The Relationship between Friendship Intimacy, Peer Use, and Self-Medication in Adolescence

Julia Madeleine Shadur

A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Psychology

Chapel Hill
2010

Approved by:

Andrea Hussong, Ph.D.

Deborah Jones, Ph.D.

Mitch Prinstein, Ph.D.

Abstract

JULIA MADELEINE SHADUR: The Relationship between Friendship Intimacy, Peer
Use, and Self-Medication in Adolescence
(Under the direction of Andrea Hussong, Ph.D., Deborah Jones, Ph.D., & Mitch
Prinstein, Ph.D.)

The current study examined the relationship between peer substance use and

friendship intimacy in predicting adolescent self-medication. Two hypotheses were

tested: 1) greater peer substance use is associated with less friendship intimacy, and 2)

friendship intimacy and peer substance use moderate the temporal relationship between

daily negative affect and subsequent substance use (i.e., self-medication). Experience

sampling methods (ESM) were employed to capture daily variations in mood and

substance use, and multilevel modeling techniques were used to parse between- versus

within-person differences in risk for use. Findings did not support the primary

hypotheses, indicating that characteristics of the peer context (i.e., intimacy and peer use)

do not predict risk for self-medication among younger adolescents. However, there was a

weak but consistent trend indicating that friendship intimacy and peer use interact to

predict substance use more generally, such that the effect of friendship intimacy depends

on the degree of peer use.

Acknowledgements

Table of Contents

List of Tables

Table

List of Figures

Figure

List of Abbreviations

ESM   Experience Sampling Methodology

HSTS   High School Transition Study

SD   Standard Deviation

Chapter 1

Introduction

Adolescent substance use has become an outcome of interest to researchers across many disciplines in response to the staggering national rates of underage alcohol and drug use. The most recent data from Monitoring the Future (Johnston, O'Malley, Bachman, & Schulenberg, 2009) show that 72% of twelfth graders and 39% of eighth graders report having consumed alcohol at some point in their lives, and equally concerning are reported rates of having ever been drunk for twelfth graders (55%) and eighth graders (18%). Furthermore, 28% of eighth graders and 49% of twelfth graders report having tried an illicit drug at some point in their lives (Johnston et al., 2009).

Adolescent substance use is associated with a host of negative consequences ranging from compromised cognitive functioning in college (Sher, Martin, Wood, & Rutledge, 1997) to increased rates of internalizing disorders in adulthood (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Trim, Meehan, King, & Chassin, 2007). Furthermore, problematic alcohol use during adolescence predicts adulthood depression and antisocial personality disorder (Rohde, Lewinsohn, Kahler, Seeley, & Brown, 2001), and marijuana use during adolescence is related to suicidal ideation and attempts, as well as criminal involvement (Fergusson, Horwood, & Swain-Campbell, 2002). With rates of use showing that nearly half of all students have experimented with some sort of

substance by the time they reach the end of high school, it is imperative that research efforts continue to identify factors that consistently predict adolescent substance use.

Self-Medication

Some adolescents are at an increased risk not only for substance use generally, but for a specific problematic style of use, namely, using substances as a means to cope with negative affect. There are several mechanisms that describe how substances may be used as a means to minimize negative affect, including theories of stress and coping (Wills & Shiffman, 1985), tension reduction (Conger, 1956), and self-medication (Khantzian, 1997). These theories share a focus on the negative reinforcement model of substance use, whereby the use of drugs temporarily minimizes the experience of negative affect and becomes a pattern of learned coping. Such negative reinforcement models can be distinguished from other mechanisms underlying the negative affect-use relationship by their focus on the effect that substances have on minimizing negative affective states, compared to other theoretical models that focus on positive reinforcement (Kassel et al., in press), or on other mediating mechanisms, including peer affiliations as in self-derogation theory (Kaplan, Martin, & Robbins, 1982).

. The self-medication model posits that substance use is triggered by the experience of negative emotion (Khantzian, 1997). Self-medication is defined by a temporal specificity, meaning that negative affect predicts subsequent substance use within hours or days. This specific pattern of emotion priming the subsequent use of drugs in order to cope has been associated with both heavy and problematic alcohol use (Cooper, Russell, & George, 1988), and is thus an important potential target for early intervention designed to reduce long-term risk for substance use disorders.

There are a host of reasons that suggest why some adolescents may be at increased risk for using substances to minimize negative affect. First, adolescence is a period during which youth are more vulnerable to increases in negative affect, but developmentally lack the neurobiological systems to appropriately regulate these changes in affect (Steinberg et al., 2006). Thus, without proper regulatory systems, adolescents may seek maladaptive methods of coping, including the use of substances (Steinberg et al.). Second, research shows that some adolescents report positive expectancies about the effects of drugs and alcohol, such that use is sometimes believed to minimize or relieve negative affective states (Kassel et al., in press). Such expectancies may subsequently increase risk for self-medication in these youth. Indeed, in a sample of college students, anxiety and alcohol use were more strongly related for those who *expected* alcohol to minimize negative affect (Kushner, Sher, Wood, & Wood, 1994). And third, negative affect disorders and substance use are highly correlated (Substance Abuse and Mental Health Services Administration, 2009), and self-medication may indeed be one mechanism that explains this comorbidity.

Whereas findings supporting a self-medication hypothesis are more consistently evidenced with adult samples, negative affect-motivated substance use in adolescence is less extensively studied and the findings are quite mixed (see Kassel et al., in press, and Chassin, Ritter, Trim, & King, 2003, for reviews). There are at least two potential explanations for the inconsistent findings concerning the self-medication hypothesis in adolescence. First, different methodologies are employed across studies, and they may (or may not) tap daily variations in affect and substance use (Kassel et al., in press). In cross-sectional designs, the direction of effect cannot be determined and self-medication

cannot be isolated from other potential mechanisms underlying the negative affect-use relationship. Longitudinal designs are more promising, but even when employed they typically use long time lags that do not match onto predictions of self-medication (i.e., years vs. days) (Chassin et al., 2003).

Second, most substance use in youth does not represent self-medication, but *some* youth are more at risk for self-medication and represent a *vulnerable subgroup* of individuals. For example, in a subgroup of adults, stress and alcohol use were more strongly related specifically for men with both positive expectancies for alcohol and who also evidenced avoidant coping styles (Cooper, Russell, Skinner, Frone, & Mudar, 1992). Vulnerable subgroups of adolescents may also be at increased risk for self-medication, including those who evidence low levels of conduct problems (Hussong, Feagans Gould, & Hersh, 2008), or whose parents exhibit over-involved parental emotion socialization (Hersh & Hussong, 2009) or high levels of parental social support (Reimuller, Shadur, & Hussong, under review). Such subgroups may not be represented in all samples, thus yielding mixed results.

Despite these inconsistent findings, some evidence suggests that substance use in the form of self-medication may emerge as early as adolescence (e.g., Hersh & Hussong, 2009; Hussong et al., 2008; Stice, Kirz, & Borbely, 2002). Gaining a better understanding of *which* adolescents may be more likely to engage in self-medication will help to further resolve the inconsistent findings across samples and will also help identify appropriate targets for prevention efforts. In the current study, the theory of self-medication is matched to the appropriate methodology by using daily experience sampling data from a vulnerable subgroup of adolescents at elevated-risk for drug use.

With such methods, it is possible to elucidate factors of risk for self-medicating patterns of substance use. Given that adolescent substance use is so intimately tied to the peer group (e.g., Ennett et al., 2006), friendship intimacy and aspects of the peer relationship may be one such risk factor.

Friendship Intimacy versus Peer Social Support

Support for the role of the peer context in adolescent drug use comes from research that identifies both friendship intimacy and peer support as factors that predict substance use among youth, and although these two constructs are distinguished in the peer relations literature (e.g., La Greca & Lopez, 1998), intimacy and support often inform the same theoretical mechanisms in studies of substance use. The current study specifically assessed the effect of friendship intimacy on drug use, but much of the larger framework for understanding such peer risk processes has been focused on peer social support.

The term *social support* includes a range of characteristics, including the number of people in one's support net, the structure of the network, specific actions of support (e.g., listening, offering help), and perceptions or appraisals of support from others (Vaux et al., 1986). In the current study as well as in other contexts, *friendship intimacy* has been defined as the combination of loyalty, self-disclosure, affection, and companionship (Hussong, 2000b). There is some degree of overlap between these two constructs; indeed, measures of friendship quality, such as intimacy, map on nicely to the construct of peer social support (Urberg, Goldstein, & Toro, 2005). Moreover, friendship intimacy (i.e., quality of peer relations) has been shown empirically to be one of several indicators of peer social support (Newcomb, 1990). The relationship between these two constructs

suggests that the larger social support literature may help inform research aiming to understand mechanisms that involve friendship intimacy. Moreover, some research has shown that both measures of friendship intimacy and social support predict similar outcomes, including substance use (e.g., Hussong, Hicks, Levy, & Curran, 2001). Thus, examining the literature that encompasses both of these constructs is critical for understanding potential substance risk processes within the context of the current study.

Friendship Intimacy, Peer Social Support, and Substance Use

One of the strongest indicators of adolescent behavior is that of their peers (Prinstein & Dodge, 2008). Indeed, theory and supporting research (e.g., Van Beest & Baerveldt, 1999; Wills & Vaughan, 1989) suggest that adolescence is a period during which teens are more involved with and seek greater support from their peers than their parents. During the middle school years, it has been found that parental support decreases and peer supports increases (Wills, Resko, Ainette, & Mendoza, 2004). Furthermore, the strength of the protective effect that parental support has against adolescent substance use weakens during middle school (Wills et al., 2004).

This trend for peers to become increasingly influential during adolescence is pronounced among substance using teens. Adolescents who have already begun drinking alcohol report being able to depend more on their peers than their parents compared to abstaining teens (Holden, Brown, & Mott, 1988), and teens who use substances are twice as likely to report that their peers are more understanding and influential than their parents when compared to teens who are non-users (Coombs, Paulson, & Richardson, 1991). Additionally, adolescents who report problematic alcohol use are also more easily influenced by pressure from their peers (Arata, Stafford, & Tims, 2003). Interestingly,

research shows that both closest friends (within dyads) and larger peer networks independently influence adolescent substance use (Urberg, Değirmencioğlu, & Pilgrim, 1997). There are multiple aspects of the peer relationship that may impact adolescents' substance use, and it is unclear which specific characteristics of the peer context might subsequently impact the risk for self-medication specifically. However, stress and coping models of substance use suggest that the degree of intimacy and support from close friends may indeed impact risk for self-medication.

