friends' drug use and targets' (composite) drug use at both high BAS and Extraversion.
		Clark et al., 2012.	567 9 to 21 year old African Americans from the	Peer problem behavior (including substance use).	Drug and Alcohol Refusal Efficacy, Gender	Past 30-day alcohol use and past 30-day marijuana use.	Stronger link between deviant peers and marijuana for males.

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
			USA (M=15.27)				
		Bergh et al., 2011.	About 9900 adolescents (aged 15–16) from Sweden.	Peer activity level (how often the targets spend time with their friends; does not assess if friend use substances)	Gender Academic orientation Year of investigation.	Alcohol use frequency past year.	No significant interactions were found.
		Dumas et al., 2012	1070 adolescents aged from 14 to 17 years old (M=15.45) from Canada	Peer group pressure, 2 items (to do things the target didn't want or to drink, smoke and try drugs) Peer group control, 5 items (assessing to what extent some members of the group try to control the other members.)	Identity commitment (16 items). Items included information on: future occupation, religion, politics, relationships, family, friends, dating partners, sex roles, and personal values.	Substance use (frequency of alcohol use, binge drinking and marijuana use over the past three months).	Weaker link between peer group pressure and substance use in those with high identity commitment. Higher substance use in adolescents with both controlling groups and high identity commitment.
		Trucco et al., 2011	387 girls and boys (mean age 11.60) from the USA	Self-report Perceived peer approval of alcohol and tobacco use.	Agentic and Communal Goals: Self-report using revised version of the Interpersonal Goals Inventory for Children	Self-reported intention to use alcohol and cigarettes: 4 items from the Monitoring the Future Project	Agentic goals, n.s. A trend for a stronger link between perceived peer approval of alcohol use and target's intention to use alcohol with high communal goals.
		Guo et al., 2009	600 pairs of same sex siblings (mean age 16.1) from the US	Friends' reported drinking	Genetic Heritability calculated through twin modeling	Self-reported drinking frequency	The genetic contribution to target alcohol use is stronger at higher levels of friends' drinking.
		Harden et al., 2008	1,636 sibling pairs (mean age 16.1) from the US	Best friend's-reported drinking and smoking	Genetic Heritability	Self-reported drinking and smoking frequency	Stronger link between and target substance use in adolescents with high genetic liability to substance use.
		Dick et al., 2007	2918 same sex twins (17 years) from Finland	Self-report proportion of friends that drink	Genetic Heritability	Self-reported alcohol use frequency at 17 years	Stronger genetic heritability for alcohol use in adolescents with many alcohol using friends.
	(the study is longitudinal but was analyzed Cross-sectionally)	Miranda et al., 2013	104, boys and girls 12 to 19 years old (M = 15.60, SD = 1.77).	Self-reported deviancies (i.e., friends substance use, and perceived friends' reaction to targets' substance use)	Genotype OPRM1 (A and G allele carriers)	Alcohol use disorder (AUD)	Higher links between G allele carriers an AUD in adolescents with delinquent peers.
	Cross-sectional	Kendler et al., 2011.	1796 adult male twins from the US.	Peer group deviance	Genetic risk for AUDs (history of alcohol abuse and	Alcohol use frequency by month.	At 12 to 14 years old there was higher alcohol use for those with both the genetic

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
		Anderson et al., 2011	1571 girls and boys (13 years) from the USA	Self-report proportion of friends that drink	dependence by the target's parents and co-twin) Gender Social Anxiety Assessed with the Social Anxiety Scale for Adolescents—Revised (SAS-A)	Self-reported alcohol use quantity (30 day period)	risk-factor and deviant peers. Stronger link between perceived peer alcohol use and target's alcohol use quantity in girls. Stronger link between peer and target alcohol use, in adolescents that had a strong need for affiliation and were high in social anxiety. Stronger link between peer alcohol use and target binge drinking in boys who were socially anxious.
		Bobakova et al., 2012.	1052 boys and girls (M= 14.68) from Eastern Slovakia.	Friends alcohol use (at least once a week)	Gender Ethnicity	Having been drunk in the past month (yes/non)	No significant interactions were found.
		Mennis et al., 2012	254 adolescent primary care patients at a Philadelphia Department of Public Health (ages 13 to 20)	Social network quality (Perceived friends substance use, if friends have tried to influence their substance use and positive activities with these friends).	Gender Age	Alcohol and Drug Involvement	Higher substance use in adolescents which both have low social network quality and are older.
		Burk et al., 2012.	950 4 th , 7 th and 10 th graders from Sweden	Self-reported past year frequency of alcohol intoxication.	Gender Grade	Past year frequency of alcohol intoxication.	No significant interactions were found.
		Gaughan, 2006	2980 best friend dyads (boy-boy, girl-girl and girl-boy; mean age 16.55) from the USA	Peer reported drunkenness frequency assessed by one item	Friend's Gender	Self-reported drunkenness frequency assessed by one item	Positive link between male alcohol using peers and female targets' drunkenness, but no link between female alcohol using peers and male targets' drunkenness.
		Ferguson et al., 2011	8,256 girls and boys (mean age 14) from the USA	Self-reported peer delinquency, assessed by 11 items including 4 items on substance use	Age	Self-reported alcohol use (7 items) and illegal substance use (14 items)	Stronger link between peer delinquency and target substance use when targets were between the ages of