In previous research, friendship intimacy (Hussong, 1996; Hussong et al., 2001) and social support from peers (e.g., Hussong et al., 2001; Lifrak, McKay, Rostain, Alterman, & O'Brien, 1997; MacNeil, Kaufman, Dressler, & LeCroy, 1999; Wills & Vaughan, 1989; Wills et al., 2004) are both repeatedly found to predict youth's drug use. Adolescents whose friendships involve both higher levels of positive *and* negative friendship qualities are more likely to use substances (Hussong, 2000b), and Windle (1994) found that greater hostility and less reciprocity within close friendship dyads predicted greater alcohol use, which he suggested may be associated with lower levels of social support as well.

Research also suggests, however, that peer support and intimacy have the potential to either increase or decrease risk for adolescent substance use, depending on other characteristics of the friend. Specifically, the relationship between the level of peer support and adolescent substance use is moderated by the level of peer substance use. Indeed, one of the greatest risk factors for substance use is affiliation with drug-using peers (e.g., Ennett et al., 2006; Frauenglass, Routh, Pantin, & Mason, 1997; Hussong, 2002; MacNeil et al., 1999) and high levels of social support from such peer groups

(Piko, 2000; Wills & Vaughan, 1989; Wills, 1990; Wills et al., 2004) and identified close friends (Urberg et al., 2005) further increase this risk, whereas high levels of support from close friends who do not use tend to minimize risk for use (Urberg et al., 2005). Wills and Vaughan (1989) further specify that it is the combination of high levels of *perceived* support from peers and peer substance use that increases adolescents' involvement with drugs. With respect to friendship quality, it has also been found that adolescents in close friendships with substance users that are characterized by fewer negative friendship qualities are at increased risk for substance use (Hussong & Hicks, 2003).

Although the way in which friendship intimacy impacts substance use may depend on peer use, it is also expected that friendship intimacy and peer use are related. Very little is known about the levels of friendship intimacy and support provided by peers who use substances more frequently compared to those who use substances less frequently. Nonetheless, research suggests that substance use during adolescence may impair the development of healthy social skills in a number of ways. Indeed, Spooner's (1999) review notes that adolescent drug users are less socially capable and have fewer social skills than non-drug-users. Such social skill deficits may ultimately affect the type of friendships these adolescents provide for their peers.

A long-standing theory from Baumrind and Moselle (1985) suggests that normative social development is interrupted by the use of substances during adolescence. Specifically, adolescent substance use may be associated with egocentrism, less awareness of others' thoughts and feelings, decreased experience with mature social interactions, impaired cognitive development, and increased alienation from others.

Moreover, adolescents may actually use substances to cope with the stress associated with new social interactions, thus minimizing the extent to which intimacy and social awareness may develop (Baumrind & Moselle). These developmental challenges, in turn, may lead to a lack of social experience and skill, ultimately impacting the social support and the quality of friendships that drug users are able to provide to their peers. Thus, the current study tested the hypothesis that friendship intimacy and peer substance use are negatively associated.

Friendship Intimacy, Peer Social Support, and Self-Medication

The contribution of peers' substance use to subsequently impaired social skills and relationships is important because it helps further explain why association with drug using peers can increase risk for an adolescent's own substance use and self-medication, more specifically. Peer drug use may impact the quality of friendships that adolescents experience and compromise peers' ability to provide support, which may negatively impact adolescents' ability to use and access adaptive coping mechanisms. Collectively, these findings suggest that we must gain a better understanding of what it is about friendships with substance users that might increase risk for self-medication in teens.

Research has shown that self-medication is more *effective* in reducing negative affect for adults when in the company of their friends (Armeli et al., 2003). This suggests that there are characteristics of the peer context that play a critical role in the use of substances to cope. Indeed, in a sample of college-aged students, individuals in friendships characterized by lower levels of friendship intimacy and peer social support were more likely to drink in response to increases in negative affect (Hussong et al., 2001). It is less clear if the same pattern regarding friendship intimacy and self-

medication emerges during adolescence. However, associations between mood and substance use may be stronger for adolescents who are in friendships characterized by both peer substance use and lower levels of positive friendship quality (Hussong & Hicks, 2003). This finding suggests that the interaction between peer substance use and friendship quality may explain who is at risk for self-medication.

The moderating effects of peer use and friendship intimacy on self-medication may reflect at least two different mechanisms of risk. Stress and coping models of adolescent substance use suggest that in the context of lower levels of friendship intimacy and greater negative affect, adolescents seek alternative coping mechanisms, such as alcohol and substance use. Additionally, adolescents' risk for increased negative affect may be exacerbated if their friendships are characterized by less intimacy and support, a potentially stressful social experience for teens. If these less intimate peer contexts include drug using friends, then teens may be even more likely to self-medicate due to easy access and joint engagement in drinking and drug use. Thus, adolescents with lower levels of friendship intimacy and greater exposure to peer substance use may be more likely to self-medicate.

Social Learning Theory (Bandura, 1986) offers another mechanism of risk for substance use. Such models of social influence suggest that for those in more intimate and supportive friendships with drug using peers, interactions with these friends may provide increased exposure to and modeling and encouragement of drug involvement. These friendships may also provide adolescents prone to negative affect with an environment conducive to self-medication. Adolescents may thus be more likely to behave in ways similar to their peers when their friendships are more positively

characterized. Indeed, the adverse effect that modeling by peers has on adolescents' risk for substance use may be further strengthened in contexts of high levels of peer support (Wills & Vaughan, 1989).

Social learning of particular styles of use can also occur in these friendships. Indeed, previous research indicates that adolescents' heavy drinking is in part associated not only with their own drinking motives but also with those of their peers (Hussong, 2003). Peers who use may motivate and indeed teach and reinforce adolescents to self-medicate as a way of using substances. Thus, adolescents with high levels of friendship intimacy and with greater exposure to friends who use substances may also be more likely to self-medicate as compared to their peers.

In sum, there are at least two mechanisms of risk that may explain why both friendship intimacy and peer use impact risk for self-medication. Models of social learning and stress and coping indicate that adolescent self-medication may be moderated by *how much* intimacy exists in these friendships and also *who* is delivering it. Both of these models were tested in the current study.

The Current Study

The current study examined how the construct of friendship intimacy influences the relation between negative affect and substance use in adolescents. Specifically, two hypotheses were tested: (1) higher levels of peer substance use are associated with lower levels of friendship intimacy (see Figure 1), and (2) friendship intimacy and peer use both moderate adolescent self-medication (see Figure 2). This second hypothesis reflects two predictions, such that the association between negative affect and substance use will be strongest for those in friendships with higher levels of intimacy and higher levels of peer

use (reflecting social learning) and for those in friendships with lower levels of intimacy (regardless of peer use, reflecting stress and coping), as compared to others.

In testing these hypotheses, this study offers a unique contribution to the fields of adolescent substance use and social development. Peer relationships are frequently included as a component of prevention programs (Essau, 2004; Scheier, 2001), but these relationships are often not considered with respect to self-medicating forms of drug use in particular. Friendship intimacy and peer substance use may be potential moderators of the relationship between negative affect and subsequent substance use in adolescents, and characterizing these adolescent friendships may help identify which adolescents are at greatest risk for self-medication. Thus, the current study has the potential to inform prevention programs that target both peer mechanisms and a salient, problematic style of drug use in particular (i.e., self-medication). Notable strengths of this study include the use of experience sampling methods (ESM) to uniquely capture and examine the temporal relationship between negative affect and substance use in a sample representing diverse ethnic groups.

Chapter 2

Method

Data from the High School Transition Study (HSTS) were analyzed to complete

both aims of this study (Hussong, 2005). The data were collected during the spring and

summer of 2002. The goal of the HSTS was to use novel methodology and design to

examine how different contexts (e.g. peers, parents) impact adolescent substance use

during the transition period to high school. The use of a daily experience sampling

design measures within-person variability in daily mood and substance use (in addition to

between-person variability) which is critical for assessing self-medication (Swendsen et

al., 2000; Tennen, Affleck, Coyne, Larsen, & DeLongis, 2006). These experience

sampling procedures also reveal affect and substance use patterns in real-world contexts

and circumstances, which increases the external validity of the subsequent results

(Swendsen et al.).

Participants

Participants completed all study procedures in the spring of their eighth grade year

(Phase I) and the summer before starting ninth grade (Phase II). In Phase I, 399 (out of

436 enrolled) eighth grade students from seven schools in Chatham County (North

Carolina) completed school-based surveys. Valid data were provided by 365 students,

determined by an honesty item assessing whether or not ("true" or "false") participants

felt they were honest in their responses to the questionnaire. Recruitment for Phase II

began with rank-ordering these participants based on a risk index that indicated current substance use, any initiation of substance use by eighth grade, or affiliation with peers who had been involved in substance use prior to ninth grade. Students were contacted and screened in order of risk, such that the individuals with the highest risk indices were contacted first, yielding an elevated-risk sample. Participants were not excluded based on gender, ethnicity, or socioeconomic status. The only criteria for eligibility in Phase II were that adolescents and at least one of their parents spoke English sufficiently in order to complete informed consent. Research staff attempted to contact the first 196 participants on the recruitment list (including all 169 participants who listed any level of risk on the 6-point index as well as 27 participants who indicated no risk on this index), with 81 completing the study (i.e., 41% of those targeted for recruitment, n=196, or 57% of those eligible and contacted for recruitment, n=142). Primary reasons for non-participation were inability to contact (n=33), ineligibility (n=21, language barrier, moving, did not pass grade, child death), limited availability (n=17), discomfort with the sampling paradigm (n=5), and privacy concerns (n=11). Twenty-eight individuals who did not participate provided no reason. The adolescents in Phase II are representative of the original elevated-risk targets initially contacted for recruitment, suggesting a lack of recruitment bias (see Hussong et al., 2008, for details). This sample also evidences greater risk than the Phase I school-based sample, suggesting the successful recruitment of an elevated-risk sample.

To be eligible for analysis in the current study, participants had to complete the assessment involving the experience sampling methodology (ESM). Of the original 81 from Phase II, two participants did not complete the ESM procedures and six were

missing more than 16 of the 21 days of ESM data and were not included in the analyses. Thus, the final sample includes 73 target adolescents from Phase II, with a total of 1406 observations of both daily negative affect and substance use scores. The 73 participants are 53% female, have a mean age of 13.92 years (SD=0.47), and self-identify as 56% Caucasian, 19% African American, 3% Hispanic, 1.5% American Indian or Alaska Native, 1.5% Asian, and 19% Other.

Procedure

For the current study, data are from Phase II only and involve adolescents and their closest friends. In the summer between eighth and ninth grade, students completed in-home assessments during both an initial and final visit (three weeks apart) and completed an experience sampling procedure during the three intervening weeks. During the initial visit, students completed computer-administered interviews with inquiries regarding substance use, mood and symptomotology, and peer and parental relationships in the three months prior to the visit. Students and their parents also completed a videotaped interaction task. During a second consent process, adolescents were asked if they would like to provide the names and contact information for their closest friends so that staff could contact them in regards to participation in the final visit of the study (three weeks later). The last component of the initial visit involved explaining the experience sampling procedure to the adolescents and providing them with related materials (i.e., a wristwatch, a recording device and booklets, and a security box).

During the final visit, adolescents completed computer-administered self-report interviews similar to the initial visit assessments. Additionally, the adolescent's closest friend completed separate interviews. The two friends also completed a videotaped

interactive task. There were four friendship dyads in which both members mutually participated as a friend and also as a target adolescent for one another; one of these individuals participated as a friend twice (once mutually and once for a second target adolescent). There were eight other adolescents who participated as a target adolescent and also as a friend for a different target adolescent (but not mutually so).

The experience sampling procedure occurred during the 21 days in between the initial and final visits. Target adolescents were asked to complete brief surveys (1-2 minutes) in response to a pre-programmed wristwatch alarm. Each day, three pre-set alarms prompted participants to rate their levels of negative affect (sad, mad, worried, and stressed) at the moment that the alarm sounded. Measures of daily affect were contained in a recording device that was attached to the back of the wristwatch. A fourth and final daily alarm prompted adolescents to record their substance use (alcohol, marijuana, and other illicit drugs) for the entire day. In order to protect participant confidentiality, the substance use recordings were kept in a security box in the adolescent's home. These sensitive response codes were purposefully meant to be cryptic to protect participants' reports of substance use (e.g., the numbers 1-5 were used to report alcohol use, "M" for marijuana, and "D" for other drugs).

Finally, as a back-up source of data collection of daily reports, and to minimize data loss, participants also placed a phone call into the study office phone to leave a message with their daily recordings (three assessments of mood, one substance use assessment). In the original sample, 46% of the observations were reported in two forms (daily in-vivo recordings and the corresponding data phoned in by participants), and of those data available from both sources, 99% of the observations overlapped perfectly.

Overall, nearly all observations (99.5%) were clearly discernible in at least one form of response (Hussong et al., 2008).

Precautions were taken to help ensure the privacy and confidentiality of all daily recordings and phone messages, including the use of response codes that were not interpretable to anyone outside of the study. Additional precautions were taken to further prevent the disclosure of personal information, which included acquiring a Certificate of Confidentiality.

Measures

All assessments for this analysis were completed during the initial and final visits and during the three-week experience sampling period during Phase II.

Demographics. During the initial visit, adolescents self-reported gender, age, and ethnicity, and parents self-reported their highest level of education. The highest level of education obtained between both parents was used to indicate parent education. The majority of parents (63%) had either partially or fully completed college or technical/vocational school. During the final visit, adolescents' closest friends self-reported gender, age, and ethnicity.

Peer report of peer substance use (final visit). Research has shown that even when adolescents report on the deviant behaviors of their *closest* friends, there are often notable discrepancies between adolescents' perceptions and peer self-reports of deviant behavior (Prinstein & Wang, 2005). Thus, including self-report measures of peer substance use minimizes potential reporter biases and also eliminates shared method variance.

The peer substance use scale consisted of five items from Chassin, Rogosch, and

Barrera (1991) that were adapted to capture peer self-reports of drug use in the past three

months. The five items included frequency of alcohol, marijuana, and other illicit drug

use, frequency of heavy alcohol use (5 or more drinks at one time), and frequency of

being drunk. For reports of alcohol use, frequency item responses ranged from (0) not at

all to (7) everyday; frequency item responses for number of times drunk, heavy alcohol

use, marijuana use, and use of other drugs, ranged from (0) not at all to (4) once a week.

The scale for peer substance use was constructed by first standardizing all items and then

calculating the mean score across all items. Results from the current sample yielded a

mean peer substance use score of 0.004 (SD=0.74), with adequate internal reliability (α =

.80).

Target report of general peer network substance use (initial visit). Target

adolescents reported on the amount of substance use in their peer group. Four items were

adapted from the Monitoring the Future study (Johnston, O'Malley, & Bachman, 1995).

These items asked for the number of the adolescent's close friends who use cigarettes,

alcohol, marijuana, and other illicit drugs. The response scale included: (0) none, (1) a

few, (2) some, (3) most, and (4) all. The scale for general peer network substance use

was constructed by calculating the mean score across all items. Results from the current

sample yielded a mean peer network substance use score of 0.81 (SD=0.62), with

adequate internal reliability (α = .80). There was a weak correlation between target-

report of general peer network substance use and individual peer-report of substance use

(r = 0.15, p >.05).

Adolescent daily substance use (ESM). The experience sampling of substance use involved adolescents recording their daily use of alcohol, marijuana, and other illicit substances each day for 21 days. Nightly recordings of drug use were completed at 10:00 pm in response to the final pre-set alarm, or before going to bed if after 10:00 pm. Alcohol use was rated on a 6-point scale from 0 to 5 or more standard drinks of alcohol per day. In order to protect reports of alcohol use, recordings were made by using numbers (0-5). Responses for marijuana and other illicit drug use were endorsed as either "yes" or "no." Items were taken from Hussong et al. (2001). The outcome measure for overall daily substance use was dichotomized to represent any use versus no use.

During the 21-day experience sampling period, 24.7% of all participants endorsed using alcohol, 9.6% endorsed using marijuana, and 5.5% endorsed using any illicit drug other than marijuana. Compared to national data from the same year that the current study was conducted, which show that in retrospective 30-day reports 19.6% of eighth graders endorsed using alcohol, 8.3% endorsed using marijuana, and 4.7% endorsed using any illicit drug other than marijuana (Johnston et al., 2009), the current sample reflects notably elevated risk for overall substance use.

Adolescent daily negative affect (ESM). Variation in negative affect was assessed through the experience sampling of daily mood across the three-week period. Adolescents reported the degree to which they felt sad, mad, worried, and stressed when prompted by three daily random pre-set alarms. For each of the four types of negative affect, item responses ranged from (1) not at all to (5) very much, indicating the degree to which adolescents endorsed feeling each emotion at that moment. Items reflecting

negative affect were chosen based on the dimensions that are often used in self-medication research (e.g., Hussong et al., 2001). The descriptions of the four types of negative affect were adapted from the Multiple Affect Adjective Check List – Revised (MAACL-R; Lubin et al., 1986) in order to use age-appropriate wording. To create a daily negative affect composite score for each of the 21 days, the maximum ratings given to each type of emotion (sad, mad, worried, and stressed) were averaged together within any given day. In previous research, reports of daily negative affect were found to be adequately reliable (average α = .79; Hussong et al., 2008). Results from the current sample yielded a mean aggregated negative affect score of 1.83 (*SD*=0.69) with scores ranging from 1.00 to 3.5; alphas for the daily negative affect measures ranged from .70 to .91 with an average alpha of .82.

Peer and adolescent reports of friendship intimacy (final visit). Both the target adolescent and his/her closest friend independently reported on the positive qualities of their shared friendship in regards to the previous three weeks. Four subscales from the Network of Relationships Inventory (NRI, Furman & Buhrmester, 1985), including three items each for loyalty, self-disclosure, affection, and companionship, were used to assess friendship intimacy. The loyalty subscale was supplemented with an additional item in order to capture a broader dimension of loyalty, and the affection subscale was supplemented with an additional item in order to assess reciprocation within the friendship (Barrera, Chassin, and Rogosch, 1993), yielding a total of 14 items. The item responses ranged from (1) little to none to (5) the most possible. All item responses were averaged and the mean score across all subscales represents an overall score for friendship intimacy, separately for each reporter. Adequate internal reliabilities have

been found for all four subscales (α = .81-.93), along with significant inter-scale

correlations for the loyalty, self-disclosure, and affection subscales (r =.67-.78), and

inter-scale correlations including the companionship subscale ranged from .45-.50

(Hussong, 2000a). For target-report of friendship intimacy, results from the current

sample yielded a mean score of 3.57 (*SD*=0.89), with good internal reliability (α = .94).

For peer-report of friendship intimacy, results from the current sample yielded a mean

score of 3.61 (*SD*=0.88), with good internal reliability (α = .94). The correlation between

peer- and target-report of friendship intimacy was strong and significant (r = 0.47, *p*

<.001).

Chapter 3

Results

Preliminary Analyses

Regression diagnostic tests were conducted to check for model assumptions, model fit, and for potential outliers. Model assumptions were adequately met and diagnostic tests did not indicate any particular observations outlying on dependent or predictor variables.

Missing Data Analysis

The analysis sample consists of 73 target adolescents, however only 57 had complete data on all variables for analysis in hypothesis 2, including self-reports from peers on both peer substance use (n=59) and friendship intimacy (n=57). Target adolescents also reported on friendship intimacy (n=71) and substance use in their general peer network (n=72), and had nearly complete data for these measures. Initial attrition analyses were conducted in order to determine if target adolescents with missing peer-reports of key predictor variables differed significantly from those who had complete data. A series of *t*-tests showed that there were no significant differences across key variables, including target-report of friendship intimacy, target-report of substance use in the general peer network, and target self-report of substance use. These findings suggest that missingness in these data is not related to key variables of interest, and

values are likely missing at random (MAR). Thus, the subsequent missing data techniques were appropriately employed to impute these missing values.

Multiple Imputation procedures were used to perform missing data analyses following Rässler, Rubin, and Schenker (2008). Predictors in the Multiple Imputation analysis included all predictors from the regression models to test hypotheses (i.e., control variables, peer-reports of substance use, and both peer and target reports of friendship intimacy) as well as adolescents' reports of daily mood and substance use, and target reports of substance use in their general peer network. Thirty imputed data sets were generated using SAS PROC MI (SAS Institute, 2009). Results of subsequent data analysis of these 30 data sets were combined using SAS PROC MI ANALYZE (SAS Institute).