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
Peer	Experimental	Kelly., 2012	7064 adolescents in grade 6 (M= 11 years old) and grade 8 (M= 13 years old) from Australia.	Number of friends which have tried alcohol without their parent's knowledge in the past 12 months (0 to four).	Age (grade 6 or 8)	Past 30 days alcohol use frequency	13 and 16 years old as opposed to older. In 8 th grade: weaker link between having one peer who tried alcohol and targets alcohol use. No significant interaction between grade level and having two, three or four friends who have tried alcohol.
		Miranda et al., 2012	429 boys and girls (M = 15.74 and SD = 0.82) from Québec, Canada	Peer reported Substance Use (Alcohol, Cannabis and cigarette)	Fantazizing while listening to music	Substance Use (Alcohol, Cannabis and cigarette)	Lower Substance Use in highly musically involved adolescents with substance using peers who fantasized while listening to music. No significant interaction effect in adolescents who were moderately musically involved.
		Teunissen et al., 2012	74 male adolescents from the Netherlands	pro-alcohol and anti-alcohol norms in a simulated chat-room	Classroom Peers' popularity	Willingness to Drink	Higher willingness to drink when pro-alcohol norms were given by more popular peers. Lower willingness to drink when anti-alcohol norms were given by more popular peers.
Peer	Longitudinal	Bot et al., 2005	1276 girls and boys (12–14 years) from the Netherlands	Best friend's reported number of alcoholic beverages consumed in the past week	Unilateral friendships: Non-reciprocated friendship Popularity: 5 most and least popular adolescents as nominated by the class.	Self-reported number of alcoholic beverages consumed in the past week	Stronger link between peer alcohol use and target friendships. Stronger link between peer alcohol use and target alcohol use when peer is of higher status.
		Urberg et al., 1997	1,028 girls and boys (in 6th, 8th, and 10th grades) from the USA, followed for one school year	Friend's reported alcohol use.	Friendships stability: Target' nominated best friend at wave 1 and wave 2. Quality/closeness of friendship: friendship qualities scale.	Target's self-reported alcohol use and drinking to intoxication.	Friendship stability, n.s. Stronger link between peer and target alcohol use as a function of increased quality/closeness of friends.
		Poelen et al., 2007	416 girls and boys (13 to 16 years)	Self-reported friends frequency and quantity of alcohol used.	Quality of friendship: Quality of Friendship Scale Friend's popularity: 5 items from Differential Peer	Self-reported number of alcoholic beverages consumed in the past week	Quality of friendship and Friend popularity, n.s.