Hypothesis 1

Hypothesis 1 tested whether peer substance use was associated with friendship intimacy as reported by both the target adolescent and his/her closest friend. To test this hypothesis, two separate hierarchical multiple linear regression analyses were conducted. In both hierarchical models, the same predictors were used, including control variables in the first step (adolescent gender, parent education, and adolescent ethnicity), and peer substance use in the second and final step. The outcome measures were target-report (model 1) and peer-report (model 2) of friendship intimacy. Results in Table 1 show that peer substance use did not predict either target-report of friendship intimacy ($\beta = 0.04$, $p > .05$; model 1) or peer-report of friendship intimacy ($\beta = 0.28$, $p > .05$; model 2).

Hypothesis 2

        Multilevel modeling was used to test the second hypothesis that friendship intimacy and peer substance use moderate the relationship between daily negative affect and substance use. Multilevel models can parse between- and within-person variability, which is necessary in order to test the self-medication hypothesis. In this analysis, within-person effects were examined to determine whether increases in negative mood relative to individual baseline levels increase the likelihood that an adolescent will use substances the following day. This analysis focused on the moderating influences of friendship intimacy and peer substance use on self-medication. These primary hypotheses were tested through a three-way cross-level interaction between a within-subjects factor (daily negative affect) and two between-subjects factors (friendship intimacy and peer substance use) to predict the likelihood of an adolescent's substance use. Between-person (level 2) predictors of substance use intercepts included control variables (i.e., adolescent gender, parent education, and adolescent ethnicity), the aggregated negative affect index, and the main effects for friendship intimacy and peer substance use. Within-person (level 1) predictors included whether ESM data were collected on a weekend or weekday (to control for variation of substance use based on time of the week) and daily negative affect ratings. Thus, repeated measures were nested within person. Interactions between daily negative affect by friendship intimacy, daily negative affect by peer substance use, peer substance use by friendship intimacy, and daily negative affect by friendship intimacy by peer substance use were each added to the model to test study hypotheses. All continuous between-person predictors were grand-mean centered, and the daily within-person negative mood predictor was person-centered.

The random effect of the model intercept and the fixed effect for the slope for daily effect of negative affect on substance use were estimated as well. Both target and peer reports of friendship intimacy were tested in two separate models.

Due to the dichotomous outcome, a non-linear multilevel model was estimated using maximum likelihood with nine points of quadrature in PROC Glimmix (SAS Institute, 2009). As reported in Table 2, results show a strong and consistent between-person main effect of aggregated negative affect on substance use in both model 1 (β = 1.54, OR = 4.66, $p < .01$) and model 2 (β = 1.66, OR = 5.26, $p < .01$). However, the between-person main effect of peer substance use on target substance use did not reach significance in either model 1 (β = 0.76, OR = 2.14, $p > .05$) or model 2 (β = 0.52, OR = 1.68, $p > .05$). The between-person main effect of friendship intimacy was significant in model 1 (target-report; β = -1.11, OR = .33, $p < .01$) but not in model 2 (peer-report; β = -0.26, OR = .77, $p > .05$). The within-person effect of daily negative affect on subsequent substance use was not significant across both model 1 (β = -0.07, OR = 0.93, $p > .05$) and model 2 (β = 0.01, OR = 1.01, $p > .05$). The cross-level two-way interaction between peer substance use and friendship intimacy was marginally significant only in model 1 (target-report; β =.82, OR = 2.27, $p < .10$). Probing of this marginally significant interaction indicated a trend for increasing levels of peer use to predict adolescent substance use more strongly for those who also have high levels of friendship intimacy (see Figure 3). Finally, the cross-level three-way interaction between peer substance use, friendship intimacy, and daily negative affect was not significant across both model 1 (β = -0.08, OR = .92, $p > .05$) and model 2 (β = 0.04, OR = 1.04, $p > .05$). Thus, these results do not support hypothesis 2, but suggest that higher levels of adolescent substance

use are associated with higher mean levels of negative affect and lower levels of target-reported friendship intimacy. Additionally, there is some evidence for the interaction between peer use and friendship intimacy in predicting daily substance use (but not self-medication).

Sensitivity Analyses

Concerns with power (hypothesis 2). The first series of sensitivity analyses was conducted to address the potential limitation of adequate power to detect a significant effect in the original three-way interaction (peer substance use x friendship intimacy x daily negative affect) given the modest sample size. Thus, although the three-way interaction is statistically the optimal method to test the current set of hypotheses, a second series of analyses used an alternative method to test this hypothesis using fewer terms and thus increasing available power.

A new variable was created that combines both friendship intimacy and peer use into one moderator, thus resulting in a test of a two-way interaction to examine the hypotheses. Because the buffering effect of friendship intimacy on adolescent substance use depends on peer use, this new variable represents the degree of friendship intimacy between the target and *a non-substance-using close friend*. The value for this new variable is equal to zero for all target adolescents whose closest friend is a substance user. For target adolescents whose close friends did not report using substances in the past three months (approximately 16% of the sample), the value is equal to the friendship intimacy rating (separately for the target and peer report, resulting in two models). Models 3 and 4 (see Table 2) tested the two-way cross-level interaction between daily negative affect and the new friendship intimacy scale to predict adolescent substance use.

The results in Table 2 show that in this series of sensitivity analyses, the between-person main effect of aggregated negative affect remains strong and consistent in both models 3 and 4 (same effect; $\beta = 1.53$, $OR = 4.62$, $p < .01$). The cross-level two-way interaction between degree of friendship intimacy with a non-using peer and daily negative affect remained non-significant across both models 3 and 4 (same effect; $\beta = 0.08$, $OR = 1.08$, $p > .05$), indicating that power alone did not account for the lack of support for this hypothesis. However, the between-person main effect of the degree of friendship intimacy with a non-using peer was significant in model 3 (target-report; $\beta = -0.49$, $OR = 0.61$, $p < .05$) and marginally significant in model 4 (peer-report; $\beta = -0.44$, $OR = 0.64$, $p < .10$), indicating that being close with a *non-using peer* may be protective against substance use.

Since the buffering effect of friendship intimacy with a non-using peer did not interact with daily negative affect to predict daily substance use, two subsequent models were estimated to test the effect of the degree of friendship intimacy between the target and *a substance-using close friend* to see if this risk process would yield different results. The between-person main effect of the degree of friendship intimacy with a *substance-using close friend* was marginally significant only for peer-report of intimacy ($\beta = 0.35$, $OR = 1.42$, $p < .10$), a trend indicating that being close with substance-using peers may increase risk for use. All other results were similar to previous analyses and made no substantive change in the findings.

Reformulation of the friendship intimacy construct (Hypotheses 1 & 2). The original purpose of hypothesis 1 was to determine whether peer substance use is associated with friendship intimacy. In the original analyses, the construct of friendship

intimacy was indicated by the full NRI scale, which includes four subscales (loyalty, self-disclosure, affection, and companionship). The companionship scale taps into frequency of time spent together, thus serving as a proxy for exposure to a friend's behaviors and activities. For this elevated-risk sample (approximately 84% have a close friend who reports using substances), this measure of degree of exposure becomes a measure of increased risk for substance use, whereas the other three scales may be measures of decreased risk (increased intimacy and support). Therefore, there are theoretically motivated reasons to estimate the original models in a subsequent sensitivity analysis, removing companionship from the overall friendship intimacy scale.

When models 1 and 2 testing hypothesis 1 were re-estimated, however, results did not differ; peer substance use remained a non-significant predictor of friendship intimacy (see models 3 and 4 in Table 1). To test hypothesis 2, models 3 and 4 testing the two-way cross-level interaction between the degree of friendship intimacy with a non-using peer and daily negative affect were also re-estimated testing intimacy without companionship. Consistent with previous findings, the cross-level two-way interaction between degree of friendship intimacy with a non-using peer and daily negative affect remained non-significant. The between-person main effect of the degree of friendship intimacy with a non-using peer was significant in the first model (target-report; $\beta = -0.49$, OR $= .61$, $p < .05$) and marginally significant in the second model (peer-report; $\beta = -0.42$, OR $= .66$, $p < .10$). The within-person effect of daily negative affect on subsequent substance use remained non-significant across both models. Other results were similar to those previously reported. Thus, dropping companionship from the intimacy variable made no substantive changes in the findings.

**Substituting general peer network use for individual peer use (hypotheses 1
& 2).** In a final round of sensitivity analyses, a more global measure of peer substance
use was included to test both hypotheses 1 and 2. In the original set of analyses, there
was no significant main effect for peer substance use in predicting adolescent substance
use, which is largely inconsistent with the literature (e.g., Ennett et al., 2006). Generally,
peer substance use is highly predictive of adolescent use, but perhaps in the current study
the use of an identified close friend's self-report of substance use to represent peer use is
an inappropriate depiction of the overall peer substance use construct. Thus, a more
global measure of substance use in the peer context was used in a series of sensitivity
analyses to test the original hypotheses more generally. These sensitivity analyses re-
estimated models 1 and 2 for hypothesis 1, and models 1-4 for hypothesis 2 using the
general peer network substance use variable to replace the specific peer substance use
variable in predicting adolescent substance use.

For hypothesis 1, results showed that general peer network substance use did not
predict target-report or peer-report of friendship intimacy (same effect; $\beta = -0.19$, $p > .05$).
For hypothesis 2, there were several notable differences in this series of sensitivity
analyses. When re-estimating models 1 and 2, the between-person main effect of general
peer network substance use on target substance use was significant (model 1: $\beta = 1.40$,
OR = 4.06, $p < .05$; model 2: $\beta = 1.55$, OR = 4.71, $p < .01$), when previously the effect of
peer use had been non-significant; however, the between-person main effect of
aggregated negative affect became only marginally significant in re-estimations of both
model 1 ($\beta = 1.00$, OR = 2.72, $p < .10$) and model 2 ($\beta = 1.01$, OR = 2.75, $p < .10$).
Additionally, in re-estimating model 1, the between-person main effect of friendship

intimacy was no longer significant, and the interaction between peer network substance use and friendship intimacy became non-significant. When re-estimating models 3 and 4, the between-person main effect of the degree of friendship intimacy, given a non-using peer network, was marginally significant only with peer-report of intimacy (β = -1.03, OR = .36, $p < .10$), rather than in both target and peer report of intimacy as in previous analyses (models 3-4). Finally, the cross-level two-way interaction between friendship intimacy and daily negative affect (previously non-significant in model 1) became marginally significant (β = -0.60, OR = .55, $p < .10$) when model 1 was re-estimated, testing the three-way interaction between peer network substance use, friendship intimacy, and daily negative affect for target-report of intimacy. However, because this effect was marginally significant, isolated, and was found only in a sensitivity analysis, this effect was not interpreted further.

Summary of key results from sensitivity analyses. For hypothesis 1, dropping companionship from the full intimacy scale and including general peer network substance use as a predictor yielded no substantive changes to the original findings. For hypothesis 2, the two-way interactions between negative affect and the degree of friendship intimacy with a non-using and substance-using peer were both non-significant, suggesting that power alone does not explain the lack of support for this hypothesis in the original analyses. Additionally, the main effect of intimacy showed a trend indicating a buffering effect for those in friendships with *non-using peers* and increased risk for those in friendships with *substance-using peers*. Finally, the main effect of general peer network substance use was a significant positive predictor of target daily substance use.

Chapter 4

Discussion

The current study examined whether greater peer substance use and lower friendship intimacy predict risk for self-medication among adolescents. Primary hypotheses were not supported, even when a series of sensitivity analyses was conducted to maximize power and to consider alternative conceptualizations of the friendship intimacy and peer use constructs. There was no relation between peer substance use and friendship intimacy, and this finding was consistent across both peer and target reports of both measures (hypothesis 1). Moreover, the interaction between peer substance use, friendship intimacy, and daily negative affect did not predict daily use, indicating that there was no support for the moderating effect of peer use and friendship intimacy on adolescent self-medication (hypothesis 2). However, there was some support for the interaction between friendship intimacy and peer substance use predicting daily adolescent substance use.

The Peer Context and Self-Medication

Lack of support for the primary self-medication hypothesis does not appear to be related to limited power, the manner in which friendship intimacy and peer substance use were conceptualized, or reporter differences, as each of these potential limitations was addressed. There are three potential explanations for why the current results emerged: **(1)** the risk mechanisms are more specific and complex than initially hypothesized, **(2)** the

peer context operates independently from peer use and friendship intimacy in predicting self-medication during adolescence, and **(3)** even more generally, the peer context may not indicate risk for self-medication during adolescence. Each of these three alternatives is described below.

First, the original proposed mechanism reflected two different risk processes, including a social learning model whereby adolescents who are engaged in close friendships with substance-using peers have easy access to substances and gain exposure to and encouragement of drug use, and the stress and coping model whereby adolescents with less intimate friendships and greater levels of negative affect may seek substance use as an alternative coping method. Although this mechanism offers two potential pathways of risk, it still may not capture the full complexity underlying the relationship between peer substance use, friendship intimacy, and self-medication in youth. A more specific reformulation of these processes may be necessary.

For example, there could be a gender effect such that peer use and friendship intimacy predict self-medication only for girls. Indeed, research has shown that girls more than boys endorse greater levels of intimacy, enhancement of worth from their friendships, and affection with their peers, and also report depending more on their close friends (Furman & Buhrmester, 1985). Moreover, middle school girls report that peer friendships offer significantly more intimacy compared to all other relationships, whereas boys do not report such differences, indicating that intimacy with close friends becomes increasingly important for girls (Buhrmester & Furman, 1987). With peer friendship holding such value and import for girls, those who struggle to maintain intimate friendships may be at greater risk both for increased levels of negative affect and

subsequently for self-medication. Females may also be more prone to risk processes involving social learning and joint engagement in drug use, as increased levels of peer support have been shown to predict substance use more strongly in girls than in boys (Wills & Vaughan, 1989).

Another possible reformulation of the proposed mechanism is that social learning may be the risk process only for adolescents whose peers also engage in negative affect-motivated substance use, but in the current study there is no way to know if peers are self-medicating because their drug use was reported at just one time point. Similarly, the stress and coping model of risk may only hold for adolescents who find lower levels of friendship intimacy to be distressing, and unfortunately the manner in which target adolescents internalized their specific peer relationships was not captured in the current study. Thus, it is not clear if the adolescents reporting lower levels of intimacy are more distressed by their friendships, compared to those reporting higher levels of intimacy. If indeed youth do not experience lower levels of intimacy to be stressful, it may not be reasonable to expect an increased risk for self-medication in these contexts.

Second, because the proposed risk mechanisms were not supported among *younger youth*, but others have found that lower levels of friendship intimacy and peer social support predict self-medication in *young adults* (Hussong et al., 2001), it is possible that alternative components of the peer context play a role in predicting negative affect-motivated use among these younger teens. In other words, the peer context may operate independently from friendship intimacy and peer substance use levels in predicting this particular style of drug use among adolescents. To speculate, components of the peer context that may predict self-medication for *younger* youth might include

close relationships with older teens, the prevalence of affective disorders among peers (e.g., depression, anxiety), or exposure to other types of deviant peer behavior (e.g., peer conduct problems), rather than the interaction between intimacy and peer use which may be a better predictor of self-medication among *older* youth.

Third, the entire adolescent friendship context may not be related to self-medication for this younger age group – rather, there may simply be other mechanisms that moderate the relation between negative affect and substance use for adolescent youth. Although cross-sectional designs show that peer use and friendship intimacy impact substance use more generally (and there is also support for this in the current study), the peer context may be less critical in predicting risk for this particular pattern of substance use among younger adolescents. Thus, contrary to ESM research findings with adult samples suggesting that the social context matters in predicting self-medication as a coping method (e.g., Armeli et al., 2003; Hussong et al., 2001), the same mechanism may not apply to younger age groups. Other factors and mechanisms may be more appropriate predictors of self-medication for such youth, including greater parental social support (Reimuller, Shadur, & Hussong, under review), poorer parental emotion socialization (Hersh & Hussong, 2009), fewer adolescent conduct problems (Hussong et al., 2008), and greater adolescent depressive symptoms (Feagans Gould, Hersh, & Hussong, 2007). It may be that compared to peer influences, parental support and influence during this developmental period are ultimately stronger predictors for self-medication, which reflects a more problematic style of use, as opposed to drug use more generally. Thus, both risk for and protection against negative affect-motivated substance

use among younger adolescents may be best indicated by specific characteristics of the parent-child relationship.

Self-medication research generally supports the idea that the majority of teens may *not* be at risk for this style of use, thus increasing the need for better identification of the subgroups of individuals who *are* at heightened risk for self-medication (Chassin et al., 2003; Hussong et al., 2001). Therefore, the current findings preliminarily rule out one potential contextual factor that does not seem to predict such risk. However, this argument is made cautiously given that the sample size is relatively small, and this study was the first to test the moderating effect of the peer context on self-medication in teens; thus findings are considered preliminary. Nonetheless, using the same sample others have found significant effects of multiple varying moderators on self-medication (e.g., see above), offering further support for the notion that power alone cannot explain the lack of significant findings in the current study.

Friendship Intimacy, Peer Use, and Daily Substance Use

Although the primary interaction effects were not found in the current study, the marginally significant interaction between peer use and friendship intimacy indicates that the two proposed mechanisms (i.e., social learning, stress and coping) may underlie risk for substance use more generally, though not specifically for self-medication. This interaction shows a trend for the positive association between peer substance use and adolescent daily use to be strongest for target adolescents who report high levels of friendship intimacy, reflecting the social learning model. The stress and coping model is also indicated in this interaction such that even at low levels of peer substance use, adolescents with the lowest levels of friendship intimacy are at increased risk for use.

35

Finally, a buffering effect can be seen in the interaction as well, showing that the lowest risk for substance use appears to be the combination of low peer use and high intimacy. Thus, the one interaction effect and the subsequent main effects indicate a consistent but weak trend for the effect of intimacy and peer use on adolescent daily use, such that friendship intimacy may be either protective or risky depending on the degree of peer substance use.

Although these patterns are consistent with the two different risk mechanisms, the interaction is only marginally significant and thus further exploration of this relationship within the context of ESM data is certainly needed. This interaction effect is consistent with other studies finding that peer use predicts adolescent use most strongly for those with fewer negative friendship qualities (Hussong & Hicks, 2003) and greater peer social support (e.g., Piko, 2000; Wills & Vaughn, 1989; Wills, 1990; Wills et al., 2004; Urberg et al., 2005), as well as findings showing that high levels of support from non-using peers minimizes risk for use (Urberg et al.), though these studies used either cross-sectional or short-term longitudinal designs and not ESM techniques.

One surprising finding was that friendship intimacy was predictive of target adolescents' daily substance use but not predictive of peer use. Given that the measure of friendship intimacy is meant to capture the nature of the shared friendship within dyads, it would be expected that the buffering effect of higher levels of friendship intimacy would minimize risk for substance use in both members of the shared friendship. However, current findings from hypothesis 1 across several series of sensitivity analyses showed consistently that peer substance use and friendship intimacy were *not* related, whereas findings from hypothesis 2 showed consistently that target adolescents' daily

drug use and friendship intimacy were associated. Furthermore, the discrepancy in these results was consistent across different reporters of friendship intimacy (peer versus target adolescent).

One potential explanation for the observed inconsistency is that the recruitment of participating peers was based on a ranking system in which target adolescents rated their closest five friends who were then contacted in corresponding order by study staff. Although all target adolescents had ranked the participating peers within their top five closest friends, there is no way to know whether the peers would have mutually selected the target adolescents as one of their closest friends. In fact, research shows that there is a low rate of reciprocity between adolescent peers regarding best friend nominations (50%; Ennett et al., 2006). The potential implication is that greater friendship intimacy may be more strongly associated with a buffering effect that minimizes risk for substance use for target adolescents because they all considered the participating peers to be one of their top five closest friends. On the other hand, the degree of friendship intimacy within these dyads may not impact risk for peer use as strongly because some of the target adolescents may not have been among the peers' closest friends, had they been able to rank order their friends in a similar fashion.