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
Cross-sectional		Fallu et al., 2010	from the Netherlands 1037 boys (6 to 15 years) from Canada	Self-reported peer conventionality: Friends' school liking and Friends having trouble with the police (reversed)	Popularity Scale. A subscale of the sibling inventory of differential experience Attachment to friends: Communication, affective assimilation and support between friends	Self-reported frequency of tobacco and drug use by frequency of alcohol intoxication episodes in the past 12 months, at 14–15 years.	Stronger link between peer conventionality and future target substance use as a function of attachment to friends.
		Allen et al., 2012.	157 adolescents (M= 13.35) from Southeastern US.	Self-reported friends alcohol and marijuana use frequency (past 30 days).	Close friend social acceptance (using a limited nomination sociometric procedure)	Alcohol and marijuana use frequency (past 30 days).	Stronger association between peer substance use and target substance use for those with socially accepted peers.
		Denault et al., 2012	185 8 th and 9 th graders (M= 14.34) from Quebec Canada	Deviancy in the activity peer group (including alcohol and drug use).	Type of activity (sport vs non sport).	Substance use frequency in the past month (alcohol, drugs and cigarettes)	Higher substance use in those adolescents with deviant peers and participating in sport activities
Longitudinal	Parents/Family	Burk et al., 2012.	950 4 th , 7 th and 10 th graders from Sweden	Self-reported past year frequency of alcohol intoxication.	Reciprocity of the relationship	Past year frequency of alcohol intoxication.	No significant interactions were found.
		Kiesner et al., 2010	151 girls and boys (mean age 14) from Canada	Self-reported substance co-use with friends	Parental monitoring: Parent Monitoring measure (Kerr & Stattin, 2000)	Self-reported substance use frequency	Weaker link between substance co-use between friends' and targets' substance use frequency as a function of good parental monitoring.
		Mason et al., 1994	148 girls and boys (mean age 14) from the USA	Self-reported peer's problem behavior from Problem behavior scale	Parental monitoring: Mother-rated subscale of the inventory of parent and peer attachment.	Self-reported problem behavior from problem behavior scale, including gang activity, drug use, stealing.	Weaker link between peer's and target's problem behavior as a function of good parental monitoring.
		Nash et al., 2005	2573 girls and boys (mean age 15.5) from the USA	Self-reported Peer influence: 3 items on peer acceptance of alcohol use and 1 item on number of friends who drink alcohol.	Parental monitoring: Adolescent version of the Assessment of Child Monitoring Scale.	Target self-reported drinking behavior: Alcohol use frequency, quantity and frequency of alcohol use problems	Weaker link between peer influence and adolescent drinking behavior as a function of good parental monitoring.
		Mounts et al., 1995	1000 girls and boys (9 th to 12 th grade) from the USA	Friend's reported drug use	Perceived Authoritative parenting: Acceptance-Involvement and Strictness-Supervision.	Self-reported drug use frequency	Weaker link between peer and target drug use as a function of authoritative parenting.

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
		Sullivan et al., 2004	1,282 girls and boys (6 th grade) from the USA	Self-reported Witnessing violence: 6 item scale from the Children's Report of Exposure to Violence	Parental monitoring: monitoring scale from the Alabama Parenting Questionnaire	Self-reported substance use initiation: Cigarettes, beer, wine and liquor	Weaker link between witnessing peer violence and target substance use initiation as a function of parental monitoring.
		Mrug et al., 2009	500 girls and boys (followed from 11 to 13 years) from the USA	Teacher-rated peer deviancy: the Social Behavior Questionnaire (Tremblay et al., 1991)	Negative parenting: 13 items reverse coded on (nurturance, harsh discipline, and inconsistent discipline)	Self-reported externalizing behaviors: 27 different delinquent acts in the past 12 months including substance use	Stronger link between peer deviancy and target's externalizing behaviors as a function of negative parenting.
		Allen et al., 2012.	157 adolescents (M= 13.35) from Southeastern US.	Self-reported friends alcohol and marijuana use frequency (past 30 days).	Maternal support (supportive behavior interaction task)	Alcohol and marijuana use frequency (past 30 days).	Weaker link between peer substance use and target substance use for those with maternal support.
		Lee., 2012	3,125 high school students from south Korea, (10 graders assessed for 3 years)	Peer substance use (number of friends who use alcohol and tobacco)	Parent- adolescent relationship quality (6 items) Parental monitoring (4 items)	Substance use frequency (alcohol and tobacco)	Weaker link between peer substance use and targets substance use in teens with a better parent-adolescent relationship. No significant moderating effect for parental monitoring.
		Trucco et al., 2011.	371 girls and boys (11 to 13 years old) from the US.	Perceived peer approval and use of alcohol.	Parental control and Parental warmth	Alcohol use initiation (yes/no)	No significant interactions were found.
Cross-sectional		Denault et al., 2012	185 8 th and 9 th graders (M= 14.34) from Quebec Canada	Deviancy in the activity peer group (including alcohol and drug use).	Degree of adult supervision during activity.	Substance use frequency in the past month (alcohol, drugs and cigarettes)	No significant interactions.
		Wood et al., 2004	578 girls and boys (mean age 18) from the USA	Self-reported peer influence: Alcohol offers (4 items), social modeling (3 items) and perceived norms (10 items)	Parental monitoring: modified version of the Strictness-Supervision scale (Steinberg et al., 1992). Parental permissiveness toward alcohol: targets perception of what parents consider an appropriate amount of drinking. Parental attitudes and values: perceived parental disapproval for heavy drinking, and permissiveness for alcohol use	Self-reported binge drinking: 5 or more drinks in one sitting.	Weaker link between peer influence and binge drinking as a function of parental monitoring, low parental permissiveness and parental attitudes and values.