Daily versus Aggregated Negative Affect

The current study employed multilevel modeling as a technique to parse within- versus between-person effects of negative affect on substance use, which is critical for testing the self-medication hypothesis. Across all analyses, there was a strong and consistent significant between-person main effect of aggregated negative affect on substance use. These findings provide strong support for greater substance use among

adolescents with higher mean negative affect levels, compared to those with lower mean negative affect levels. Although this consistent between-person effect helps to identify greater levels of negative affect as a risk factor for increased substance use among youth, this cross-sectional finding does not indicate *why* these adolescents are at increased risk for use. Thus, alternative affective-based risk processes such as theories of self-derogation (Kaplan et al., 1982) may be important to explore in order to help explain the positive between-person effect of negative affect on substance use.

The within-person analysis of negative affect examines daily variations in negative mood and substance use, and can predict changes in substance use from relative increases or decreases in an individual's daily negative affect compared to his or her baseline levels of affect. The temporal specificity in this type of analysis can directly test the self-medication hypothesis. Consistent with the notion that negative affect-motivated substance use occurs among only more specific vulnerable subgroups of individuals, the overall within-person main effect of daily negative affect on daily substance use was non-significant across all models in the current study. Moreover, results showed that friendship intimacy and peer substance use do not moderate the relationship between negative affect and substance use, suggesting that these characteristics of the peer context are *not* among the factors that identify subgroups of youth to be at increased risk for self-medication.

Strengths and Limitations

Strengths of the current study include the use of experience sampling methods to capture daily variations in mood and substance use as an index of self-medication, and the use of multiple reporters of friendship intimacy and peer use. The sample is relatively

38

diverse, and the majority of experience sampling studies to date have been employed with mostly Caucasian adult samples (e.g., Armeli et al., 2003; Cleveland & Harris, 2010; Swendsen et al., 2000). Moreover, this study is the first to test multiple mechanisms of risk related to the peer context as moderators of self-medication among youth.

Although thorough sensitivity analyses were aimed at maximizing power and offering alternative conceptualizations of the friendship intimacy and peer use constructs, remaining limitations must also be addressed. First, quantitative methods do not currently include power calculations for multilevel models with binary outcomes that include interactions (D.J. Bauer, personal communication, March 2, 2010), but given the modest sample size of 73, power to detect even the simpler two-way interaction may still be limited. Second, the low base rate of daily substance use in the current sample limits the extent to which the proposed mechanisms can be tested, given that only 77 of 1411 observations of drug use were endorsed positively, and only 20 of 73 adolescents reported any use during the 21-day experience sampling period. However, the rates of use in the current sample are even higher than the average amount of monthly use reported nationally by adolescents in the same year the study was conducted (Johnston et al., 2009). Thus, the current findings are likely to generalize well to the broader population given that rates of use would be even lower. Third, the self-report measure of friendship intimacy may limit the extent to which closeness and supportive behaviors within dyads are truly captured. An observational measure of intimacy would allow greater insight into enacted friendship behaviors, and future studies should consider employing such alternative methods of measuring the friendship intimacy construct.

Implications and Conclusions

The current study employed experience sampling methodology and multilevel modeling techniques to assess between-person and within-person differences in risk for substance use. Between-person effects suggest that adolescents who have higher mean levels of negative affect and lower levels of friendship intimacy are at greatest risk for substance use. The interaction between peer use and friendship intimacy highlights a trend suggesting that close peer friendships may serve to either buffer or increase risk for general substance use, depending on the degree of peer use.

However, findings do not indicate *why* individuals are at risk, as the peer context did not moderate the within-person relation between daily variations in negative affect and substance use. Nonetheless, these results have implications for helping us to gain a better understanding of the mechanisms involved in predicting negative affect-motivated use. The findings indicate that characteristics of the peer context do not help identify younger youth who are at risk for self-medication; furthermore, the proposed mechanisms involving intimacy and peer use do not explain *why* individuals may be at increased risk for this particularly problematic style of use. Thus, the results encourage greater exploration of other factors that help to further identify vulnerable subgroups who may be more likely to use self-medication as a way to cope with negative affect. Finally, an additional direction for future research includes further exploration of alternative within-person affective-based processes (i.e., other than self-medication) that may help explain why between-person differences in friendship intimacy predict risk for substance use.

Table 1. Results of Regression Analyses with Peer Substance Use Predicting Friendship Intimacy (Hypothesis 1)

|	Outcome Variables						
	Primary Analyses				Sensitivity Analyses		
	Full Friendship Intimacy Scale (Target-report)		Full Friendship Intimacy Scale (Peer-report)		Friendship Intimacy Scale without Companionship (Target-report)		Friendship Intimacy Scale without Companionship (Peer-report)	
	Model 1		Model 2		Model 3		Model 4	
PREDICTORS	β	t	β	t	β	t	β	t
Control Variables (Step 1)								
Gender	**-0.42**	**-1.97***	-0.12	-0.44	**-0.51**	**-2.24***	-0.17	-0.60
Race	0.34	1.57	-0.12	-0.48	**0.40**	**1.73**+	-0.06	-0.23
Parent Education	-0.06	-0.61	-0.15	-1.19	-0.06	-0.54	-0.19	-1.43
Main Effect (Step 2)								
Peer substance use	0.04	0.29	0.28	1.39	0.03	0.16	0.31	1.53
Full Model Effects								
F	1.63		1.06		**1.98**+		1.36	
ΔR^2	0.007		0.06		0.005		0.07	

Note. Reported values are unstandardized betas. Significance levels are indicated by + (for $p <$ .10) and * (for $p <$.05).

Table 2. Results of Mixed Models Testing Friendship Intimacy and Peer Substance Use Effects on Self-Medication (Hypothesis 2)

	Variations of Friendship Intimacy Predictor Variables across Models							
	Primary Analyses				Sensitivity Analyses			
	Full Friendship Intimacy Scale (Target-report)		Full Friendship Intimacy Scale (Peer-report)		Friendship Intimacy with a non-using Peer (Target-report)		Friendship Intimacy with a non-using Peer (Peer-report)	
	Model 1		Model 2		Model 3		Model 4	
PREDICTORS	β	OR	β	OR	β	OR	β	OR
Between- Person								
Gender	-0.25	.78	0.23	1.26	-0.12	.89	0.005	1.01
Race	0.98	2.66	0.95	2.59	0.75	2.12	0.68	1.97
Parent Education	0.54	1.72	0.59	1.80	0.43	1.54	0.44	1.55
Aggregated Negative Affect	**1.54****	**4.66**	**1.66****	**5.26**	**1.53****	**4.62**	**1.53****	**4.62**
Peer Substance Use	0.76	2.14	0.52	1.68	-----		-----	
Friendship Intimacy	**-1.11****	**.33**	-0.26	.77	-----		-----	
Friendship Intimacy with a non-using Peer	**-----**		-----		**-0.49***	**.61**	**-0.44+**	**.64**
Within-Person								
Weekday	-0.09	.91	-0.09	.91	-0.08	.92	-0.08	.92
Daily Negative Affect	-0.07	.93	0.01	1.01	0.02	1.02	0.02	1.02
Cross-level Interactions								
Peer Substance Use x Friendship Intimacy	**0.82+**	**2.27**	0.45	1.57	-----		-----	
Peer Substance Use x Daily Negative Affect	-0.17	.84	-0.32	.73	-----		-----	
Friendship Intimacy x Daily Negative Affect	-0.18	.84	-0.003	1.00	-----		-----	
Friendship Intimacy with a non-using Peer x Daily Negative Affect	-----		-----		0.08	1.08	0.08	1.08
Peer Substance Use x Friendship Intimacy x Daily Negative Affect	-0.08	.92	0.04	1.04	-----		-----	

Reported values are unstandardized betas. Significance levels are indicated by + (for $p < .10$), * (for $p < .05$), and ** (for $p < .01$). OR = odds ratio.

Figure 1. Substantive model for hypothesis 1

Peer Substance Use → Friendship Intimacy
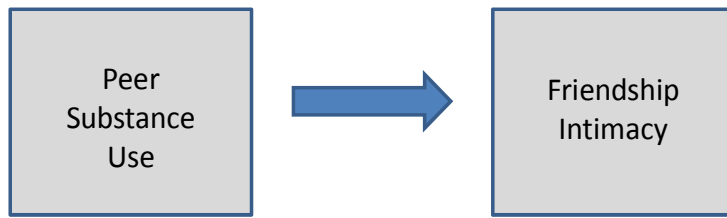
Control variables:
- Gender
- Ethnicity
- Parent Education
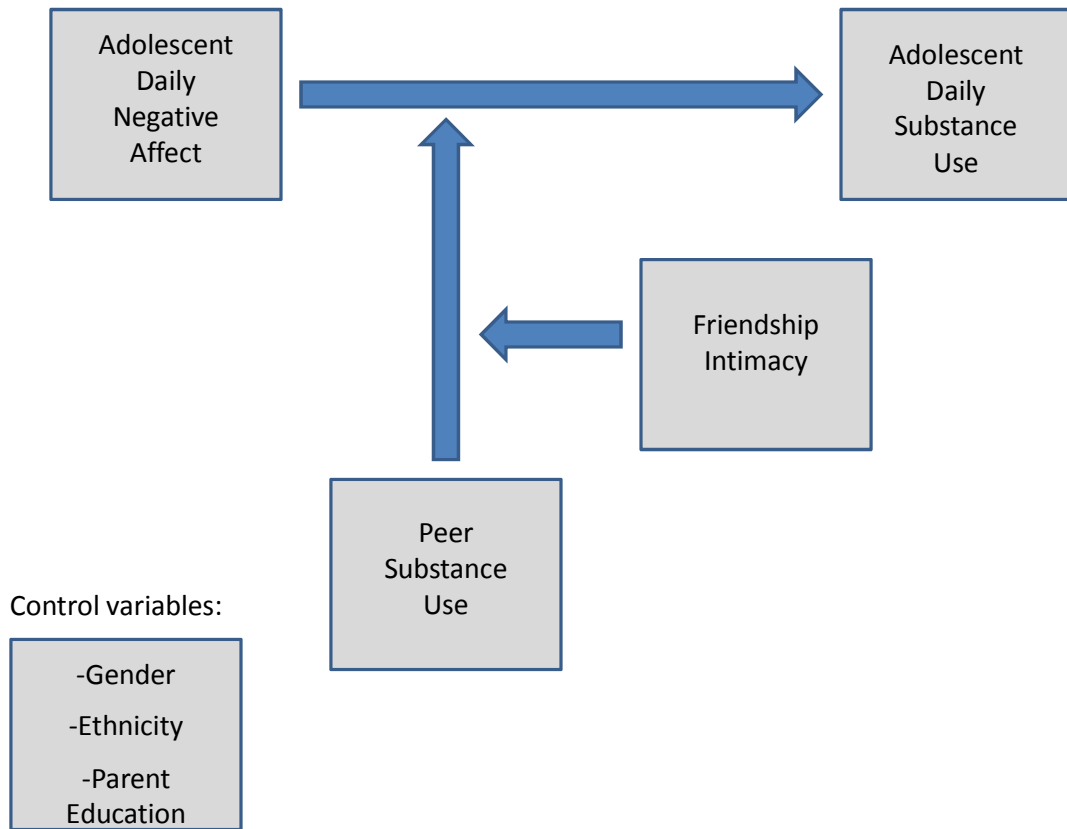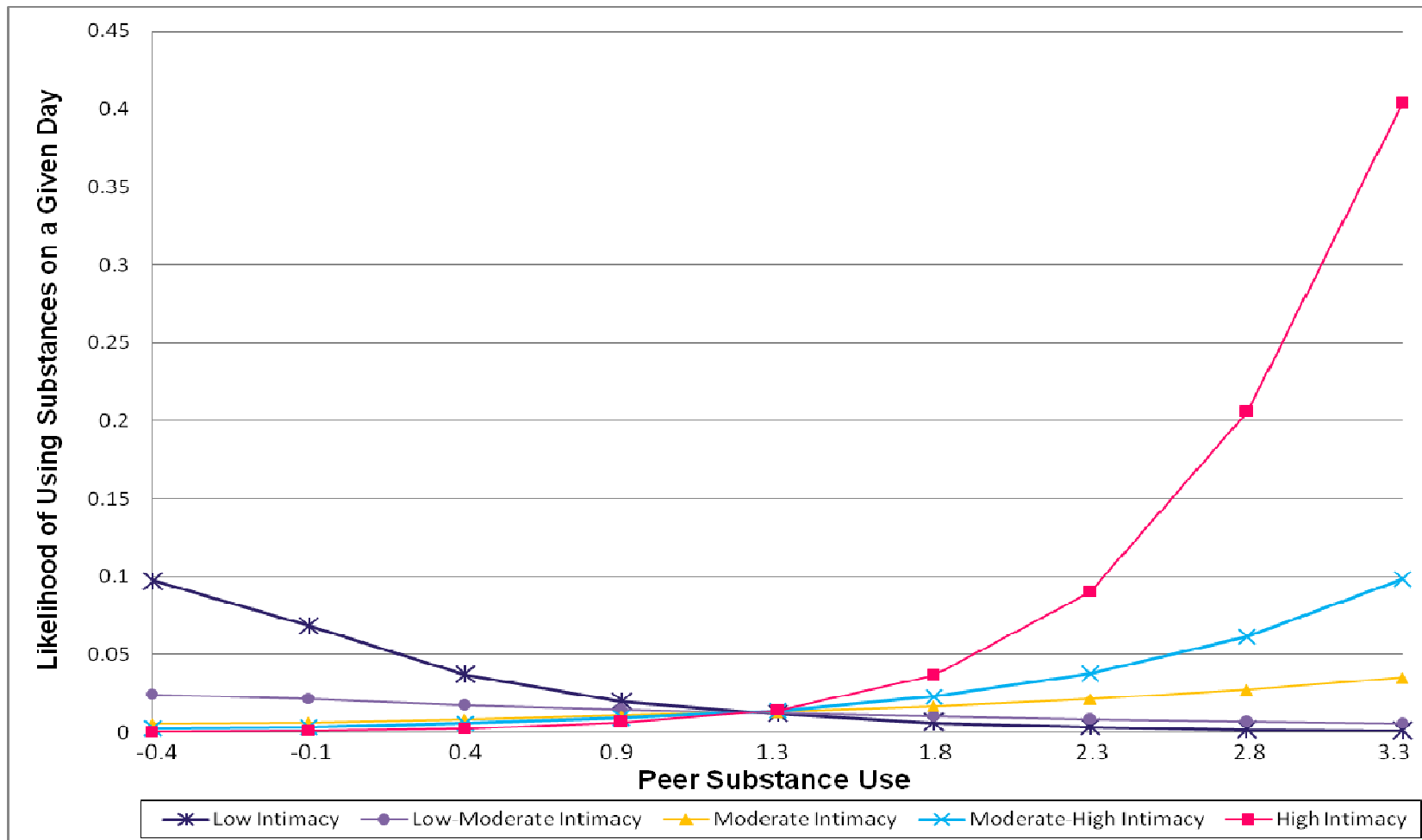
Figure 2. Substantive model for hypothesis 2.

Figure 3. Marginally significant cross-level two-way interaction between peer substance use and target-report of friendship intimacy

Note: peer substance use values are grand-mean centered.

References

Arata, C. M., Stafford, J., & Tims, M. S. (2003). High school drinking and its consequences. *Adolescence, 38*(151), 567-579. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/

Armeli, S., Tennen, H., Todd, M., Carney, M. A., Mohr, C., Affleck, G., et al. (2003). A daily process examination of the stress-response dampening effects of alcohol consumption. *Psychology of Addictive Behaviors, 17*(4), 266-276. doi: 10.1037/0893-164X.17.4.266

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ US: Prentice-Hall, Inc.

Barrera, M., Chassin, L., & Rogosch, F. (1993). Effects of social support and conflict on adolescent children of alcoholic and nonalcoholic fathers. *Journal of Personality and Social Psychology, 64*(4), 602-612. doi: 10.1037/0022-3514.64.4.602

Baumrind, D. & Moselle, K.A. (1985). A developmental perspective on adolescent drug abuse. *Advances in Alcohol and Substance Abuse, 4,* 41-67. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/

Brook, D. W., Brook, J. S., Zhang, C., Cohen, P., & Whiteman, M. (2002). Drug use and the risk of major depressive disorder, alcohol dependence and substance use disorders. *Archives of General Psychiatry, 59*(11), 1039-1044. doi: 10.1001/archpsyc.59.11.1039

Buhrmester, D. & Furman, W. (1987). The development of companionship and intimacy. *Child Development, 58*(4), 1101-1113. doi: 10.2307/1130550

Chassin, L., Ritter, J., Trim, R.S., & King, K.M. (2003). Adolescent substance use disorders. In E.J. Mash & R.A. Barkley (Eds.), *Child Psychopathology (2nd ed.).* (pp. 199-230). New York, NY: The Guilford Press.

Chassin, L., Rogosch, F., & Barrera, M. (1991). Substance use and symptomotology among adolescent children of alcoholics. *Journal of Abnormal Psychology, 100,* 449-463. doi: 10.1037/0021-843X.100.4.449

Cleveland, H.H., & Harris, K.S. (2010). The role of coping in moderating within-day associations between negative triggers and substance use cravings: A daily diary investigation. *Addictive Behaviors, 35*(1), 60-63. doi: 10.1016/j.addbeh.2009.08.010

Conger, J. J. (1956). Alcoholism: Theory, problem and challenge. II. Reinforcement theory and the dynamics of alcoholism. *Quarterly Journal of Studies of Alcohol, 13,* 260-276. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/

Coombs, R.H., Paulson, M.J., & Richardson, M.A. (1991). Peer vs. parental influence in substance use among Hispanic and Anglo children and adolescents. *Journal of Youth and Adolescence, 20*(1), 73-88. doi: 10.1007/BF01537352

Cooper, M. L., Russell, M., & George, W. H. (1988). Coping, expectancies, and alcohol abuse: A test of social learning formulations. *Journal of Abnormal Psychology, 97*(2), 218-230. doi: 10.1037/0021-843X.97.2.218

Cooper, M. L., Russell, M., Skinner, J. B., Frone, M. R., & Mudar, P. (1992). Stress and alcohol use: Moderating effects of gender, coping, and alcohol expectancies. *Journal of Abnormal Psychology, 101*(1), 139-152. doi: 10.1037/0021-843X.101.1.139

Ennett, S.T., Bauman, K.E., Hussong, A.M., Faris, R., Foshee, V.A., Cai, L., et al. (2006). The peer context of adolescent substance use: Findings from social network analysis. *Journal of Research on Adolescence, 16*(2), 159-186. doi: 10.1111/j.1532-7795.2006.00127.x

Essau, C.A. (2004). Prevention of substance abuse in children and adolescents. In P.M. Barrett & T.H. Ollendick (Eds.), *Handbook of interventions that work with children and adolescents: Prevention and treatment.* (pp. 517-539). Hoboken, NJ: John Wiley & Sons Inc. doi: 10.1002/9780470753385.ch21.

Feagans Gould, L., Hersh, M. A. & Hussong, A. M. (2007, April). *Self-medication in adolescence: Examining sub-populations at risk.* Poster presented at the biennial meeting of the Society for Research in Child Development, Boston, MA.

Fergusson, D. M., Horwood, L. J., & Swain-Campbell, N. (2002). Cannabis use and psychosocial adjustment in adolescence and young adulthood. *Addiction, 97*(9), 1123-1135. doi: 10.1046/j.1360-0443.2002.00103.x

Frauenglass, S., Routh, D.K., Pantin, H.M., & Mason, C.A. (1997). Family support decreases influence of deviant peers on Hispanic adolescents' substance use. *Journal of Clinical Child Psychology, 26*(1), 15-23. doi: 10.1207/s15374424jccp2601_2

Furman, W. & Buhrmester, D. (1985). Children's perceptions of the personal relationships in their social networks. *Developmental Psychology, 21*(6), 1016-1024. doi: 10.1037/0012-1649.21.6.1016

Furman, W., & Burhmester, D. (1992). Age and sex differences in perceptions of networks of personal relationships. *Child Development, 63*(1), 103-115. doi: 10.2307/1130905

Hersh, M. A., & Hussong, A. M. (2009). The association between observed parental emotion socialization and adolescent self-medication. *Journal of Abnormal Child*

Psychology: An Official Publication of the International Society for Research in Child and Adolescent Psychopathology, 37(4), 493-506. doi: 10.1007/s10802-008-9291-z

Holden, M.G., Brown, S.A., Mott, M.A. (1988). Social support network of adolescents: Relation to alcohol abuse. *American Journal of Drug and Alcohol Abuse, 14*(4), 487-498. doi: 10.3109/00952998809001566

Hussong, A.M. (1996). *Gender differences in adolescent friendships and adjustment.* (Unpublished doctoral dissertation). Arizona State University, Tempe.