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
Broader Context	Longitudinal	Clark et al., 2012.	567 9 to 21 year old African Americans from the USA (M=15.27)	Peer problem behavior (including substance use).	Parental Attitudes Toward Substance use Parental monitoring.	Past 30-day alcohol use and past 30-day marijuana use.	Weaker link between deviant peers and alcohol and marijuana use in those with higher parental monitoring. No other significant interactions were found.
		Bergh et al., 2011.	About 9900 adolescents (aged 15–16) from Sweden.	Peer activity level (how often the targets spend time with their friends; does not assess if friend use substances)	Parental monitoring (1 item assessing how often the target tells parents where he or she is).	Alcohol use frequency past year.	Stronger link between peer activity frequency and alcohol use frequency in those with lower parental supervision.
		Bobakova et al., 2012.	1052 boys and girls (M= 14.68) from Eastern Slovakia.	Friends alcohol use (at least once a week)	Parental monitoring	Having been drunk in the past month (yes/non)	Higher odds of drunkenness in girls with both alcohol using peers and low parental monitoring.
		Warr, 1993	1,726 girls and boys (13 to 19 years old) from the USA	Self-reported number of friends that commit delinquent acts: cheating at School, marijuana, burglary, alcohol use, petty larceny and grand larceny	Time spent with family: during afternoons, evenings, and weekends Attachment to parents: 3 items created by researchers	Target's self-reported delinquency: cheating at School, marijuana, burglary, alcohol use, petty larceny and grand larceny	Weaker link between friends' and targets' delinquency as a function of time spent with family. Attachment to parents, n.s.
		Mrug et al., 2009	500 girls and boys (followed from 11 to 13 years old) from the USA	Teacher-rated peer deviancy: the Social Behavior Questionnaire (Tremblay et al., 1991)	School connectedness: three items from the Attitudes Toward School Scale (Institute of Behavioral Science, 1987) and five items from the School Connectedness Scale (Sieving et al., 2001)	Self-reported externalizing behaviors: 27 different delinquent acts in the past 12 months including substance use	School connectedness, n.s. Ethnicity, n.s.
		Crosnoe et al., 2002	3,046 girls and boys (grades 9 to 12) from USA	Friend reported deviance including substance use alcohol marijuana	Ethnicity School connectedness: bonding to teachers, Academic achievement and orientation to School	Self-reported delinquency including substance use: cigarette, alcohol marijuana.	Weaker link between peer and target delinquency as a function of bonding to teachers, academic achievement and orientation to school.
Broader Context	Longitudinal	Zimmerman et al., 2011	1 639 boys and girls from the US (9 to 17 years old).	Friends substance use (alcohol, marijuana tobacco)	Neighborhood opportunities for crime	Substance use (alcohol, marijuana, tobacco and illicit drugs)	Within neighborhoods with low opportunities for crime, the effect of peers was initially small, but as peer substance use increased, the effect of peers increased multiplicatively. Within neighborhoods with more opportunities for crime, the effect of peers was initially strong, but

Moderator Level	Study Design	Authors, Year	Sample	Measures			Results
				Peer association	Moderator	Outcomes	
Cross-sectional		Dickens et al., 2012	2 582 American Indian and/or Alaskan Native Students from the USA (11 to 19 years old)	Peer alcohol use (tree items assessing number of friends who get drunk, get drunk once in a while and almost every week-end).	School bonding (4 items assessing if the target likes school, is liked by teachers, likes his teachers and finds school fun).	Alcohol use (composite measure of lifetime alcohol use, alcohol use frequency, drunkenness and alcohol use consequences)	decreased as peer substance use increased, suggesting a ceiling or saturation effect. For those under 16 years old: Weaker link between peer alcohol use and target's alcohol use in those with higher school bonding. No significant interaction with school bonding for those who are over 16 years old.
		Snedker et al., 2009	2,006 girls and boys (13 to 21 years old) from USA.	Self-reported peer deviancy, including substance use.	Disadvantaged Neighborhood: percentages of residents below the federal poverty level, female-headed households, residents receiving public assistance, and unemployment)	Self-reported substance use frequency: alcohol and marijuana	Weaker link between peer deviancy and target substance use frequency in disadvantaged neighborhoods.

* Studies are repeated if they included moderators at different levels of analyses (e.g., if individual and contextual moderating factors are included in the study, it will appear under both sections)

Table 2

Descriptive characteristics of subcategories.

Subcategory	Number of articles reviewed	Mean age of participants (years)	Study design not available
Age	10	13.92	All Available
Gender	16	15	Experimental
Pubertal status	3	12.2	Experimental
Genetic vulnerability	5	16.2	Longitudinal and Experimental
Personality	16	13.91	All Available
SU expectancies and motives	1	14.04	Cross-sectional Experimental
Peer Relationship characteristics	10	12.77	All Available
Parental factor	17	14.29	Experimental
School Context	3	14.8	Experimental
Neighborhood context	2	17	Experimental