Hussong, A.M. (2000a). Distinguishing mean and structural sex differences in adolescent friendship quality. *Journal of Social and Personal Relationships, 17,* 223-243. doi: 10.1177/0265407500172004

Hussong, A. M. (2000b). Perceived peer context and adolescent adjustment. *Journal of Research on Adolescence, 10(4),* 391-415. doi: 10.1207/SJRA1004_02

Hussong, A.M. (2002). Differentiating peer contexts and risk for adolescent substance use. *Journal of Youth and Adolescence, 13*(3), 207-220. doi: 10.1023/A:1015085203097

Hussong, A. M. (2003). Social influences in motivated drinking among college students. *Psychology of Addictive Behaviors, 17*(2), 142-150. doi: 10.1037/0893-164X.17.2.142

Hussong, A.M. (2005). [Documentation for Analyses, Codebook for the High School Transition Study]. Unpublished raw data.

Hussong, A.M., Feagans Gould, L., & Hersh, M.A. (2008). Conduct problems moderate self-medication and mood-related drinking consequences in adolescents. *Journal of Studies on Alcohol and Drugs, 69*(2), 296-307. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/

Hussong, A.M. & Hicks, R.E. (2003). Affect and peer context interactively impact adolescent substance use. *Journal of Abnormal Child Psychology, 31*(4), 413-426. doi: 10.1023/A:1023843618887

Hussong, A.M., Hicks, R.E., Levy, S.A., & Curran, P.J. (2001). Specifying the relations between affect and heavy alcohol use among young adults. *Journal of Abnormal Psychology, 110*(3), 449-461. doi: 10.1037/0021-843X.110.3.449

Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (1995). *National survey results on drug use from the Monitoring the Future study, 1975-1994. Volume I: Secondary school students* (NIH Pub. No. 95-4026). *Volume II: College students and young adults* (NIH Pub. No. 95-4027). Rockville, MD: National Institute on Drug Abuse.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2009). *Monitoring the Future national survey results on drug use, 1975–2008: Volume I, Secondary school students* (NIH Publication No. 09-7402). Bethesda, MD: National Institute on Drug Abuse.

Kaplan, H. B., Martin, S. S., & Robbins, C. (1982). Application of a general theory of deviant behavior: Self derogation and adolescent drug use. *Journal of Health and Social Behavior, 23*(4), 274-294. doi: 10.2307/2136487

Kassel, J.D., Hussong, A.M., Wardle, M.C., Veilleux, J.C., Heinz, A., Greenstein, J.E., et al. (in press). Affective influences in drug use etiology. In L.M. Scheier (Ed.), *Handbook of drug use etiology*. Washington, DC: American Psychological Association.

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry, 4*(5), 231-244. doi: 10.3109/10673229709030550

Kushner, M. G., Sher, K. J., Wood, M. D., & Wood, P. K. (1994). Anxiety and drinking behavior: Moderating effects of tension-reduction alcohol outcome expectancies. *Alcoholism: Clinical and Experimental Research, 18*(4), 852-860. doi: 10.1111/j.1530-0277.1994.tb00050.x

La Greca, A.M., & Lopez, N. (1998). Social anxiety among adolescents: Linkages with peer relations and friendships. *Journal of Abnormal Child Psychology, 26*(2), 83-94. doi: 10.1023/A:1022684520514

Lifrak, P.D., McKay, J.R., Rostain, A., Alterman, A.I., and O'Brien, C.P. (1997). Relationship of perceived competencies, perceived social support, and gender to substance use in adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*(7), 933-940. doi: 10.1097/00004583-199707000-00015

Lubin, B., Zuckerman, M., Hanson, P.G., Armstrong, T., Rinck, C.M., & Seever, M. (1986). Reliability and validity of the Multiple Affect Adjective Check List-Revised. *Journal of Psychopathology and Behavioral Assessment, 8*(2), 103-117. doi: 10.1007/BF00963575

MacNeil, G., Kaufman, A.V., Dressler, W.W., & LeCroy, G.W. (1999). Psychosocial moderators of substance use among middle school-aged adolescents. *Journal of Drug Education, 29*(1), 25-39. doi: 10.2190/49R9-08GD-ECUH-DXAE

Newcomb, M.D. (1990). Social support by many other names: Toward a unified conceptualization. *Journal of Social and Personal Relationships, 7*(4), 479-494. doi: 10.1177/0265407590074005

Piko, B. (2000). Perceived social support from parents and peers: Which is the stronger predictor of adolescent substance use? *Substance Use & Misuse, 35*(4), 617-630. doi: 10.3109/10826080009147475

Prinstein, M. J., & Dodge, K. A. (2008). Current issues in peer influence research. In M.J. Prinstein & K. A. Dodge (Eds.), *Understanding peer influence in children and adolescents.* (pp. 3-13). New York, NY US: Guilford Press.

Prinstein, M. J., & Wang, S. S. (2005). False consensus and adolescent peer contagion: Examining discrepancies between perceptions and actual reported levels of friends' deviant and health risk behaviors. *Journal of Abnormal Child Psychology: An Official Publication of the International Society for Research in Child and Adolescent Psychopathology, 33*(3), 293-306. doi: 10.1007/s10802-005-3566-4

Rässler, S., Rubin, D. B., & Schenker, N. (2008). Incomplete data: Diagnosis, imputation, and estimation. In E. D. de Leeuw, J. J. Hox, D. A. Dillman (Eds.), *International handbook of survey methodology.* (pp. 370-386). New York, NY: Taylor & Francis Group/Lawrence Erlbaum Associates.

Reimuller, A.N., Shadur, J.S., & Hussong, A.M. (2010). *Parental social support as a moderator of self-medication in adolescents.* Manuscript submitted for publication.

Rohde, P., Lewinsohn, P.M., Kahler, C.W., Seeley, J.R., & Brown, R.A. (2001). Natural course of alcohol use disorders from adolescence to young adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*(1), 83-90. doi: 10.1097/00004583-200101000-00020

SAS Institute Inc. (2009). *SAS documentation, Version 9.2*. Cary, NC: SAS Institute Inc.

Scheier, L.M. (2001). Etiologic studies of adolescent drug use: A compendium of data resources and their implications for prevention. *The Journal of Primary Prevention, 22*(2), 125-168. doi: 10.1023/A:1012610002391

Sher, K. J., Martin, E. D., Wood, P. K., & Rutledge, P. C. (1997). Alcohol use disorders and neuropsychological functioning in first-year undergraduates. *Experimental and Clinical Psychopharmacology, 5*(3), 304-315. doi: 10.1037/1064-1297.5.3.304

Spooner, C. (1999). Causes and correlates of adolescent drug abuse and implications for treatment. *Drug and Alcohol Review, 18,* 453-475. doi: 10.1080/09595239996329

Steinberg, L., Dahl, R., Keating, D., Kupfer, D. J., Masten, A. S., & Pine, D. S. (2006). The study of developmental psychopathology in adolescence: Integrating affective neuroscience with the study of context. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology, vol 2: Developmental neuroscience (2nd ed.).* (pp. 710-741). Hoboken, NJ US: John Wiley & Sons Inc.

Stice, E., Kirz, J., & Borbely, C. (2002). Disentangling adolescent substance use and problem use within a clinical sample. *Journal of Adolescent Research, 17*(2), 122-142. doi: 10.1177/0743558402172002

Substance Abuse and Mental Health Services Administration. (2009). *Results from the 2008 National Survey on Drug Use and Health: National Findings* (Office of Applied Studies, NSDUH Series H-36, HHS Publication No. SMA 09-4434). Rockville, MD.

Swendsen, J. D., Tennen, H., Carney, M. A., Affleck, G., Willard, A., & Hromi, A. (2000). Mood and alcohol consumption: An experience sampling test of the self-medication hypothesis. *Journal of Abnormal Psychology, 109*(2), 198-204. doi: 10.1037/0021-843X.109.2.198

Tennen, H., Affleck, G., Coyne, J. C., Larsen, R. J., & DeLongis, A. (2006). Paper and plastic in daily diary research: Comment on Green, Rafaeli, Bolger, Shrout, and Reis (2006). *Psychological Methods, 11*(1), 112-118. doi: 10.1037/1082-989X.11.1.112

Trim, R. S., Meehan, B. T., King, K. M., & Chassin, L. (2007). The relation between adolescent substance use and young adult internalizing symptoms: Findings from a high-risk longitudinal sample. *Psychology of Addictive Behaviors, 21*(1), 97-107. doi: 10.1037/0893-164X.21.1.97

Urberg, K. A., Değirmencioğlu, S. M., & Pilgrim, C. (1997). Close friend and group influence on adolescent cigarette smoking and alcohol use. *Developmental Psychology, 33*(5), 834-844. doi: 10.1037/0012-1649.33.5.834

Urberg, K., Goldstein, M.S., & Toro, P.A. (2005). Supportive relationships as a moderator of the effects of parent and peer drinking on adolescent drinking. *Journal of Research on Adolescents, 15*(1), 1-19. doi: 10.1111/j.1532-7795.2005.00084.x

Van Beest, M. & Baerveldt, C. (1999). The relationship between adolescents' social support from parents and from peers. *Adolescence, 34*(133), 193-201. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/

Vaux, A., Phillips, J., Holly, L., Thomson, B., Williams, D., & Stewart, D. (1986). The social support appraisals (SS-A) scale: Studies of reliability and validity. *American Journal of Community Psychology, 14*(2), 195-219. doi: 10.1007/BF00911821

Wills, T.A. (1990). Multiple networks and substance use. *Journal of Social & Clinical Psychology, 9*(1), 78-90.

Wills, T.A., Resko, J.A., Ainette, M.G., & Mendoza, D. (2004). Role of parental support and peer support in adolescent substance use: A test of mediated effects. *Psychology of Addictive Behaviors, 18*(2), 122-134. doi: 10.1037/0893-

164X.18.2.122

Wills, T.A., & Shiffman, S. (1985). Coping and substance use: A conceptual framework. In S. Shiffman & T.A. Wills (Eds.), *Coping and substance use* (pp. 3-24). New York: Academic Press.

Wills, T.A. & Vaughan, R. (1989). Social support and substance use in early adolescence. *Journal of Behavioral Medicine, 12*(4), 321-339. doi: 10.1007/BF00844927